JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF PUBLIC WORKS AND TERRITORIAL PLANNING
ROMANIA

THE FEASIBILITY STUDY

ON WASTEWATER TREATMENT
ALONG THE DANUBE RIVER DOWNSTREAM REACH
IN ROMANIA

FINAL REPORT

SUPPORTING REPORT

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CONTENTS OF SUPPORTING REPORT

PART AI: GENERAL

APPENDIX-1 INSTITUTIONAL CONSIDERATIONS

1. STUDY ON PRIVATIZATION PROCESS ---- AI-1-1
   1.1 HISTORY OF PRIVATIZATION OF PUBLIC SERVICE SECTOR ---- AI-1-1
   1.2 THE OWNERSHIP OF SEWERAGE FACILITIES ---- AI-1-1
   1.3 CONCESSION ---- AI-1-1
   1.4 PROSPECT OF PRIVATIZATION IN ROMANIA ---- AI-1-2
2. STUDY ON LOCAL PUBLIC FINANCE ---- AI-1-3
   2.1 GENERAL ---- AI-1-3
   2.2 LOCAL PUBLIC FINANCE LAW ---- AI-1-3
   2.3 PUBLIC DEBT LAW ---- AI-1-5
3. STUDY ON FINANCIAL INSTRUMENTS ---- AI-1-7
   3.1 EBRD LOAN ---- AI-1-7
   3.2 ISPA ---- AI-1-7
   3.3 JBIC LOAN ---- AI-1-9

APPENDIX-2 PEOPLE'S AWARENESS SURVEY

1. INTRODUCTION ---- AI-2-1
2. ECONOMIC QUESTIONNAIRE SURVEY ---- AI-2-1
   2.1 OBJECTIVES OF THE SURVEY ---- AI-2-1
   2.2 SURVEY DESIGN ---- AI-2-2
   2.3 PRE-TEST ---- AI-2-3
   2.4 FULL SCALE SURVEY ---- AI-2-5
   2.6 VERIFICATION OF DATA RELIABILITY ---- AI-2-9
   2.7 ESTIMATION OF ECONOMIC BENEFIT ---- AI-2-12
3 FINANCIAL QUESTIONNAIRE SURVEY ---- AI-2-16
   3.1 OBJECTIVES OF THE SURVEY ---- AI-2-16
   3.2 SURVEY DESIGN ---- AI-2-16
   3.3 FIELDWORK ---- AI-2-16
   3.4 SAMPLING RESULTS ---- AI-2-16
   3.5 ESTIMATION OF WTP FOR SEWERAGE SERVICE ---- AI-2-19
   3.6 HOUSEHOLD INCOME AND MISCELLANEOUS EXPENSES ---- AI-2-21
ATTACHMENT 1 THE QUESTIONNAIRES (VERSION E1) ---- AI-2-24
ATTACHMENT 2 THE FINANCIAL QUESTIONNAIRE ---- AI-2-29

APPENDIX-3 SELECTION OF TREATMENT PROCESS

1. GENERAL ---- AI-3-1
2. PROCEDURES FOR EVALUATION OF TREATMENT PROCESSES ---- AI-3-2
3. PLANNING BASIS ---- AI-3-3
4. STUDY ON TREATMENT PROCESS ---- AI-3-3
   4.1 PRELIMINARY TREATMENT SYSTEM ---- AI-3-3
   4.2 BIOLOGICAL WASTEWATER TREATMENT SYSTEM ---- AI-3-3
   4.3 SLUDGE TREATMENT ---- AI-3-8
   4.4 ADVANCED WASTEWATER TREATMENT ---- AI-3-9
5. CONSIDERATION FOR LAND RESTRICTION ---- AI-3-15
   5.1 PREPARATION OF ALTERNATIVES ---- AI-3-15
   5.2 COMPARISON OF ALTERNATIVE SCENARIOS ---- AI-3-16

6. EVALUATION OF TREATMENT PROCESSES ---- AI-3-16
6.1 EVALUATION OF NORMAL TYPE WWTP ---- AI-3-16
6.2 EVALUATION OF SMALL AREA TYPE WWTP ---- AI-3-17

PART AII-1: FEASIBILITY STUDY FOR TULCEA WWTP PROJECT

APPENDIX-1 PLANNING BASIS

1. INTRODUCTION ---- AII-1-1

2. POPULATION ---- AII-1-1
2.1 ADMINISTRATIVE POPULATION ---- AII-1-1
2.2 SERVICE POPULATION ---- AII-1-2

3. DESIGN FLOW ---- AII-1-2
3.1 INTRODUCTION ---- AII-1-2
3.2 DOMESTIC, COMMERCIAL AND INSTITUTIONAL WASTEWATERS ---- AII-1-3
3.3 INDUSTRIAL WASTEWATER ---- AII-1-6
3.4 GROUNDWATER INFILTRATION ---- AII-1-7
3.5 SUMMARY OF DESIGN WASTEWATER FLOW ---- AII-1-8

4. WASTEWATER CHARACTERISTICS ---- AII-1-8
4.1 PRESENT WASTEWATER CHARACTERISTICS ---- AII-1-8
4.2 DESIGN INFLUENT QUALITY ---- AII-1-10

APPENDIX-2 INTERCEPTOR SYSTEM

1. EXISTING OUTFALLS ---- AII-2-1

2. PROPOSED INTERCEPTOR SYSTEM ---- AII-2-1
2.1 COLLECTION SYSTEM PLANNING ---- AII-2-1
2.2 CONNECTION OF EXISTING OUTFALLS TO NEW INTERCEPTORS ---- AII-2-1
2.3 PUMPING STATION ---- AII-2-2
2.4 CONFIRMATION OF WATER HEADS IN SEWER PIPES ---- AII-2-3
2.5 PROPOSED FACILITIES ---- AII-2-3

3. WWTP OUTFALL SEWERS ---- AII-2-4

APPENDIX-3 FACILITY PLANNING

1. PLANNING PRINCIPLE ---- AII-3-1
1.1 HYDRAULIC/ORGANIC LOADING ON FACILITIES ---- AII-3-1
1.2 FLOW DIVISION CONTROL ---- AII-3-1
1.3 UNIT BYPASSES ---- AII-3-1
1.4 PIPE CLEANING AND MAINTENANCE ---- AII-3-1
1.5 CONSTRUCTION MATERIALS ---- AII-3-1
1.6 GRADING AND LANDSCAPING ---- AII-3-1
1.7 PLANT OUTFALL LINES ---- AII-3-2
1.8 SITE DEVELOPMENT ---- AII-3-2

2. ESSENTIAL FACILITIES ---- AII-3-3
2.1 EMERGENCY POWER FACILITIES ---- AII-3-3
2.2 PLANT SANITARY SYSTEM ---- AII-3-3
2.3 FLOW MEASUREMENT ---- AII-3-4
2.4 PLANT BYPASS ---- AII-3-4
2.5 LABORATORY ---- AII-3-4

3. PROCESS DESIGN ---- AII-3-4
3.1 HYDRAULIC LOADING OF PROCESS FACILITIES ---- AII-3-4
3.2 PRELIMINARY TREATMENT ---- AII-3-5
3.3 PRIMARY TREATMENT ---- AII-3-7
3.4 BIOLOGICAL TREATMENT ---- AII-3-8

3.5 SLUDGE MANAGEMENT ---- AII-3-13
3.6 MAJOR MECHANICAL EQUIPMENT ---- AII-3-17
3.7 LAYOUT OF FACILITIES ---- AII-3-18

4. ELECTRICAL, INSTRUMENTATION AND CONTROL FACILITIES ---- AII-3-18
4.1 GENERAL ---- AII-3-18
4.2 ELECTRIC POWER FACILITY ---- AII-3-18
4.3 INSTRUMENTATION ---- AII-3-20

5. MAJOR PLANT BUILDINGS AND UTILITY SERVICES ---- AII-3-22
5.1 GENERAL LAYOUT ---- AII-3-22
5.2 ARCHITECTURAL WORKS ---- AII-3-23
5.3 GENERAL CRITERIA FOR THE STRUCTURAL DESIGN ---- AII-3-24
5.4 PRINCIPAL PLANT FACILITIES ---- AII-3-25
5.5 BUILDING UTILITIES ---- AII-3-26

APPENDIX-4 DESIGN CALCULATIONS OF TULCEA WWTP

1. CONVENTIONAL ACTIVATED SLUDGE PROCESS ---- AII-4-1
1.1 DESIGN BASIS ---- AII-4-1
1.2 CALCULATIONS OF SIDESTREAM POLLUTANT LOADS ---- AII-4-2
1.3 SLUDGE PRODUCTIONS ---- AII-4-4
1.4 COMPONENT OF FACILITIES ---- AII-4-5
1.5 ANAEROBIC SLUDGE DIGESTERS ---- AII-4-9
1.6 CHLORINE REQUIREMENTS ---- AII-4-11
1.7 DIGESTER HEATING SYSTEM ---- AII-4-12
1.8 ANAEROBIC SLUDGE DIGESTION SYSTEM ---- AII-4-14
1.9 REQUIRED OXYGEN ---- AII-4-15
1.10 SCREENS AND PUMPING STATION ---- AII-4-16
1.11 GRIT, OIL/GREASE REMOVAL EQUIPMENT ---- AII-4-19
1.12 SLUDGE DIGESTER EQUIPMENT ---- AII-4-21
1.13 APPARATUS FOR SLUDGE DEWATERING EQUIPMENT ---- AII-4-26
1.14 EFFLUENT PUMPING STATION ---- AII-4-29

2. RECIRCURATION PROCESS ---- AII-4-31
2.1 DESIGN BASIS ---- AII-4-31
2.2 CALCULATIONS OF SIDESTREAM POLLUTANT LOADS ---- AII-4-32
2.3 SLUDGE PRODUCTIONS ---- AII-4-35
2.4 COMPONENT FACILITIES ---- AII-4-36

APPENDIX-5 CONSTRUCTION PLAN AND COST ESTIMATE

1. CONSTRUCTION PLAN ---- AII-5-1
1.1 GENERAL ---- AII-5-1
1.2 CONSTRUCTION METHOD ---- AII-5-1
1.3 CONSTRUCTION SCHEDULE ---- AII-5-1

2. COST ESTIMATE ---- AII-5-2
2.1 BASIS OF COST ESTIMATE ---- AII-5-2
2.2 CONSTRUCTION COST ---- AII-5-3
2.3 PROJECT COST ---- AII-5-6
2.4 OPERATION AND MAINTENANCE (O/M) COST ---- AII-5-6

3 IMPLEMENTATION SCHEDULE ---- AII-5-7
3.1 IMPLEMENTATION SCHEDULE ---- AII-5-7
3.2 DISBURSEMENT SCHEDULE ---- AII-5-7

APPENDIX-6 FINANCIAL AND ECONOMIC ANALYSIS

1 FINANCIAL ANALYSIS ---- AII-6-1
1.1 MAJOR PRECONDITIONS AND ASSUMPTIONS ---- AII-6-1
1.2 TERMS AND CONDITIONS OF EXTERNAL FINANCIAL SOURCES ---- AII-6-1

1.3 BACKGROUND DATA FOR FINANCIAL PLAN ---- AII-6-1
1.4 FINANCIAL STATEMENTS FOR PROPOSED FINANCIAL PLANS ---- AII-6-2

2 ECONOMIC ANALYSIS ---- AII-6-3

APPENDIX-7 ENVIRONMENTAL IMPACT ASSESSMENT SURVEY

1. INTRODUCTION ---- AII-7-1
1.1 THE OBJECTIVE AND SCOPE OF THE STUDY ---- AII-7-1
1.2 EIA SITUATION IN ROMANIA ---- AII-7-1
1.3 THE REGULATIONS USED IN EIA STUDY ---- AII-7-2
1.4 EIA IMPLEMENTING ORGANIZATION AND SPECIALISTS ---- AII-7-2

2. EIA FOR TULCEA WWTP PROJECT ---- AII-7-3
2.1 DESCRIPTION OF PROPOSED PROJECTS IN THE FEASIBILITY STUDY (F/S) ---- AII-7-3
2.2 DESCRIPTION OF THE ENVIRONMENT ---- AII-7-5
2.3 IMPACTS ON ENVIRONMENT ---- AII-7-14
2.4 RECOMMENDATIONS FOR MITIGATING ACTIONS AND MONITORING PLAN ---- AII-7-22

3. ANNEXES ---- AII-7-23
3.1 REFERENCES ---- AII-7-23
3.2 ABBREVIATIONS ---- AII-7-24
3.3 RESULTS OF SURVEY ---- AII-7-25

APPENDIX-8 GEOLOGICAL SURVEY ---- AII-8-1

PART AII-2: FEASIBILITY STUDY FOR GALATI WWTP PROJECT

APPENDIX-1 PLANNING BASIS

1. PROCESS TO DETERMINE THE DESIGN BASIS ---- AII-1-1

2 POPULATION ---- AII-1-2
2.1 ADMINISTRATIVE POPULATION ---- AII-1-2
2.2 SERVICE POPULATION ---- AII-1-2

3 DESIGN FLOW ---- AII-1-3
3.1 METHODOLOGY ---- AII-1-3
3.2 DOMESTIC, COMMERCIAL AND INSTITUTIONAL WASTEWATER ---- AII-1-3
3.3 INDUSTRIAL WASTEWATER ---- AII-1-4
3.4 SUMMARY OF DESIGN WASTEWATER FLOW ---- AII-1-5

4 WASTEWATER CHARACTERISTICS ---- AII-1-5
4.1 PRESENT WASTEWATER CHARACTERISTICS ---- AII-1-5
4.2 DESIGN INFLUENT QUALITY ---- AII-1-6

APPENDIX-3 INTERCEPTOR SYSTEM

1. EXISTING WASTEWATER OUTFALLS ---- AII-3-1

2. PROPOSED INTERCEPTOR SYSTEM ---- AII-3-1
2.1 WASTEWATER COLLECTION PLANNING ---- AII-3-1
2.2 ALTERNATIVE STUDY ON CONNECTION OF EXISTING OUTFALLS TO PROPOSED INTERCEPTOR ---- AII-3-2
2.3 PROPOSED FACILITIES ---- AII-3-3

3. WWTP OUTFALL SEWER ---- AII-3-3

APPENDIX-4 FACILITY PLANNING

1. PLANNING PRINCIPLE ---- AII-4-1
1.1 PLANT DESIGN ---- AII-4-1
1.2 FLOW CONDUITS ---- AII-4-1

1.3 FLOW DIVISION CONTROL ---- AII-4-2
1.4 UNIT BYPASSES ---- AII-4-2
1.5 PIPE CLEANING AND MAINTENANCE ---- AII-4-2
1.6 CONSTRUCTION MATERIALS ---- AII-4-2
1.7 GRADING AND LANDSCAPING ---- AII-4-2
1.8 PLANT OUTFALL LINES ---- AII-4-2

2. ESSENTIAL FACILITIES ---- AII-4-3
2.1 MECHANICAL EQUIPMENT ---- AII-4-3
2.2 EMERGENCY POWER FACILITIES ---- AII-4-3
2.3 PLANT SANITARY SYSTEM ---- AII-4-3
2.4 FLOW MEASUREMENT ---- AII-4-4
2.5 PLANT BYPASS ---- AII-4-4
2.6 LABORATORY ---- AII-4-4

3. SITE DEVELOPMENT ---- AII-4-4
3.1 PROPERTY ---- AII-4-4
3.2 SITE ACCESS ---- AII-4-4
3.3 DANUBE RIVER WATER SURFACE ELEVATIONS ---- AII-4-5
3.4 GROUND PREPARATION ---- AII-4-5
3.5 WATER TABLE/SOIL PROFILES ---- AII-4-5

4. PROCESS DESIGN ---- AII-4-5
4.1 HYDRAULIC LOADINGS OF COMPONENT FACILITIES ---- AII-4-6
4.2 PRELIMINARY TREATMENT ---- AII-4-6
4.3 PRIMARY TREATMENT ---- AII-4-11
4.4 BIOLOGICAL TREATMENT ---- AII-4-12
4.5 SLUDGE MANAGEMENT ---- AII-4-17

5. LAYOUT OF FACILITIES ---- AII-4-22

6. ELECTRICAL, INSTRUMENTATION AND CONTROL FACILITIES ---- AII-4-22
6.1 GENERAL ---- AII-4-22
6.2 ELECTRIC POWER FACILITY ---- AII-4-23
6.3 INSTRUMENTATION ---- AII-4-24

7. MAJOR PLANT BUILDINGS AND UTILITY SERVICES ---- AII-4-27
7.1 GENERAL LAYOUT ---- AII-4-27
7.2 ARCHITECTURAL WORKS ---- AII-4-27
7.3 GENERAL CRITERIA FOR THE STRUCTURAL DESIGN ---- AII-4-28
7.4 PRINCIPAL PLANT FACILITIES ---- AII-4-30
7.5 BUILDING UTILITIES ---- AII-4-31

APPENDIX-5 DESIGN CALCULATIONS OF GALATI WWTP

1. CONVENTIONAL ACTIVATED SLUDGE PROCESS ---- AII-5-1
1.1 DESIGN BASIS ---- AII-5-1
1.2 CALCULATIONS OF SIDESTREAM POLLUTANT LOADS ---- AII-5-2
1.3 SLUDGE PRODUCTIONS ---- AII-5-4
1.4 COMPONENT FACILITIES ---- AII-5-6
1.5 ANAEROBIC SLUDGE DIGESTER ---- AII-5-9
1.6 CHLORINE REQUIREMENTS ---- AII-5-11
1.7 DIGESTER HEATING SYSTEM ---- AII-5-12
1.8 ANAEROBIC SLUDGE DIGESTION SYSTEM ---- AII-5-14
1.9 REQUIRED OXYGEN ---- AII-5-15
1.10 SCREENS AND PUMPING STATION ---- AII-5-16
1.11 GRIT, OIL/GREASE REMOVAL EQUIPMENT ---- AII-5-21
1.12 SLUDGE DIGESTER EQUIPMENT ---- AII-5-23
1.13 APPARATUS FOR SLUDGE DEWATERING EQUIPMENT ---- AII-5-28
1.14 EFFLUENT PUMPING STATION ---- AII-5-31

2. RECIRCURATION PROCESS ---- AII-5-34
2.1 DESIGN BASIS ---- AII-5-34
2.2 CALCULATIONS OF SIDESTREAM POLLUTANT LOADS ---- AII-5-35
2.3 SLUDGE PRODUCTIONS ---- AII-5-37
2.4 COMPONENT FACILITIES ---- AII-5-39

APPENDIX-6 CONSTRUCTION PLAN AND COST ESTIMATE

1. CONSTRUCTION PLAN ---- AII-6-1
1.1 GENERAL ---- AII-6-1
1.2 CONSTRUCTION METHOD ---- AII-6-1
1.3 CONSTRUCTION SCHEDULE ---- AII-6-1

2. COST ESTIMATE ---- AII-6-2
2.1 BASIS OF COST ESTIMATE ---- AII-6-2
2.2 CONSTRUCTION COST ---- AII-6-3
2.3 PROJECT COST ---- AII-6-6
2.4 OPERATION AND MAINTENANCE (O/M) COST ---- AII-6-6
3. IMPLEMENTATION PROGRAM ---- AII-6-7
3.1 IMPLEMENTATION SCHEDULE ---- AII-6-7
3.2 DISBURSEMENT SCHEDULE ---- AII-6-7

APPENDIX-7 FINANCIAL AND ECONOMIC ANALYSIS

1 FINANCIAL ANALYSIS ---- AII-7-1
1.1 MAJOR PRECONDITIONS AND ASSUMPTIONS ---- AII-7-1
1.2 TERMS AND CONDITIONS OF EXTERNAL FINANCIAL SOURCES ---- AII-7-1
1.3 BACKGROUND DATA FOR FINANCIAL PLAN ---- AII-7-1
1.4 FINANCIAL STATEMENTS FOR PROPOSED FINANCIAL PLANS ---- AII-7-2

2 ECONOMIC ANALYSIS ---- AII-7-3

APPENDIX-8 ENVIRONMENTAL IMPACT ASSESSMENT SURVEY

1. INTRODUCTION ---- AII-8-1
1.1 THE OBJECTIVE AND SCOPE OF THE STUDY ---- AII-8-1
1.2 EIA SITUATION IN ROMANIA ---- AII-8-1
1.3 THE REGULATIONS USED IN EIA STUDY ---- AII-8-2
1.4 EIA IMPLEMENTING ORGANIZATION AND SPECIALISTS ---- AII-8-2

2. EIA FOR GALATI WWTP PROJECT ---- AII-8-3
2.1 DESCRIPTION OF PROPOSED PROJECTS IN THE FEASIBILITY STUDY (F/S) ---- AII-8-3
2.2 DESCRIPTION OF THE ENVIRONMENT ---- AII-8-5
2.3 IMPACTS ON ENVIRONMENT ---- AII-8-9
2.4 RECOMMENDATIONS FOR MITIGATING ACTIONS AND MONITORING PLAN ---- AII-8-17

3. ANNEXES ---- AII-8-17
3.1 REFERENCES ---- AII-8-17
3.2 ABBREVIATIONS ---- AII-8-18
3.3 RESULTS OF SURVEY ---- AII-8-19

APPENDIX-9 GEOLOGICAL SURVEY ---- AII-9-1

PART AII-3: FEASIBILITY STUDY FOR BRAILA WWTP PROJECT

APPENDIX-1 PLANNING BASIS FOR BRAILA WWTP

1. PROCESS TO DETERMINE THE DESIGN BASIS ---- AII-1-1

2. POPULATION ---- AII-1-2
2.1 ADMINISTRATIVE POPULATION ---- AII-1-2
2.2 SERVICE POPULATION ---- AII-1-2

3. DESIGN FLOW ---- AII-1-4
3.1 INTRODUCTION ---- AII-1-4
3.2 DESIGN FLOWS IN THE 1997 F/S ---- AII-1-5
3.3 DOMESTIC, COMMERCIAL AND INSTITUTIONAL WASTEWATER ---- AII-1-5
3.4 INDUSTRIAL WASTEWATER ---- AII-1-9
3.5 GROUNDWATER INFILTRATION ---- AII-1-11
3.6 SUMMARY OF DESIGN WASTEWATER FLOW ---- AII-1-11
3.7 PROPOSED DESIGN FLOWS FOR BRAILA WWTP ---- AII-1-13

4. WASTEWATER CHARACTERISTICS ---- AII-1-13
4.1 PRESENT WASTEWATER CHARACTERISTICS ---- AII-1-13
4.2 DESIGN INFLUENT QUALITY ---- AII-1-15

APPENDIX-2 INTERCEPTOR SYSTEM

1. EXISTING OUTFALLS ---- AII-2-1

2. INTERCEPTOR SYSTEM ---- AII-2-2
2.1 COLLECTION SYSTEM PLANS ---- AII-2-2
2.2 DESIGN OF INTERCEPTOR AND PUMPING STATION ---- AII-2-4
2.2 PROPOSED FACILITIES ---- AII-2-5

3. WWTP OUTFALL SEWERS ---- AII-2-6

APPENDIX-3 FACILITY PLANNING

1. PLANNING PRINCIPLE ---- AII-3-1
1.1 HYDRAULIC/ORGANIC LOADING OF FACILITIES ---- AII-3-1
1.2 FLOW DIVISION CONTROL ---- AII-3-1
1.3 UNIT BYPASSES ---- AII-3-1
1.4 PIPE CLEANING AND MAINTENANCE ---- AII-3-1
1.5 CONSTRUCTION MATERIALS ---- AII-3-1
1.6 GRADING AND LANDSCAPING ---- AII-3-1
1.7 PLANT OUTFALL LINES ---- AII-3-2
1.8 SITE DEVELOPMENT ---- AII-3-2

2. ESSENTIAL FACILITIES ---- AII-3-3
2.1 EMERGENCY POWER FACILITIES ---- AII-3-3
2.2 PLANT SANITARY SYSTEM ---- AII-3-3
2.3 FLOW MEASUREMENT ---- AII-3-4
2.4 PLANT BYPASS ---- AII-3-4
2.5 LABORATORY ---- AII-3-4

3. PROCESS DESIGN ---- AII-3-4
3.1 HYDRAULIC LOADING OF COMPONENT FACILITIES ---- AII-3-5
3.2 PRELIMINARY TREATMENT ---- AII-3-5
3.3 PRIMARY TREATMENT ---- AII-3-9
3.4 BIOLOGICAL TREATMENT ---- AII-3-10
3.5 SLUDGE MANAGEMENT ---- AII-3-15
3.6 LAYOUT OF FACILITIES ---- AII-3-19

4. ELECTRICAL, INSTRUMENTATION AND CONTROL FACILITIES ---- AII-3-19
4.1 GENERAL ---- AII-3-19
4.2 ELECTRIC POWER FACILITY ---- AII-3-19
4.3 INSTRUMENTATION ---- AII-3-21

5. MAJOR PLANT BUILDINGS AND UTILITY SERVICES ---- AII-3-23
5.1 GENERAL LAYOUT ---- AII-3-23
5.2 ARCHITECTURAL WORKS ---- AII-3-24
5.3 GENERAL CRITERIA FOR THE STRUCTURAL DESIGN ---- AII-3-24
5.4 PRINCIPAL PLANT FACILITIES ---- AII-3-26
5.5 BUILDING UTILITIES ---- AII-3-27

APPENDIX-4 DESIGN CALCULATIONS OF BRAILA WWTP

1. CONVENTIONAL ACTIVATED SLUDGE PROCESS ---- AII-4-1
   1.1 DESIGN BASIS ---- AII-4-1
   1.2 CALCULATIONS OF SIDESTREAM POLLUTANT LOADS ---- AII-4-2
   1.3 SLUDGE PRODUCTIONS ---- AII-4-4
   1.4 COMPONENT FACILITIES ---- AII-4-6
   1.5 ANAEROBIC SLUDGE DIGESTERS ---- AII-4-10
   1.6 CHLORINE REQUIREMENTS ---- AII-4-12
   1.7 DIGESTER HEATING SYSTEM ---- AII-4-12
   1.8 ANAEROBIC SLUDGE DIGESTION SYSTEM ---- AII-4-14
   1.9 REQUIRED OXYGEN ---- AII-4-15
   1.10 SCREENS AND PUMPING STATION ---- AII-4-16
   1.11 GRIT OIL/GREASE REMOVAL EQUIPMENT ---- AII-4-22
   1.12 SLUDGE DIGESTER EQUIPMENT ---- AII-4-23
   1.13 APPARATUS FOR SLUDGE DEWATERING EQUIPMENT ---- AII-4-29
   1.14 EFFLUENT PUMPING STATION ---- AII-4-31

2. RECIRCURATION PROCESS ---- AII-4-34
   2.1 DESIGN BASIS ---- AII-4-34
   2.2 CALCULATIONS OF SIDESTREAM POLLUTANT LOADS ---- AII-4-35
   2.3 SLUDGE PRODUCTIONS ---- AII-4-37
   2.4 COMPONENT OF FACILITIES ---- AII-4-39

APPENDIX-5 CONSTRUCTION PLAN AND COST ESTIMATE

1. CONSTRUCTION PLAN ---- AII-5-1
   1.1 GENERAL ---- AII-5-1
   1.2 CONSTRUCTION METHOD ---- AII-5-1
   1.3 CONSTRUCTION SCHEDULE ---- AII-5-1

2. COST ESTIMATE ---- AII-5-2
   2.1 BASIS OF COST ESTIMATE ---- AII-5-2
   2.2 CONSTRUCTION COST ---- AII-5-3
   2.3 PROJECT COST ---- AII-5-6
   2.4 OPERATION AND MAINTENANCE (O/M) COST ---- AII-5-7

3. IMPLEMENTATION PROGRAM ---- AII-5-8
   3.1 IMPLEMENTATION SCHEDULE ---- AII-5-8
   3.2 DISBURSEMENT SCHEDULE ---- AII-5-8

APPENDIX-6 FINANCIAL AND ECONOMIC ANALYSIS

1 FINANCIAL ANALYSIS ---- AII-6-1
   1.1 MAJOR PRECONDITIONS AND ASSUMPTIONS ---- AII-6-1
   1.2 TERMS AND CONDITIONS OF EXTERNAL FINANCIAL SOURCES ---- AII-6-1
   1.3 BACKGROUND DATA FOR FINANCIAL PLAN ---- AII-6-1
   1.4 FINANCIAL STATEMENTS FOR PROPOSED FINANCIAL PLANS ---- AII-6-2

2 ECONOMIC ANALYSIS ---- AII-6-3

APPENDIX-7 ENVIRONMENTAL IMPACT ASSESSMENT SURVEY

1. INTRODUCTION ---- AII-7-1
   1.1 THE OBJECTIVE AND SCOPE OF THE STUDY ---- AII-7-1
   1.2 EIA SITUATION IN ROMANIA ---- AII-7-1
   1.3 THE REGULATIONS USED IN EIA STUDY ---- AII-7-2
   1.4 EIA IMPLEMENTING ORGANIZATION AND SPECIALISTS ---- AII-7-2

2. EIA FOR BRAILA WWTP PROJECT ---- AII-7-3
   2.1 DESCRIPTION OF PROPOSED PROJECTS IN THE FEASIBILITY STUDY (F/S) ---- AII-7-3
   2.2 DESCRIPTION OF THE ENVIRONMENT ---- AII-7-5

2.3 IMPACTS ON ENVIRONMENT ---------- AII-7-10
2.4 RECOMMENDATIONS FOR MITIGATING ACTIONS AND MONITORING PLAN ---------- AII-7-17
3. ANNEXES ---------- AII-7-17
3.1 REFERENCES ---------- AII-7-17
3.2 ABBREVIATIONS ---------- AII-7-18
3.3 RESULTS OF SURVEY ---------- AII-7-19
APPENDIX-8 GEOLOGICAL SURVEY ---------- AII-8-1

LIST OF TABLES

PART AI: GENERAL

APPENDIX-2 PEOPLE'S AWARENESS SURVEY

Table AI.2.1 Result of Parameter Estimation ---- AI-2-23

APPENDIX-3 SELECTION OF TREATMENT PROCESS

Table AI.3.1 Romanian and Japanese Standard Design Criteria for Conventional Activated Sludge Method ---- AI-3-18

Table AI.3.2 Comparison of Wastewater Treatment Process (Normal Type, 2 sheets) ---- AI-3-19

Table AI.3.3 Comparison of Wastewater Treatment Process (Small Area Type, 2 sheets) ---- AI-3-21

PART AII-1: FEASIBILITY STUDY FOR TULCEA WWTP PROJECT

APPENDIX-1 PLANNING BASIS

Table AII.1.1 Service Population by the Public Water Supply and Sewerage Systems ---- AII-1-2

Table AII.1.2 Present Wastewater Generations except Industrial Wastewater ---- AII-1-3

Table AII.1.3 Water Supply Conditions in 1998 ---- AII-1-4

Table AII.1.4 Per Capita Consumption of Domestic, Public and Commercial Water (STAS 1343) ---- AII-1-5

Table AII.1.5 Wastewater Generation except Industrial Wastewater Estimated by the Romanian Standards ---- AII-1-5

Table AII.1.6 Average Daily Flow of Wastewater in the year 2010 ---- AII-1-6

Table AII.1.7 Design Flows for the Domestic, Commercial and Institutional Wastewaters ---- AII-1-6

Table AII.1.8 Major Manufactures and companies discharging Industrial Waterwater in Tulcea City ---- AII-1-15

Table AII.1.9 Summary of Industrial Wastewater Daily Average Flow ---- AII-1-7

Table AII.1.10 Flow Variation Factors Set for Industrial Wastewater ---- AII-1-7

Table AII.1.11 Summary of Design Flow of Industrial Wastewater ---- AII-1-7

Table AII.1.12 Summary of the Design Flow ---- AII-1-8

Table AII.1.13 Results of Wastewater Quality Surveys (24 hours, one sample every 3 hours) ---- AII-1-9

Table AII.1.14 Estimated Pollutant Loads based on Wastewater Quantity and Quality Surveys ---- AII-1-9

Table AII.1.15 Estimated Per Capita Unit Loads and Generation Rate of Domestic Wastewater ---- AII-1-9

Table AII.1.16 Industrial Wastewater Characteristics at Major Manufactures in Tulcea City ---- AII-1-16

Table AII.1.17 Major Effluent Quality Standards to Public Receiving Water Bodies ---- AII-1-10

Table AII.1.18 The Design Influent Quality of Domestic, Commercial, and Institutional Wastewater ---- AII-1-11

Table AII.1.19 Present Industrial Wastewater Discharges by Product Category ---- AII-1-11

Table AII.1.20 Design Industrial Wastewater Discharge Flow by Categorized Factories ---- AII-1-11

Table AII.1.21 Design Industrial Wastewater Characteristics Classified by Product Category ---- AII-1-12

Table AII.1.22 Major Permissible Effluent Quality Standards for the Wastewater Discharged into Public Wastewater Systems ---- AII-1-12

Table AII.1.23 Design Quality of Industrial Wastewater of Point Source ---- AII-1-13

Table AII.1.24 Design Quality of Industrial Wastewater ---- AII-1-13

Table AII.1.25 Design Influent Qualities ---- AII-1-14

APPENDIX-2 INTERCEPTOR SYSTEM

Table AII.2.1 Flow of Each Outfall in Tulcea ---- AII-2-5

Table AII.2.2 Population Density Categorized in Landuse in Tulcea ---------- AII-2-6
Table AII.2.3 Computations of Existing Sewer along Street Isaccei to SP3 in Tulcea ---------- AII-2-7
Table AII.2.4 Computations of Planned Interceptor along Street Isaccei to SP3 in Tulcea (Alt.1) ---------- AII-2-8
Table AII.2.5 Computations of Planned Interceptor along Street Isaccei to S-P3 in Tulcea (Alt.2) ---------- AII-2-9
Table AII.2.6 Existing Sewer Head in Tulcea ---------- AII-2-10
Table AII.2.7 Planed Sewer Head in Tulcea ---------- AII-2-11
Table AII.2.8 Quantity of Planned Interceptor System in Tulcea ---------- AII-2-12

APPENDIX-3 FACILITY PLANNING

Table AII.3.1 Lists of Equipment of Tulcea WWTP ---------- AII-3-29

APPENDIX-5 CONSTRUCTION PLAN AND COST ESTIMATE

Table AII.5.1 Structure of Project Cost ---------- AII-5-3
Table AII.5.2 Structure of Construction Cost ---------- AII-5-3
Table AII.5.3 Unit Costs of Personnel ---------- AII-5-4
Table AII.5.4 Unit Price of Material ---------- AII-5-5
Table AII.5.5 Unit Price of Equipment Operation ---------- AII-5-5
Table AII.5.6 Direct Construction Cost of WWTP (Tulcea) ---------- AII-5-8
Table AII.5.7 Direct Construction Cost of Interceptor (Tulcea) ---------- AII-5-10
Table AII.5.8 Project Cost (Tulcea Project) ---------- AII-5-6
Table AII.5.9 Operation and Maintenance Cost for Tulcea Project ---------- AII-5-7
Table AII.5.10 Disbursement Schedule of Tulcea Project ---------- AII-5-11

APPENDIX-6 FINANCIAL AND ECONOMIC ANALYSIS

Table AII.6.1 Financial Statement of Tulcea Financial Plan (Case IB3) ---------- AII-6-5
Table AII.6.2 Financial Statement of Tulcea Financial Plan (Case IIA3) ---------- AII-6-6
Table AII.6.3 Financial Statement of Tulcea Financial Plan (Case IIIB2) ---------- AII-6-7
Table AII.6.4 Financial Statement of Tulcea Financial Plan (Case IVB2) ---------- AII-6-8
Table AII.6.5 Cost Benefit Stream for Tulcea WWTP Project ---------- AII-6-9

APPENDIX-7 ENVIRONMENTAL IMPACT ASSESSMENT SURVEY

Table AII.7.1 Summary of Proposed WWTP in Tulcea City ---------- AII-7-4
Table AII.7.2 Summary of Climate Characteristics in Tulcea ---------- AII-7-5
Table AII.7.3 Some Results of Air Pollution Measurements in the WWTP Site (July 1999) ---------- AII-7-6
Table AII.7.4 Results of Noise Measurements (July 1999) ---------- AII-7-7
Table AII.7.5 Summary of the Effects of Vibration on the Building Structure ---------- AII-7-7
Table AII.7.6 Results of Vibration Survey ---------- AII-7-8
Table AII.7.7 Water Intaken and Discharged In The County Of Tulcea ---------- AII-7-12
Table AII.7.8 Estimated Costs of Resettlement ---------- AII-7-15
Table AII.7.9 Estimation Of The Noise Generated From Vehicles And Machinery ---------- AII-7-16
Table AII.7.10 Estimated Pollutant Load Generation and Reduction (2010) ---------- AII-7-19
Table AII.7.11 Maximum Concentration of Pollutant in the Mixture ---------- AII-7-20
Table AII.7.12 Summary of Heavy Metals in Soil (Tulcea) And Sludge (Roman and Constanta) ---------- AII-7-21
Table AII.7.13 Analysis Results of Odor in Existing WWTP Site (July 1999) ---------- AII-7-22
Table AII.7.14 Summary of Analysis Results for Soil ---------- AII-7-26
Table AII.7.15 Summary of Analysis Results for Sludge from Existing WWTPs ---------- AII-7-27
Table AII.7.16 Summary of Analysis Results for Groundwater ---------- AII-7-28
Table AII.7.17 Summary of Analysis Results for Leachate from Existing Solid Disposal Site ---------- AII-7-29
Table AII.7.18 Summary of Analysis Results for Industrial Wastewater in Tulcea ---------- AII-7-30
Table AII.7.19 Summary of Analysis Results for the Air in Braila, Galati, Tulcea, Roman and Constanta WWTPs ---------- AII-7-31

PART AII-2: FEASIBILITY STUDY FOR GALATI WWTP PROJECT

APPENDIX-1 PLANNING BASIS

Table AII.1.1 Service Population by the Public Water Supply and Sewerage Systems ---------- AII-1-8
Table AII.1.2 Present Wastewater Generation except Industrial Wastewater (Estimated) ------ AII-1-9
Table AII.1.3 Water Supply Conditions in 1998 ---------- AII-1-9
Table AII.1.4 Per Capita Consumption of Domestic, Public and Commercial Water (STAS 1343) ---------- AII-1-10
Table AII.1.5 Average Daily Flow of Wastewater in the year 2010 ---------- AII-1-10
Table AII.1.6 Design Flows for the Domestic, Commercial and Institutional Wastewaters ---------- AII-1-10
Table AII.1.7 Major Manufactures and Companies discharge the wastewater to the public sewers ---------- AII-1-11
Table AII.1.8 Industrial Wastewater Discharge through the Existing Collectors ---------- AII-1-12
Table AII.1.9 Summary of Industrial Wastewater Flow ---------- AII-1-12
Table AII.1.10 Flow variation factors set for industrial wastewater ---------- AII-1-12
Table AII.1.11 Summary of Design Flow of Industrial Wastewater ---------- AII-1-13
Table AII.1.12 The Design Flow for JICA F/S ---------- AII-1-13
Table AII.1.13 Comparison of Design Flows ---------- AII-1-13
Table AII.1.14 Quality of Wastewater Discharged by each Collector (1998) ---------- AII-1-3
Table AII.1.15 Results of Wastewater Quality Surveys (24 hours, one sample every 3 hours) ---------- AII-1-14
Table AII.1.16 Estimated Pollutant Loads based on Wastewater Quantity and Quality Surveys ---------- AII-1-14
Table AII.1.17 Estimated Per Capita Unit Loads and Generation Rate of Domestic Wastewater ---------- AII-1-14
Table AII.1.18 Estimation of Industrial Wastewater Quality ---------- AII-1-15
Table AII.1.19 Major Effluent Quality Standards to Public Receiving Water Bodies. ---------- AII-1-16
Table AII.1.20 The Design Influent Quality in the 1992 Pre F/S ---------- AII-1-17
Table AII.1.21 Major Permissible Effluent Quality Standards for the Wastewater Discharged into Public Wastewater Systems ---------- AII-1-17
Table AII.1.22 Estimated Equivalent Per Capita Loads ---------- AII-1-17
Table AII.1.23 Estimated BOD5 Concentration in Domestic, Commercial and Institutional Wastewater based on Per Capita Loads ---------- AII-1-18
Table AII.1.24 Estimated SS Concentration in Domestic, Commercial and Institutional Wastewater based on Per Capita Loads ---------- AII-1-18
Table AII.1.25 Estimated T-N Concentration in Domestic, Commercial and Institutional Wastewater based on Per Capita Loads ---------- AII-1-19
Table AII.1.26 Estimated T-P Concentration in Domestic, Commercial and Institutional Wastewater based on Per Capita Loads ---------- AII-1-19
Table AII.1.27 The Design Influent Quality of Domestic, Commercial, and Institutional Wastewater for the JICA F/S ---------- AII-1-20
Table AII.1.28 Major Industry classified by Product Category ---------- AII-1-21
Table AII.1.29 Present Industrial Wastewater Discharges by Product Category ---------- AII-1-22
Table AII.1.30 Design Industrial Wastewater Discharge Flow by Categorized Factories ------- AII-1-22
Table AII.1.31 Design Industrial Wastewater Characteristics Classified by Product Category ---------- AII-1-22
Table AII.1.32 Design Quality of Industrial Wastewater by Categorized Factories(BOD, SS), (T-N,T-P) ---------- AII-1-23
Table AII.1.33 Design Quality of Industrial Wastewater(BOD, SS), (T-N,T-P) ---------- AII-1-23
Table AII.1.34 Design Influent Quality(BOD, SS), (T-N,T-P) ---------- AII-1-24

APPENDIX-2 SITE SELECTION

Table AII.2.1 Economic Costs of Strategy Option No.1 and No.2 ---------- AII-2-8

APPENDIX-3 INTERCEPTOR SYSTEM

Table AII.3.1 Computations of Planned Interceptor in Galati (Alt.1) ---------- AII-3-5
Table AII.3.2 Computations of Planned Interceptor in Galati (Alt.2) ---------- AII-3-6
Table AII.3.3 Quantity of Planned Interceptor System in Galati ---------- AII-3-7

APPENDIX-4 FACILITY PLANNING
Table AII.4.1 Lists of Equipment of Galati WWTP ---- AII-4-33

APPENDIX-6 CONSTRUCTION PLAN AND COST ESTIMATE
Table AII.6.1 Direct Construction Cost of WWTP (Galati) ---- AII-6-8
Table AII.6.2 Direct Construction Cost of Interceptor (Galati) ---- AII-6-10
Table AII.6.3 Disbursement Schedule of Galati Project ---- AII-6-11

APPENDIX-7 FINANCIAL AND ECONOMIC ANALYSIS
Table AII.7.1 Financial Statement of Galati Financial Plan (Case IA2) ---- AII-7-5
Table AII.7.2 Financial Statement of Galati Financial Plan (Case IIB2) ---- AII-7-6
Table AII.7.3 Financial Statement of Galati Financial Plan (Case IIIB2) ---- AII-7-7
Table AII.7.4 Financial Statement of Galati Financial Plan (Case IVB2) ---- AII-7-8
Table AII.7.5 Cost Benefit Stream for Galati WWTP Project ---- AII-7-9

APPENDIX-8 ENVIRONMENTAL IMPACT ASSESSMENT SURVEY
Table AII.8.1 Summary of proposed WWTP in Galati City ---- AII-8-4
Table AII.8.2 Summary of climate characteristics in Galati ---- AII-8-5
Table AII.8.3 Some results of air pollution measurements in the WWTP site (July 1999) ---- AII-8-5
Table AII.8.4 Quality parameters of the groundwater in the Galati solid waste disposal site ---- AII-8-11
Table AII.8.5 Estimated pollutant load generation and reduction (2010) ---- AII-8-14
Table AII.8.6 Maximum concentration of pollutant in the mixture ---- AII-8-14
Table AII.8.7 Summary of heavy metals in soil (Galati) and sludge (Roman and Constanta) ---- AII-8-15
Table AII.8.8 Analysis results of odor in existing WWTP site (July 1999) ---- AII-8-16
Table AII.8.9 Summary of Analysis Results for Soil ---- AII-8-20
Table AII.8.10 Summary of Analysis Results for Sludge from Existing WWTPs ---- AII-8-21
Table AII.8.11 Summary of Analysis Results for Groundwater ---- AII-8-22
Table AII.8.12 Summary of Analysis Results for Leachate from Existing Solid Disposal Site ---- AII-8-23
Table AII.8.13 Summary of Analysis Results for Industrial Wastewater in Galati (1) ---- AII-8-24
Table AII.8.14 Summary of Analysis Results for Industrial Wastewater in Galati (2) ---- AII-8-25
Table AII.8.15 Summary of Analysis Results for the Air in Braila, Galati, Tulcea, Roman and Constanta WWTPs ---- AII-8-26

PART AII-3: FEASIBILITY STUDY FOR BRAILA WWTP PROJECT

APPENDIX-1 PLANNING BASIS
Table AII.1.1 Registered Service Population of the Public Water Supply ---- AII-1-3
Table AII.1.2 Estimated Service Population based on a further study for the 1996 M/P ---- AII-1-3
Table AII.1.3 Estimated Sewerage Service Population as of 1998 ---- AII-1-22
Table AII.1.4 Proposed Sewerage Service Population in 2010 ---- AII-1-4
Table AII.1.5 Present Wastewater Generation except Industrial Wastewater ---- AII-1-6
Table AII.1.6 Present Water Supply Conditions as of 1998 ---- AII-1-6
Table AII.1.7 Per Capita Consumption of Domestic, Public and Commercial Water (STAS 1343) ---- AII-1-7
Table AII.1.8 Average Daily Flow of Wastewater in the year 2010 (Scenario A-1), (Scenario A-2), (Scenario B) ---- AII-1-7
Table AII.1.9 Design Flows for the Domestic, Commercial and Institutional Wastewater(Scenario A-1), (Scenario A-2), (Scenario B) ---- AII-1-8
Table AII.1.10 Industrial Wastewater Discharging from Major Industries ---- AII-1-9
Table AII.1.11 Industrial Wastewater Discharge based on the Questionnaire Surveys ---- AII-1-23
Table AII.1.12 Design Average Daily Flow of Industrial Wastewater ---- AII-1-10
Table AII.1.13 Flow Variation Coefficients Set For Industrial Wastewater ---- AII-1-10
Table AII.1.14 Summary of Design Flow of Industrial Wastewater ---- AII-1-11

Table AII.1.15 Summary of the Design Flow (Scenario A-1), (Scenario A-2), (Scenario B) ---- AII-1-11
Table AII.1.16 Summary of the Design Flow (Scenario A-2) ---- AII-1-13
Table AII.1.17 Comparison of Design Flows ---- AII-1-13
Table AII.1.18 Monthly Average Quality of Wastewater in Major Outfalls (1996 to 98) ---- AII-1-14
Table AII.1.19 Results of Wastewater Quality Surveys (24 hours, one sample every 3 hours) ---- AII-1-14
Table AII.1.20 Estimated Pollutant Loads based on Wastewater Quantity and Quality Surveys ---- AII-1-14
Table AII.1.21 Estimated Per Capita Unit Loads and Generation Rate of Domestic Wastewater ---- AII-1-15
Table AII.1.22 Present Industrial Wastewater Pollutant Loads ---- AII-1-24
Table AII.1.23 Major Effluent Quality Standards to Public Receiving Water Bodies. ---- AII-1-16
Table AII.1.24 Estimated Per Capita Unit Loads ---- AII-1-17
Table AII.1.25 Estimated BOD5 and SS Concentration in Domestic, Commercial and Institutional Wastewater based on Per Capita Loads (Scenario A-2) ---- AII-1-17
Table AII.1.26 The Design Influent Quality of Domestic, Commercial, and Institutional Wastewater (Scenario A-2) ---- AII-1-18
Table AII.1.27 Present Industrial Wastewater Discharges by Product Category ---- AII-1-18
Table AII.1.28 Design Industrial Wastewater Discharge Flow by Categorized Factories ---- AII-1-18
Table AII.1.29 Design Industrial Wastewater Characteristics Classified by Product Category ---- AII-1-19
Table AII.1.30 Major Permissible Effluent Quality Standards for the WastewaterDischarged into Public Wastewater Systems ---- AII-1-19
Table AII.1.31 Design Quality of Industrial Wastewater by Categorized Factories (BOD, SS), (T-N,T-P) ---- AII-1-20
Table AII.1.32 Design Quality of Industrial Wastewater(BOD, SS), (T-N,T-P) ---- AII-1-20
Table AII.1.33 Design Influent Quality(BOD, SS), (T-N,T-P) ---- AII-1-21

APPENDIX-2 INTERCEPTOR SYSTEM

Table AII.2.1 Comparison of Alternative Study on Pumping Station in Braila ---- AII-2-7
Table AII.2.2 Computation of Planned Interceptor in Braila ---- AII-2-8
Table AII.2.3 Quantity of Planned Interceptor System in Braila ---- AII-2-9

APPENDIX-3 FACILITY PLANNING

Table AII.3.1 Lists of Equipment of Braila WWTP ---- AII-3-29

APPENDIX-5 CONSTRUCTION PLAN AND COST ESTIMATE

Table AII.5.1 Structure of Project Cost ---- AII-5-3
Table AII.5.2 Structure of Construction Cost ---- AII-5-3
Table AII.5.3 Unit Costs of Personnel ---- AII-5-4
Table AII.5.4 Unit Price of Material ---- AII-5-5
Table AII.5.5 Unit Price of Equipment Operation ---- AII-5-6
Table AII.5.6 Direct Construction Cost of WWTP (Braila) ---- AII-5-9
Table AII.5.7 Direct Construction Cost of Interceptor (Braila) ---- AII-5-11
Table AII.5.8 Project Cost (Braila Project) ---- AII-5-7
Table AII.5.9 Operation and Maintenance Cost for Braila Project ---- AII-5-7
Table AII.5.10 Disbursement Schedule of Braila Project ---- AII-5-12

APPENDIX-6 FINANCIAL AND ECONOMIC ANALYSIS

Table AII.6.1 Financial Statement of Braila Financial Plan (Case IB3) ---- AII-6-5
Table AII.6.2 Financial Statement of Braila Financial Plan (Case IIA3) ---- AII-6-6
Table AII.6.3 Financial Statement of Braila Financial Plan (Case IIIB2) ---- AII-6-7
Table AII.6.4 Financial Statement of Braila Financial Plan (Case IVB2) ---- AII-6-8
Table AII.6.5 Cost Benefit Stream for Braila WWTP Project ---- AII-6-9

APPENDIX-7 ENVIRONMENTAL IMPACT ASSESSMENT SURVEY

Table AII.7.1 Summary of proposed WWTP in Braila City ---- AII-7-4
Table AII.7.2 Summary of climate characteristics in Braila ---- AII-7-5

Table AII.7.3 Average concentrations of gaseous pollutants ---------- AII-7-5
Table AII.7.4 Some results of air pollution measurements in the WWTP site (July 1999) ---------- AII-7-4
Table AII.7.5 Quality parameters of the groundwater in the Braila solid waste disposal site ---------- AII-7-12
Table AII.7.6 Estimated pollutant load generation and reduction (2010) ---------- AII-7-14
Table AII.7.7 Maximum concentration of pollutant in the mixture ---------- AII-7-14
Table AII.7.8 Summary of heavy metals in soil (Braila) and sludge (Roman and Constanta) ---------- AII-7-15
Table AII.7.9 Analysis results of odor in existing WWTP site (July 1999) ---------- AII-7-16
Table AII.7.10 Summary of Analysis Results for Soil ---------- AII-7-20
Table AII.7.11 Summary of Analysis Results for Sludge from Existing WWTPs ---------- AII-7-21
Table AII.7.12 Summary of Analysis Results for Groundwater ---------- AII-7-22
Table AII.7.13 Summary of Analysis Results for Leachate from Existing Solid Disposal Site ---------- AII-7-23
Table AII.7.14 Summary of Analysis Results for Industrial Wastewater in Braila ---------- AII-7-24
Table AII.7.15 Summary of Analysis Results for the Air in Braila, Galati, Tulcea, Roman and Constanta WWTPs ---------- AII-7-25

LIST OF FIGURES

PART AII-1: FEASIBILITY STUDY FOR TULCEA WWTP PROJECT

APPENDIX-1 PLANNING BASIS

Figure AII.1.1 Population Projection for Tulcea City ----- AII-1-17
Figure AII.1.2 Tourist Number Stayed in Three Major Hotels in Tulcea City ----- AII-1-18
Figure AII.1.3 Result of Wastewater Quality Survey at 1848 Street in Tulcea City ----- AII-1-19
Figure AII.1.4 Result of Wastewater Quality Survey at the Pumping Station in Tulcea City ----- AII-1-20

APPENDIX-2 INTERCEPTOR SYSTEM

Figure AII.2.1 Tulcea City Sewerage System (Existing and Planning) ----- AII-2-13
Figure AII.2.2 Schematic Representation of Tulcea Sewerage System (Existing and Planning) ----- AII-2-14
Figure AII.2.3 Existing Sewerage Service Area by Each Outfall ----- AII-2-15
Figure AII.2.4 Existing Sewer Layout around Planned Interceptor in Tulcea ----- AII-2-16
Figure AII.2.5 Flow Chart of Existing Sewer and Planned Interceptor of Tulcea ----- AII-2-17
Figure AII.2.6 Longitudinal Profile of Existing Sewer to SP3 in Tulcea ----- AII-2-18
Figure AII.2.7 Longitudinal Profile of Planned Interceptor to SP3 in Tulcea (Alt.1) ----- AII-2-19
Figure AII.2.8 Longitudinal Profile of Planned Interceptor to S-SP3 in Tulcea (Alt.2) ----- AII-2-20
Figure AII.2.9 Layout of Planned Interceptor in Tulcea (Alt.2) ----- AII-2-21
Figure AII.2.10 Typical Sewer Bedding and Typical Sheathing on Sewer Construction ----- AII-2-22
Figure AII.2.11 Typical Structure of Manhole ----- AII-2-23
Figure AII.2.12 Typical Combined Sewer Overflow (CSO) Regulator ----- AII-2-24

APPENDIX-3 FACILITY PLANNING

Figure AII.3.1 Primary Sedimentation Tank of Tulcea WWTP ----- AII-3-35
Figure AII.3.2 Aeration Tank of Tulcea WWTP ----- AII-3-36
Figure AII.3.3 Final Sedimentation Tank of Tulcea WWTP ----- AII-3-37
Figure AII.3.4 Sludge Thickener of Tulcea WWTP ----- AII-3-38
Figure AII.3.5 Sludge Digester of Tulcea ----- AII-3-39
Figure AII.3.6 Grit Chamber and Oil Separator of Tulcea WWTP ----- AII-3-40
Figure AII.3.7 Chlorination Chamber of Tulcea WWTP ----- AII-3-41
Figure AII.3.8 Effluent Pumping Station of Tulcea WWTP ----- AII-3-42

APPENDIX-5 CONSTRUCTION PLAN AND COST ESTIMATION

Figure AII.5.1 Construction Plan and Sequence of Works for the Tulcea Project ----- AII-5-2
Figure AII.5.2 Implementation Schedule (Tulcea Project) ----- AII-5-7

APPENDIX-7 ENVIRONMENTAL IMPACT ASSESSMENT SURVEY

Figure AII.7.1 Location Map of Tulcea Wastewater Treatment Plant and Sampling Points ----- AII-7-32

PART AII-2: FEASIBILITY STUDY FOR GALATI WWTP PROJECT

APPENDIX-1 PLANNING BASIS

Figure AII.1.1 Population Projection for Galati City ----- AII-1-25
Figure AII.1.2 Result of Wastewater Quality Survey at Micro 21 in Galati City ----- AII-1-26
Figure AII.1.3 Result of Wastewater Quality Survey at SP 13 Iunie in Galati City ----- AII-1-27

APPENDIX-2 SITE SELECTION

Figure AII.2.1 Location of Possible WWTP Sites for Galati City ----- AII-2-9

APPENDIX-3 INTERCEPTOR SYSTEM

Figure AII.3.1 Galati City Sewerage System (Existing and Planning) ----- AII-3-8
Figure AII.3.2 Schematic Representation of Galati Sewerage System (Existing and Planning) ----- AII-3-9
Figure AII.3.3 Flow Chart of Existing Sewer and Planned Interceptor of Galati ----- AII-3-10

Figure AII.3.4 Longitudinal Profile of Planned Interceptor in Galati (Alt.1) ----------AII-3-11
Figure AII.3.5 Longitudinal Profile of Planned Interceptor in Galati (Alt.2) ----------AII-3-12
Figure AII.3.6 Layout of Planned Interceptor in Galati (Alt.2) ----------AII-3-13
Figure AII.3.7 Typical Sewer Bedding and Typical Sheathing on Sewer Construction --------AII-3-14
Figure AII.3.9 Typical Structure of Manhole ----------AII-3-16
Figure AII.3.8 Typical Combined Sewer Overflow (CSO) Regulator ----------AII-3-15

APPENDIX-4 FACILITY PLANNING

Figure AII.4.1 Primary Sedimentation Tank of Galati WWTP----------AII-4-40
Figure AII.4.2 Aeration Tank of Galati WWTP----------AII-4-41
Figure AII.4.3 Final Sedimentation Tank of Galati WWTP ----------AII-4-42
Figure AII.4.4 Sludge Thickener of Galati WWTP----------AII-4-43
Figure AII.4.5 Sludge Digester of Galati WWTP----------AII-4-44
Figure AII.4.6 Grit Chamber and Oil Separator of Galati WWTP----------AII-4-45
Figure AII.4.7 Chlorination Chamber of Galati WWTP ----------AII-4-46
Figure AII.4.8 Screening & Pumping Station of Galati WWTP ----------AII-4-47
Figure AII.4.9 Effluent Pumping Station of Galati WWTP----------AII-4-48

APPENDIX-8 ENVIRONMENTAL IMPACT ASSESSMENT SURVEY

Figure AII.8.1 Location Map of Galati Wastewater Treatment Plant and Sampling Points----------AII-8-27

PART AII-3: FEASIBILITY STUDY FOR BRAILA WWTP PROJECT

APPENDIX-1 PLANNING BASIS

Figure AII.1.1 Population Projection for Braila City ----------AII-1-2
Figure AII.1.2 Result of Wastewater Quality Survey at Manhole at Buzau St. in Braila City----------AII-1-25
Figure AII.1.3 Result of Wastewater Quality Survey at Collector Germany in Braila City----------AII-1-26

APPENDIX-2 INTERCEPTOR SYSTEM

Figure AII.2.1 Braila City Sewerage System (Existing and Planning) ----------AII-2-10
Figure AII.2.2 Schematic Representation of Braila Sewerage System ----------AII-2-11
Figure AII.2.3 Proposed Interceptor System of Braila ----------AII-2-12
Figure AII.2.4 Longitudinal Profile of Planed Interceptor in Braila ----------AII-2-13
Figure AII.2.5 Typical Sewer Bedding and Typical Sheathing on Sewer Construction --------AII-2-14
Figure AII.2.6 Typical Combined Sewer Overflow (CSO) Regulator ----------AII-2-15
Figure AII.2.7 Typical Structure of Manhole ----------AII-2-16

APPENDIX-3 FACILITY PLANNING

Figure AII.3.1 Primary Sedimentation Tank of Braila WWTP----------AII-3-36
Figure AII.3.2 Aeration Tank of Braila WWTP----------AII-3-37
Figure AII.3.3 Final Sedimentation Tank of Braila WWTP ----------AII-3-38
Figure AII.3.4 Sludge Thickener of Braila WWTP----------AII-3-39
Figure AII.3.5 Sludge Digester of Braila WWTP----------AII-3-40
Figure AII.3.6 Grit Chamber and Oil Separator of Braila WWTP----------AII-3-41
Figure AII.3.7 Chlorination Chamber of Braila WWTP ----------AII-3-42
Figure AII.3.8 Screening & Pumping Station of Braila WWTP ----------AII-3-43
Figure AII.3.9 Effluent Pumping Station of Braila WWTP----------AII-3-44

APPENDIX-5 CONSTRUCTION PLAN AND COST ESTIMATE

Figure AII.5.1 Construction Plan and Sequence of Works for the Braila Project ----------AII-5-2
Figure AII.5.2 Implementation Schedule (Braila Project) ----------AII-5-8

APPENDIX-7 ENVIRONMENTAL IMPACT ASSESSMENT SURVEY

Figure AII.7.1 Location Map of Braila Wastewater Treatment Plant and Sampling Points----------AII-7-26

ABBREVIATIONS

Organizations

EBRD	European Bank for Reconstruction and Development
ISPA	Instrument for Structural Policies for Pre-accession
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
MOF	Ministry of Finance
MPWTP	Ministry of Public Works and Territorial Planning
MWFEP	Ministry of Water, Forestry and Environmental Protection
DLPA	Department of Local Public Administration

General

LIBOR	London Inter-bank Offered Rate
WTP	Willingness to Pay
ROL	Romanian Lei

Technical Terms

WWTP	Wastewater treatment plant
EIA	Environmental Impact Assessment
TDH	Total dynamic head
BOD_5	Biochemical oxygen demands, 5-day, 20℃
COD	Chemical oxygen demands
Cl^-	Chlorine ion
DO	Dissolved oxygen
F/M	Food-to-microorganism ratio
MPN	Most probable number
MLSS	Mixed liquor suspended solids
pH	The reciprocal of the logarithm of the hydrogen-ion concentration
SRT	Sludge retention time
SS	Suspended solids
T-N	Total nitrogen
T-P	Total phosphorous
TSS	Total suspended solids
VSS	Volatile suspended solids
As	Arsenic
Cr^{6+}	Chromium, hexavalent

Units

mm	millimeter
cm	centimeter
m	meter
km	kilometer
mm^2	square millimeter
cm^2	square centimeter
m^2	square meter
km^2	square kilometer
ha	hectare
ml	milliliter
l	liter
m^3	cubic meter
mg	milligram
g	gram
kg	kilogram
t	ton (1,000 kg)
W	watt
kW	kilowatt
m^3/d	cubic meter per day
m^3/h	cubic meter per hour
m^3/m	cubic meter per minute
m^3/s	cubic meter per second
l/d	liter per day
l/s	liter per second
mg/l	milligram per liter
lcd	liter per capita per day
$m^3/m^2/d$	cubic meter per square meter per day

PART AI: GENERAL

APPENDIX-1 INSTITUTIONAL CONSIDERATIONS

1. STUDY ON PRIVATIZATION PROCESS

1.1 HISTORY OF PRIVATIZATION OF PUBLIC SERVICE SECTOR

Privatization of public service sectors, including water and sewerage service bodies, started soon after the political change of 1989. The first step was an enactment of the law 15/90 concerning reorganization of state economic units to Regia Autonomas or commercial companies. The law allows public service sectors to transform into either a Regia Autonoma or a private company. Majority chose a Regia Autonoma, however, there were some cases to be private companies. Among seven (7) cities in the Study Area, only Drobeta Turnu Severin chose a private company.

Second step of the privatization process was issuance of a series of governmental urgent ordinances related to commercialization and privatization of Regia Autonomas in 1998. Here the commercialization means transformation of Regia Autonomas into commercialized companies of which shares are owned by relevant local councils, and the privatization means transferring the shares to the State Ownership Fund followed by selling the shares to private sector by the State Ownership Fund. Currently, except the case of Drobeta Turnu Severin, each local council in the Study Area has not transferred the shares of public service companies to the State Ownership Fund.

Privatization of public services may result in higher efficiency of the service and lighter financial burden of local administrative authorities. However, progress of privatization of public services is far behind against the Romanian government's expectation. One of the main reasons is uncertain stipulation concerning ownership of relevant assets. Most public service companies recognize that they will render their services based on concession contract with relevant local council, however, they have no chance to conclude an actual contract without clear definition of their asset. To solve this problem, the public patrimony law and the concession law were recently enacted in 1999.

1.2 THE OWNERSHIP OF SEWERAGE FACILITIES

The public patrimony law No.213/98 specifies two types of public assets, i.e. inalienable public assets and private public assets. Inalienable public assets can not be transferred or sold but private public assets can be. The law is annexed with a list of inalienable public assets. According to the list, sewer network and wastewater treatment plant with related installation and land are inalienable public assets.

However, there remains a possibility to transfer inalienable public assets to private public assets. The article 10 of the public patrimony law describes how this transfer can be achieved. It is stipulated that the transfer from the public domain into private domain can be done through a governmental decision or a decision of local administrative authorities, unless the decision breaches the Constitution.

1.3 CONCESSION

1.3.1 FORMS OF CONCESSION

Concession is one of schemes for utilizing private sector in public services. Various types of concession has been developed and practiced mainly in England, France, and Germany.

Recently the British government widely promotes PFI (Private Finance Initiative), one of the

most advanced form of concession. Under the scheme of PFI, not only investment and operation of public services but also planning, fund raising, and management of the public services are contracted out to private contractors.

On the other hand, a typical concession contract in France covers only operation and maintenance based on inalienable public assets, and investment should be done by the owner of assets, namely the local council.

1.3.2 POSSIBLE CONCESSION FORMS IN ROMANIA

The concession law No.219/98 provides a framework of concession procedure in Romania. According to a MPWTP's study on institutional restructuring in the field of district heating, supported by GTZ (German Technical Co-operation Company), following three types of concession will be possible, theoretically.

Investment concession:

Concession contract includes necessary investment on the facilities relating to the public service. The concessionaire (private contractor) is responsible for fund raising for the investment, however, the concessionaire can not own the constructed facilities which is automatically regarded as inalienable public assets.

In practice, this scheme seems to be unrealistic due to difficulty in fund raising. The reason of the difficulty is that inalienable public assets can not be used as security for a bank loan.

Concession based on lease contract:

Concessionaire renders public services using inalienable public assets leased by the local council. The local council exclusively makes necessary investment.

This concession form seems the most realistic in Romania.

Concession based on transferring inalienable public assets to public private assets:

If the local council would transfer inalienable public assets to private public assets, the fund raising problem of the abovementioned investment concession can be solved. Under this type of concession, the concessionaire owns relevant facilities and takes responsibility for investment. However, it is not clear that whether this transfer is practically possible or not.

1.4 PROSPECT OF PRIVATIZATION IN ROMANIA

The most likely prospect of privatization process within the present legislative framework is as follows:

- Construction, extension, or large scale rehabilitation of sewerage facilities will be exclusively done by local councils.
- Operation companies will render operation and maintenance service based on concession contract based on the lease of facilities from the local council.

This scenario may not be preferable from the viewpoint of privatization, on the other hand, it may be advantageous to apply financial assistance of international financial sources.

2. STUDY ON LOCAL PUBLIC FINANCE

2.1 GENERAL

As mentioned in Appendix 2 either the operation body of sewerage service is a regia autonoma or a commercial company, facilities for the service including wastewater treatment plant and sewer network are inalienable local public properties, which are owned by local councils. It means that the investor for the sewerage facility construction or development must be a local council.

What determines the financial feasibility for construction of the wastewater treatment plants is thus the capability of local public finance. In this appendix the local public finance law and the public debt law, which are the most relevant laws for local public finance, are studied.

2.2 LOCAL PUBLIC FINANCE LAW

2.2.1 GENERAL

The local public finance law No.189/98 came into force on 1st of January 1999. As stated in Article 3 of the law, it targets de-centralization through transferring the financial management of certain local public expenditures with the financial resources needed for these expenditures from the state to the local administrative authorities.

The law consists of following six (6) chapters and two (2) annexes:

- Chapter I : General provisions
- Chapter II: Revenues and expenditures of local budgets
- Chapter III: The preparation, approval, and execution of local budgets
- Chapter IV: Finance of public institutions and services
- Chapter V: Loans contracted by local public authorities
- Chapter VI: Transitory and final provisions
- Annex I: List of local taxes, fees and other local budget revenues
- Annex II: List of expenses provided in the local budgets

This law has significant influence on feasibility of the project. In particular, provisions related to following issues are crucial for the project:

- Revenue and execution of local budget
- Approval of local public investments
- Special fees for local public services
- External loans contracted by local administrative authorities and sovereign guarantees

This section focused on studying these provisions, from the viewpoint of local administrative authority. Please note that in this section the term "local" means only local level though this term in the law covers not only local level but also county level.

2.2.2 REVENUE AND EXECUTION OF LOCAL BUDGETS

In old regime, local public authorities obtained their budget via the state government. The more projects they applied, the more budget the state distributed. One of the serious problems

was that distributed budgets from the state were earmarked for each of all applied projects, which resulted in severe deficit to required project costs. Furthermore, there was quite large time lag between application and distribution of the state subsidies to the local budget.

The local public finance law transfers the competence of collecting income tax from the state to the local public authorities. The income tax collected by a local public authority distributed among the state budget, the budget of county in which the local public authority locates, and the local budget. The proportion of this distribution can be modified annually by the state budget law. Currently it is 50%, 15%, and 35% to the state, county, and local, respectively. At the same time subsidies from the state budget have been drastically diminished. Hearing with seven cities in the Study Area showed that almost no state subsidy is allocated to the local budget in 1999.

For most local administrative authorities local portion of the income tax is the main local budget revenue. The law provides local governments with competence to make their investment plan based on estimable their own revenue. In other words, the local government can intensively invest their budget to certain important project as he wishes. It makes implementation of their investments more effective and realistic.

2.2.3 Approval of Local Public Investments

Execution of a local public investment financed by local budget and loans needs a registration of the investment in an investment plan of a local government and an approval on the investment plan as an annex to the local budget by the local council. For the registration in an investment plan, an approval on the feasibility study of the investment according to the law is requisite.

Approval process on the feasibility study varies depending on financial sources and amount of the investment. If the financial source of an investment is exclusively covered by a local budget or any loans engaged directly by a local administrative authority, the feasibility study of the investment can be approved by the local council. Otherwise, along with previous agreement of the Ministry of Finance, the feasibility study should be approved by an authority as follows.

(Unit: Billion Lei)

Approval authority	Executive body of investment			
	County*	City	Town	Commune
Mayor (President of county council*)	< 2	< 2	< 2	< 2
Council	2 ~ 80	2 ~ 45	2 ~ 35	2 ~ 25
The state government	> 80	> 45	> 35	> 25

Note) Criteria of investment amount is revised every three (3) months considering an inflation.

2.2.4 Special Fees for Local Public Services

The local public finance low allows local councils to charge special fees for their public services. The tariff of these special fees shall be calculated to cover, at least, the invested funds and the operation and maintenance cost of the services.

The special fees should be collected exclusively from the beneficiary of the service.

The special fees are determined, collected, and distributed only by own bodies of the local councils.

2.2.5 External Loans Contracted by Local Administrative Authorities and Sovereign Guarantees

(1) External Loans Contracted by Local Administrative Authorities

The law provides the local administrative authorities with a competence to contract internal or external loans, under following provisions:

- Total of the annual debts, which consist of the due installments, interests, and commissions incurred by loans, is less than 20 % of the total current revenue of the local budgets.
- The due installments, interests, and commissions incurred by loans shall be reimbursed by the local budgets.

Furthermore, an approval of the Commission for the authorization of loans is prerequisite to external loans contracted by the local administrative authorities. The law stipulates that the Commission shall be made up of representatives of following authorities:

- The local administrative authority
- The state government
- The National Bank of Romania

However, at the time of writing this report, the Commission has not been established yet.

(2) Applicability of State Guarantees

The law focused on the procedure for local administrative authorities by themselves to contract internal or external loans. In this case the law clearly stipulates that the local public debt does not represent a debt or responsibility of the state government and the state government has no payment obligation whatsoever. It is also stipulated in same chapter that the credibility or taxation capacity of the state government must not be used for guaranteeing loans contracted by local administrative authority.

However, still there is a possibility for local administrative authority to apply external loans via the ministry of finance. This process is not mentioned in the local public finance law but in the public debt law. The Article 55 in Chapter VI of the law merely says that the state government may offer guarantees to external loans contracted by local administrative authorities, under the provisions of the public debt law.

2.3 Public Debt Law

2.3.1 General

The public debt law No.81/99 came into force on 10th of May 1999. The law consists of following seven (7) chapters:

- Chapter I : General provisions
- Chapter II: Internal public debts
- Chapter III: External public debts
- Chapter IV: State guarantees for internal loans
- Chapter V: State guarantees for external loans
- Chapter VI: Records and administration of public debts and state guarantees
- Chapter VII Final provisions

Practically financial arrangement for large-scale public investments relies on external loans. Since most international financial sources require the state guarantee for concluding their loan agreements, realistic fund raising method is an external loan guaranteed by the state. The public debt law deals with this matter.

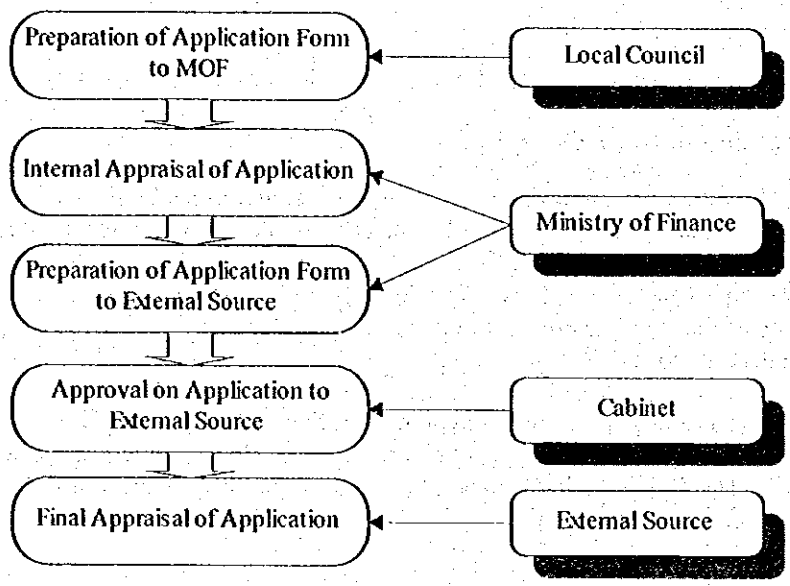
2.3.2 APPLICABILITY FOR STATE EXTERNAL LOANS AND STATE GUARANTEE

Article 22 of the public debt law allows local administrative authorities to apply state external loans for financing the investment in the field of infrastructure development and social services.

Under same criteria, the state guarantees can be issued for external loans to finance selected investment projects. For issuing the state guarantees, not only the inter-ministerial committee but also the Export-Import Bank of Romania participates the appraisal procedure.

2.3.3 PROCEDURE TO APPLY STATE EXTERNAL LOANS

Application procedure for state external loans is shown below.



Application Procedure for State External Loans

Application to the ministry of finance (MOF) should consist of following information:

- Description of the project
- Project cost
- Implementation schedule
- Financial arrangement for the project (especially for local own portion)

In the past, the ministry of finance has obliged to pay not few bad debts of local governments and now is careful for examining the repayment capability of applicant local governments. This repayment capability can be proved by the cash-flow statement which shows the total debt amount will never exceed 20% of the current revenue.

The state government establishes a maximum external debt level every year. Romanian

government concluded a loan agreement with IMF (International Monetary Fund) in August 1999. The conditionality imposed by IMF contains restriction of external loans. Nevertheless it probably affects the maximum external debt levels for next a couple of years, a drop of the level will not so significant.

3. STUDY ON FINANCIAL INSTRUMENTS

3.1 EBRD LOAN

European Bank for Reconstruction and Development (EBRD) is to help mobilize domestic and foreign direct investment, to support private sector development by;

- providing loans and equity to create/modernize/expand private companies,
- strengthening financial institutions, and
- developing the public infrastructure needed to support the private sector.

Public sector can be covered by EBRD financing through its second and third activities. For financing public sectors, EBRD requires sovereign guaranty. Terms of loans differ between loans to the public sector and the private sector. Typical terms are as follows:

Sector	Interest Rate	Payment Period	Grace Period	Remarks
Public	LIBOR*+1%	15	2~3	Sovereign guaranty
Private	LIBOR*+2~6%	5~7	1~1.5	Negotiable

* LIBOR : London Inter-bank Offered Rate

There are 47 EBRD projects in Romania as at the end of 1998. Among them, 14 projects are of the public sector and 33 projects are of the private sector. A total portfolio counts USD 1,561.02 million with 51% of the public and 49% of the private. EBRD has guidelines for the distribution of portfolio between the public and private sectors, *i.e.* 40% and 60% respectively. Therefore, there is less possibility to finance further public sector projects in Romania.

Meanwhile, EBRD welcomes the implementation of Local Public Finance Law 189/98 from a view point of the promotion of decentralization. To support local public projects, EBRD likely introduces a new scheme to finance municipality projects directly. The scheme is expected to provide a new finance source to municipalities responsible for the implementation of local projects such as the construction of wastewater treatment plants. However, since the terms for the private sector are to be applied to the new scheme, it would be not easy for the municipalities to utilize the new scheme.

3.2 ISPA

3.2.1 GENERAL

ISPA (Instrument for Structural Policies for Pre-accession) is a new pre-accession aid of the European Union (EU) established by the Council Regulation (EC) No.1267/1999 (hereinafter the ISPA Regulation) in June 1999.

Pre-accession aids are EU's aid tools for 10 EU applicant countries, *i.e.* Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia. Originally PHARE was established as the sole pre-accession aid in 1989. In 1999 ISPA and SAPARD (Support for Agricultural and Rural Development) were newly established to strengthen support for infrastructure development. ISPA aims to support investment projects in fields of environment protection and transport infrastructure improvement.

It is proposed to grant Euro 3 billion per year as pre-accession aids, of which breakdown is Euro 1.5 billion by PHARE, Euro 1.0 billion by ISPA, and Euro 0.5 billion by SAPARD, during the period from 2000 to 2006.

An allocation of ISPA money between beneficiary countries will be decided by the European Commission (EC) based on the population, per capita GDP in purchasing power parities, and surface area of each beneficiary country. It is said that the annual allocation for Romania will be Euro 200 million. This allocation might be modified taking into account of implementation of the investment supported by ISPA in previous year.

3.2.2 Forms of Assistance

ISPA provides mainly two (2) forms of assistance, namely non-repayable direct assistance and repayable assistance. Non-repayable direct assistance is so called grant. Repayable assistance is a grant for managing authority or another public authority who loan the grant money to executive bodies of the investment projects in the fields of environment protection and transport infrastructure improvement. Under repayable assistance, reimbursed money to the managing authority or another public authority shall be reapplied for the same purpose.

ISPA assistance can cover up to 75 % of initial investment cost born by public bodies or bodies regarded as equivalent to public bodies. In case of repayable assistance the rate of assistance shall be reduced from 75 %.

3.2.3 Eligibility Requirements

According to the ISPA Regulation the eligible projects for ISPA assistance shall satisfy following requirements:

- In case of environmental field, the project enables the beneficiary countries to comply with the requirements of Community environmental law and with the objectives of the Accession Partnerships.
- In case of transport infrastructure field, the project promotes sustainable mobility and enables the beneficiary countries to comply with the objectives of the Accession Partnerships.
- Total project cost exceeds Euro 5 million.

The Accession Partnership is a kind of action program clarifying the priority areas in which large efforts should be made to realize EU accession. To complement it, each applicant country prepares own National Program for the Adoption of the Acquis, which gives detailed program for adopting the 'acquis communautaire' (the European Communities' legislation framework).

The ISPA Regulation also requires that a balance be struck between environmental projects and transport infrastructure projects.

3.2.4 Application Form

Required content of applications is described in Annex I of the ISPA Regulation. In brief, a core of the application shall be an international level feasibility study containing an implementation schedule, a cost-benefit analysis, an environment impact analysis, and a financing plan. Furthermore, information on the place and priority of the project in the national environmental strategy laid down in the National Program for the Adoption of the Acquis is required.

3.2.5 APPLICATION PROCEDURE

Each beneficiary country shall establish management system as well as control system for ISPA assistance. In Romania, MWFEP (the ministry of water, forest, and environmental protection) is regarded as candidate for the central management body for ISPA.

The central management body will compile applications and prioritize them. Compiled and prioritized applications will be delivered to EC through EC delegation office of each beneficiary country.

EC appraises delivered applications based on the criteria mentioned in Annex II of the ISPA Regulation. A management committee composed of the representatives of the Member States of EU and chaired by the representative of EC shall assist this appraisal process.

The management committee will be held three times a year. Deadlines of applications are about six (6) months before the management committee.

3.3 JBIC LOAN

Japan Bank for International Cooperation (JBIC, former OECF) of Japan is a bilateral financing organ for ODA (Official Development Assistance) to foreign countries. It is widely recognized in the world for having helped develop infrastructures in developing countries.

There are two routes to provide loans: one is a yen loan which is the government to government loans, and another is overseas investment/financing to the private sector. In both cases, the currency used is the Japanese yen.

In Romania OECF signed agreements to provide yen loans to the road and harbor projects in 1998. The lending terms for the two projects are shown in the table below. The loans used to be targeted to the foreign portion of the capital cost, but today the percentage of the capital cost to which the loans are applicable is determined case by case (usually 70% to 80%). According to JBIC, joint financing with other international financial organs is desirable.

In the case of overseas investment/financing to the private sector, the lending terms are directly influenced by the domestic situation surrounding investment/financing by the Japanese government. At the present moment they are as shown in the table below. In providing loans, JBIC needs bank guaranty to protect its creditor's position. If sovereign guaranty can be arranged, there is no problem. Loans will be provided to 70% of the capital cost, the balance being borne by the debtor.

Typical Lending Terms of JBIC

Sector	Interest Rate	Repayment Period	Grace Period	Remarks
Public	Construction : 2.7% Consulting : 2.3%	30 years	10 years	Joint financing is desirable.
Private	2.0%	15 - 20 years	5 - 10 years	Sovereign guaranty is preferable.

APPENDIX-2 PEOPLE'S AWARENESS SURVEY

1. INTRODUCTION

The people's awareness survey in the Study consists of the following two (2) different questionnaire surveys.

- Questionnaire survey for project economic evaluation which aims to evaluate the socio-economic benefits borne by the project
- Questionnaire survey for project financial evaluation which aims to determine the sewerage service tariff

To avoid any confusion of respondents, sampling of these two surveys were separately made.

2. ECONOMIC QUESTIONNAIRE SURVEY

2.1 OBJECTIVES OF THE SURVEY

For the project economic evaluation it is necessary to estimate socio-economic benefits born by "the Project" that is defined as the construction of wastewater treatment plants in the Study Area. This estimation is the objective of economic questionnaire survey in the Study.

In general, expected benefits of wastewater management projects are as follows.

- Sanitary improvement by eliminating untreated wastewater from roadside ditches
- Additional water uses due to water quality improvement of sewage recipient watercourse
- Amenity improvement due to water quality improvement of sewage recipient watercourse

In the Study, however, it is difficult to expect these benefits. First, sewer networks have been installed in the Study Area and there are no sanitary problems caused by wastewater. Second, flow quantity of Danube River downstream reach is so huge that expected positive impact of the Project could not result in additional water use.

What could be expected as a positive impact of the Project was nature conservation and environmental protection of Danube Delta. The Delta is widely regarded as one of precious natural resources and national heritages of Romania.

Nevertheless, the following facts make it extremely difficult to say that the Project improves water quality of Danube River so much that the biodiversity and good landscape of the Delta can be conserved.

- Not only water pollution of Danube River but also various interactive factors have influenced the biodiversity of Danube Delta.
- Volume of treated wastewater will be negligible compare to the flow volume of Danube River, and the positive impact on water quality improvement will be intangible.

It is a fact that the proper management of communal wastewater is given high priority in the Danube Strategic Action Plan. People may appreciate the effort for the environment protection and nature conservation although any tangible benefits can not be expected.

Finally, the economic questionnaire survey was designed to estimate the value of

"implementation of the Project as the first step of a policy towards nature conservation and environmental protection of the Danube Delta".

2.2 SURVEY DESIGN

2.2.1 METHOD

The survey method is summarized below.

Sampling design	- 1,800 samples in total. 300 samples each from Tulcea, Galati and Braila as F/S target cities and 300 samples each from Bucharest, Brasov and Constanta as national samples - Respondents are the heads of households - Random sampling
Collection method	- Interview method
Elicitation method	- Double bounded dichotomous choice method
Payment vehicle	- Contribution

(1) Sampling Design

The Danube Delta is more than a precious natural resource of Romania, which is registered in the list of World Natural Heritages. Beneficiary of the Project may include at least all Romanian citizens since the Project is related to the nature conservation and environmental protection of the Danube Delta. It is necessary to collect samples from F/S target cities and other cities.

Since the unit of samples is defined as household, respondents were sampled from heads of household in this people's awareness survey.

(2) Collection Method

Interview method was applied to this people's awareness survey because this method can convey exact information to respondents. In this study, the surveyors visited each house to interview the head of each household.

(3) Elicitation Method

Close-end method was applied to this people's awareness survey. If open-end method is applied to evaluate things without any market prices, respondents tend to be embarrassed and to tell extremely high or low amounts.

This survey employed a dichotomous choice referendum method out of various close-end methods. In this method, respondents are asked to vote 'yes' or 'no' on the proposed project on condition to pay a certain amount for the project. It is said that this method can minimize various biases pertaining to the elicitation process.

There are mainly two (2) procedures widely used in the dichotomous choice referendum method, namely the single bounded procedure and the double bounded procedure. These procedures are as follows.

- **Single bounded procedure:**
  The respondents are asked to vote 'yes' or 'no' once.

- **Double bounded procedure:**
  The respondents are asked to vote twice. If the first vote is 'yes', higher amount is presented to respondents for voting, otherwise, lower amount is presented.

Double bounded procedure can narrow down the confidence intervals of estimated WTP. On the other hand, it is said that double bounded procedure has a potential to be biased. When respondents vote for the first amount, some respondents tend to regard the first amount as the 'proper' amount, and, as a result, to vote against the second amount. This phenomenon is called as downward bias.

In this survey, the double bounded procedure was employed. The downward bias was compensated by a bias-included estimation model explained in the sub-section 2.7.2.

(4) Payment Vehicle

In general, the word "contribution" or "tax" is applied to this kind of people's awareness survey as the payment vehicle. In this survey, the word contribution was chosen as the payment vehicle, based on the result of pre-test, as mentioned later.

2.2.2 Design of Questionnaire

The questionnaire consists of the following four (4) sections.

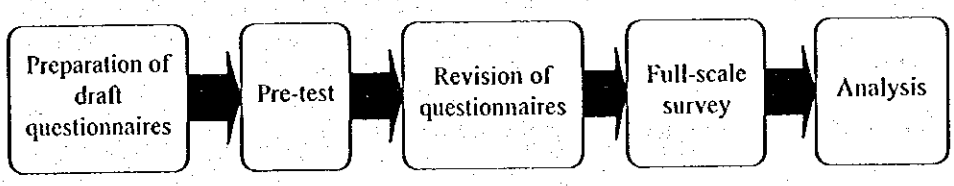
- General information of the Danube Delta and explanation of the flora and fauna observed in the Delta. If necessary, the pamphlet of the Danube Delta is shown to respondents.
- Information of negative impact to the Danube Delta, such as water pollution, industrial pollution and construction of dams.
- Purpose, effects, and cost of the project.
- Series of questions on WTP as well as respondent's attributes.

The project is defined as the construction of wastewater treatment plants with biological treatment process in the seven cities.

It is emphasized in the third section that the effect of the Project on nature conservation and environmental protection of the Danube Delta would be intangible.

2.2.3 Survey Procedure

Following figure shows the main survey procedures.



2.3 Pre-test

The objectives of the pre-test are summarized below.

- To confirm Romanian people's awareness
- To find out and correct inappropriate expressions in questionnaire

- To confirm the Romanian people's consent to project
- To roughly estimate the range of WTP

This survey aims to estimate the project benefits based on respondent's WTP. If respondents are not aware of environmental issues, it is difficult to achieve the survey purpose because such respondents do not recognize themselves as beneficiaries of the project. Thus, it is necessary to confirm people's awareness to environmental issues before starting the full-scale survey.

It is said that inappropriate expressions may distort actual WTP. For example, in some countries the word "tax" cause strong downward bias because people has been accustomed to pay "contribution" instead of "tax". It is essential to find out and correct inappropriate expressions for the improvement of survey accuracy.

In general, this kind of people's awareness survey is applied to the projects which results in tangible environmental improvements. However, as mentioned before, it is extremely difficult to describe the effects of the project quantitatively. It is the reason why to confirm the Romanian people's consent to the project is necessary prior to conduct full-scale survey.

As mentioned in 2.2.1, close-end method was applied to this people's awareness survey. In close-end method, in case that presented amount is far from the actual WTP, the survey accuracy may decrease. Thus, the range of WTP should be estimated prior to asking WTP for the improvement of survey accuracy.

2.3.2 PROCESS OF PRE-TEST

(1) Focus Group Session

Focus group sessions were held in Bucharest and Tulcea. Eight (8) to nine (9) participants attended each focus group session.

After the general discussion on environmental problem, all of participants discussed environmental problems and image of Danube Delta. Then, the draft questionnaires were presented and outline of the project was explained to participants. Discussion on the questionnaires was carried out to confirm the aforementioned issue. Finally, all participants were asked their WTP.

(2) Preliminary Interview Survey

Preliminary interview survey was conducted in the same way as full-scale survey. Surveyors visited respondents and interviewed them one by one. Purposes of this survey are not only rough estimation of WTP but also training of surveyors.

2.3.3 RESULT OF PRE-TEST

Following facts were confirmed through the pre-test.

- Romanian people's awareness of the environmental problems and the protection of the Danube Delta.
- Romanian people's consent to the implementation of the Project is confirmed

In addition, following issues were pointed out by the focus group sessions.

- The word "contribution" is more acceptable than "tax" as the payment vehicle, because

many people feel there are too many kinds of taxes.

- It is necessary to emphasize that collected contribution is correctly utilized for the implementation of the project, because not a few people distrust the budget allocation of their governments.

Furthermore, WTP for the implementation of the Project was roughly estimated.

2.4 FULL SCALE SURVEY

2.4.1 FINAL VERSION OF QUESTIONNAIRE

The questionnaire was finalized based on the result of the pre-test.

In order to improve accuracy of WTP estimation, the respondents in each city were divided into three (3) groups and given one of three (3) versions of the questionnaires. The difference of three versions is only the asked amounts as summarized below.

Unit: lei/household/month

Version	T_L	T_0	T_H
E1	2,000	5,000	10,000
E2	10,000	15,000	20,000
E3	20,000	30,000	50,000

Note: T_0 : the first vote amount,
T_L : the lower second vote amount for the respondents voting against T_0,
T_H : the higher second vote amount for the respondents voting for T_0.

Please note that respondents were inquired whether they will pay the asked amount every month for five (5) years.

The finalized questionnaire (version E1) is shown in attachment 1 at the end of this appendix.

2.4.2 FIELD SURVEY

Interview survey was conducted in six (6) cities, namely, Braila, Galati, Tulcea, Constanta, Brasov, and Bucharest, from 15th to 22nd of July.

2.4.3 REFUSAL RATE OF FIELD SURVEY

The following table shows the refusal rate of field survey in each city.

	Braila	Galati	Tulcea	Constanta	Brasov	Bucharest	Total
Number of visits	366	430	357	356	443	506	2,458
Available samples	320	322	320	321	317	317	1,917
Number of refusals	46	108	37	35	126	189	541
Refusal rate	12.6%	25.1%	10.4%	9.8%	28.4%	37.4%	22.0%

2.5 SAMPLING RESULT

2.5.1 ACCEPTANCE OF PROJECT IMPLEMENTATION AND WILLINGNESS TO PAY (WTP)

The following table shows the results concerning respondents' acceptance of project implementation and WTP at presented amount. It should be noted that more than 95% of all

respondents agreed to implement the project.

	Braila		Galati		Tulcea		Constanta		Brasov		Bucharest		Total	
	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio
Q1: Acceptance of Project Implementation														
Yes	307	95.9%	316	98.1%	308	96.3%	300	93.5%	307	96.8%	300	94.6%	1838	95.9%
No	13	4.1%	6	1.9%	12	3.8%	21	6.5%	10	3.2%	17	5.4%	79	4.1%
Q2a-Q2c. Willingness to Pay														
E1: Q2a=No, Q2c=No	34	11.1%	31	9.8%	22	7.1%	28	9.3%	35	11.4%	31	10.3%	181	9.8%
E1: Q2a=No, Q2c=Yes	14	4.6%	7	2.2%	11	3.6%	7	2.3%	7	2.3%	4	1.3%	50	2.7%
E1: Q2a=Yes, Q2b=No	28	9.1%	28	8.9%	34	11.0%	21	7.0%	23	7.5%	26	8.7%	160	8.7%
E1: Q2a=Yes, Q2b=Yes	28	9.1%	36	11.4%	37	12.0%	43	14.3%	38	12.4%	38	12.7%	220	12.0%
E2: Q2a=No, Q2c=No	44	14.3%	40	12.7%	46	14.9%	48	16.0%	51	16.6%	53	17.7%	282	15.3%
E2: Q2a=No, Q2c=Yes	10	3.3%	9	2.8%	16	5.2%	4	1.3%	6	2.0%	7	2.3%	52	2.8%
E2: Q2a=Yes, Q2b=No	23	7.5%	13	4.1%	18	5.8%	21	7.0%	14	4.6%	18	6.0%	107	5.8%
E2: Q2a=Yes, Q2b=Yes	21	6.8%	33	10.4%	20	6.5%	27	9.0%	30	9.8%	19	6.3%	150	8.2%
E3: Q2a=No, Q2c=No	61	19.9%	55	17.4%	64	20.8%	60	20.0%	60	19.5%	56	18.7%	356	19.4%
E3: Q2a=No, Q2c=Yes	4	1.3%	16	5.1%	12	3.9%	7	2.3%	7	2.3%	11	3.7%	57	3.1%
E3: Q2a=Yes, Q2b=No	27	8.8%	18	5.7%	21	6.8%	22	7.3%	21	6.8%	21	7.0%	130	7.1%
E3: Q2a=Yes, Q2b=Yes	13	4.2%	15	4.7%	7	2.3%	14	4.7%	13	4.2%	10	3.3%	72	3.9%
Disagree to the project	13	4.1%	6	1.9%	12	3.8%	21	6.5%	10	3.2%	17	5.4%	79	4.1%

2.5.2 ENVIRONMENTAL AWARENESS

The following table shows the results of respondent's awareness of environmental issues.

	Braila		Galati		Tulcea		Constanta		Brasov		Bucharest		Total	
	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio
Q3: Knowledge of Danube Strategic Plan														
Yes	54	16.9%	57	17.7%	70	21.9%	116	36.1%	108	34.1%	85	26.8%	490	25.6%
No	266	83.1%	265	82.3%	250	78.1%	205	63.9%	209	65.9%	232	73.2%	1427	74.4%
Q4: Knowledge of Agenda 21 or Environment Summit														
Yes	39	12.2%	66	20.5%	50	15.6%	67	20.9%	96	30.3%	73	23.0%	391	20.4%
No	281	87.8%	256	79.5%	270	84.4%	254	79.1%	221	69.7%	244	77.0%	1526	79.6%

Due to the above result, national samples have better knowledge about environmental issues than samples in F/S target cities.

2.5.3 DANUBE DELTA EXPERIENCES

(1) Experience of Visit to the Danube Delta

The following table shows how many respondents have ever been to the Danube Delta.

	Braila		Galati		Tulcea		Constanta		Brasov		Bucharest		Total	
	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio
Q5: Visit to Danube Delta														
Yes	121	37.8%	156	48.4%	277	86.6%	158	49.2%	161	50.8%	133	42.0%	1006	52.5%
No	199	62.2%	166	51.6%	43	13.4%	163	50.8%	156	49.2%	184	58.0%	911	47.5%

It seems to be natural that 86.6% of Tulcea respondents has been to the Danube Delta, considering the fact that Tulcea is the main access to the Delta.

(2) Details of the Visit

Questions on details of the visit were asked to the respondents who have ever visited to the Delta. The following table shows the results of the questions.

	Braila		Galati		Tulcea		Constanta		Brasov		Bucharest		Total	
	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio
Q6: Year of last visit														
before 1975	19	15.7%	14	9.0%	23	8.3%	29	18.4%	32	19.9%	18	13.5%	135	13.4%
1976-1980	19	15.7%	10	6.4%	18	6.5%	28	17.7%	24	14.9%	18	13.5%	117	11.6%
1981-1985	12	9.9%	22	14.1%	17	6.1%	19	12.0%	23	14.3%	20	15.0%	113	11.2%
1986-1990	20	16.5%	33	21.2%	33	11.9%	36	22.8%	41	25.5%	38	28.6%	201	20.0%
1991-1995	20	16.5%	34	21.8%	38	13.7%	21	13.3%	16	9.9%	21	15.8%	150	14.9%
1996-	31	25.6%	43	27.6%	148	53.4%	25	15.8%	25	15.5%	18	13.5%	290	28.8%
Q7: Frequency of visit														
Many times a year	16	13.2%	17	10.9%	115	41.5%	15	9.5%	5	3.1%	10	7.5%	178	17.7%
Once a year	15	12.4%	45	28.8%	69	24.9%	13	8.2%	39	24.2%	17	12.8%	198	19.7%
Once in three years	8	6.6%	15	9.6%	28	10.1%	4	2.5%	25	15.5%	15	11.3%	95	9.4%
More rarely	82	67.8%	79	50.6%	65	23.5%	126	79.7%	92	57.1%	91	68.4%	535	53.2%
Q8: Length of a visit														
1 day	14	11.6%	11	7.1%	58	20.9%	22	13.9%	6	3.7%	6	4.5%	117	11.6%
2 days	21	17.4%	20	12.8%	64	23.1%	40	25.3%	10	6.2%	11	8.3%	166	16.5%
3 days	18	14.9%	27	17.3%	51	18.4%	24	15.2%	14	8.7%	18	13.5%	152	15.1%
4 days	11	9.1%	9	5.8%	23	8.3%	14	8.9%	11	6.8%	8	6.0%	76	7.6%
5 days	7	5.8%	10	6.4%	16	5.8%	6	3.8%	19	11.8%	14	10.5%	72	7.2%
6 days	7	5.8%	5	3.2%	6	2.2%	4	2.5%	6	3.7%	7	5.3%	35	3.5%
7 days	26	21.5%	44	28.2%	30	10.8%	23	14.6%	38	23.6%	34	25.6%	195	19.4%
8 days to 2 weeks	9	7.4%	24	15.4%	8	2.9%	12	7.6%	44	27.3%	22	16.5%	119	11.8%
more than 2 weeks	8	6.6%	6	3.8%	21	7.6%	13	8.2%	13	8.1%	13	9.8%	74	7.4%

2.5.4 HOUSEHOLD INCOME AND EXPENSES

Distribution of household income and expenses are as shown below. Household expenses are represented by the maintenance fee which consists of water charge, garbage collection fee, gases charge, and elevator operation fee.

	Braila		Galati		Tulcea		Constanta		Brasov		Bucharest		Total	
	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio
Q9: Maintenance														
No answer	1	0.3%	0	0.0%	2	0.6%	1	0.3%	0	0.0%	22	6.9%	26	1.4%
less than 100,000 lei	101	31.6%	71	22.0%	127	39.7%	72	22.4%	17	5.4%	47	14.8%	435	22.7%
100,000 - 199,999lei	121	37.8%	131	40.7%	127	39.7%	109	34.0%	50	15.8%	35	11.0%	573	29.9%
200,000-299,999lei	61	19.1%	73	22.7%	50	15.6%	53	16.5%	68	21.5%	44	13.9%	349	18.2%
300,000 lei -	22	6.9%	25	7.8%	2	0.6%	60	18.7%	154	48.6%	144	45.4%	407	21.2%
Q10. Household income														
No answer	3	0.9%	2	0.6%	0	0.0%	3	0.9%	3	0.9%	21	6.6%	32	1.7%
less than 500,000 lei	36	11.3%	22	6.8%	41	12.8%	40	12.5%	13	4.1%	15	4.7%	167	8.7%
500,000-999,999 lei	115	35.9%	78	24.2%	90	28.1%	72	22.4%	48	15.1%	59	18.6%	462	24.1%
1,000,000-1,499,999 lei	75	23.4%	76	23.6%	76	23.8%	61	19.0%	56	17.7%	66	20.8%	410	21.4%
1,500,000-1,999,999 lei	44	13.8%	51	15.8%	48	15.0%	57	17.8%	68	21.5%	59	18.6%	327	17.1%
2,000,000-2,499,999 lei	21	6.6%	51	15.8%	35	10.9%	44	13.7%	58	18.3%	36	11.4%	245	12.8%
2,500,000 lei -	26	8.1%	42	13.0%	30	9.4%	44	13.7%	71	22.4%	61	19.2%	274	14.3%

Maintenance fee largely varies among cities. Especially the fee in Brasov and Bucharest

seems to be much higher than those of remaining cities.

2.5.5 Attributes of Respondent, and Household Size

In this people's awareness survey, a household head is defined as the person who earns the most in the household.

The attributes of respondents' and the number of household members are summarized in the following table.

	Braila		Galati		Tulcea		Constanta		Brasov		Bucharest		Total	
	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio	No.	Ratio
Q11: Occupation														
Owner, manager	5	1.6%	6	1.9%	3	0.9%	3	0.9%	9	2.8%	11	3.5%	37	1.9%
Specialist, faculty graduate	26	8.1%	44	13.7%	27	8.4%	23	7.2%	51	16.1%	43	13.6%	214	11.2%
Technician, teacher	9	2.8%	23	7.1%	23	7.2%	7	2.2%	29	9.1%	16	5.0%	107	5.6%
Clerk	11	3.4%	7	2.2%	24	7.5%	12	3.7%	13	4.1%	11	3.5%	78	4.1%
Services employee, merchant	9	2.8%	12	3.7%	18	5.6%	15	4.7%	10	3.2%	13	4.1%	77	4.0%
Qualified worker, craftsman	85	26.6%	100	31.1%	80	25.0%	87	27.1%	82	25.9%	69	21.8%	503	26.2%
Worker	16	5.0%	10	3.1%	14	4.4%	12	3.7%	4	1.3%	19	6.0%	75	3.9%
Farmer	1	0.3%	0	0.0%	4	1.3%	2	0.6%	1	0.3%	1	0.3%	9	0.5%
Military	2	0.6%	2	0.6%	3	0.9%	7	2.2%	3	0.9%	4	1.3%	21	1.1%
Pensioner	126	39.4%	107	33.2%	108	33.8%	136	42.4%	104	32.8%	121	38.2%	702	36.6%
Housewife	14	4.4%	3	0.9%	5	1.6%	5	1.6%	2	0.6%	4	1.3%	33	1.7%
Other	16	5.0%	8	2.5%	11	3.4%	12	3.7%	9	2.8%	5	1.6%	61	3.2%
Q12: Age														
18-25	5	1.6%	13	4.0%	23	7.2%	9	2.8%	6	1.9%	7	2.2%	63	3.3%
26-35	46	14.4%	37	11.5%	44	13.8%	31	9.7%	51	16.1%	49	15.5%	258	13.5%
36-45	74	23.1%	72	22.4%	70	21.9%	87	27.1%	73	23.0%	81	25.6%	457	23.8%
46-55	64	20.0%	74	23.0%	70	21.9%	59	18.4%	65	20.5%	65	20.5%	397	20.7%
56-	131	40.9%	126	39.1%	113	35.3%	135	42.1%	122	38.5%	115	36.3%	742	38.7%
Q13: Sex														
Male	224	70.0%	231	71.7%	175	54.7%	215	67.0%	206	65.0%	212	66.9%	1263	65.9%
Female	96	30.0%	91	28.3%	145	45.3%	106	33.0%	111	35.0%	105	33.1%	654	34.1%
Q14: No. of family member														
1 person	37	11.6%	43	13.4%	36	11.3%	40	12.5%	43	13.6%	39	12.3%	238	12.4%
2 persons	105	32.8%	79	24.5%	97	30.3%	89	27.7%	86	27.1%	99	31.2%	555	29.0%
3 persons	82	25.6%	98	30.4%	78	24.4%	76	23.7%	65	20.5%	78	24.6%	477	24.9%
4 persons	65	20.3%	65	20.2%	72	22.5%	74	23.1%	74	23.3%	64	20.2%	414	21.6%
5 persons	18	5.6%	31	9.6%	25	7.8%	21	6.5%	39	12.3%	20	6.3%	154	8.0%
6 persons or more	13	4.1%	6	1.9%	12	3.8%	21	6.5%	10	3.2%	17	5.4%	79	4.1%

A quite high ratio of female household head, more than 30%, may reflect the fact that females play important roles in Romanian society. It should be noted that ratio of housewives is less than 2 %.

The ratios of more than 56 years old and pensioner are conspicuously high, and these two ratios seem to be corresponding.

2.6 VERIFICATION OF DATA RELIABILITY

2.6.1 OUTLINE OF QUANTIFICATION-1

Reliability of obtained samples was verified by the quantification-1, prior to the estimation of project benefits. The quantification-1 is one of the effective analysis methods to check the reliability of collected samples.

Assuming that the samples concerning the criterion variable and explanatory variable are collected as shown in the following table. In the table, explanatory variables are translated into category of items. The item means a question such as occupation, age, and so on, and the category means an option of choices such as farmer, craftsman, and so on. The variables $Y_{(n)}$ and $y_{(n)}$ are observed and estimated criterion variables, respectively. The criterion variable means a subject of the estimation, such as WTP.

Sample code	Item		1	2	----------	R
	Category		1 2 - - c_1	1 2 - - c_2	----------	1 2 - - c_R
1	Y_1	y_1			----------	
2	Y_2	y_2			----------	
3	Y_3	y_3			----------	
-	-	-	-	-	----------	-
n	$Y_{(n)}$	$y_{(n)}$	-	-	----------	-
-	-	-	-	-	----------	-
N	$Y_{(N)}$	$y_{(N)}$			----------	

To estimate the criterion variation based on explanatory variables, following equation is applied.

$$y_{(n)} = (a_{11} \times x_{11(n)} + a_{12} \times x_{12(n)} + \cdots + a_{1c_1} \times x_{1c_1(n)}) + (a_{21} \times x_{21(n)} + a_{22} \times x_{22(n)} + \cdots + a_{2c_1} \times x_{2c_1(n)}) + \cdots + (a_{R1} \times x_{R1(n)} + a_{R2} \times x_{R2(n)} + \cdots + a_{Rc_R} \times x_{Rc_R(n)}) + a_0$$

Where,
n: *sample code,*
a_{ij}: *category score of item* i, *category* j,
a_0: *constant term, and*
$x_{ij(n)}$: *dummy variable of sample* n *(when category* j *of item* i *was chosen,* $x_{ij(n)}=1$, *otherwise 0).*

All the category scores and the constant term are optimized by minimizing the following S.

$$S = \sum_{n=1}^{N} \left(y_{(n)} - Y_{(n)} \right)^2$$

Obtained category scores tell the relationship between the criterion variable and explanatory variables.

2.6.2 SELECTION OF EXPLANATORY VARIABLES

Prior to analysis of sample reliability, multi-collinearity of explanatory variables should be checked. Explanatory variables for the criterion variable WTP are as follows.

Item	Description
X 1	Knowledge of the Danube Delta Strategic Plan
X 2	Knowledge of Environmental Summit
X 3	The Danube Delta Experience
X 4	Monthly Maintenance Cost
X 5	Monthly Income
X 6	Occupation
X 7	Age
X 8	Sex
X 9	Number of Household Members
X 10	Place of Residence

The following tables show the correlation matrices among criterion variable and explanatory variables.

Ver.E1	Y	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Y	1.00										
X1	0.06	1.00									
X2	0.10	0.21	1.00								
X3	0.23	0.12	0.10	1.00							
X4	0.11	0.02	-0.01	-0.20	1.00						
X5	0.34	0.11	0.16	0.19	0.14	1.00					
X6	0.40	0.08	0.05	0.10	0.10	*0.43*	1.00				
X7	0.39	-0.02	-0.03	0.05	0.13	*0.30*	*0.64*	1.00			
X8	-0.02	-0.01	0.00	-0.05	-0.09	-0.21	-0.12	-0.03	1.00		
X9	-0.04	0.00	0.05	0.17	-0.06	-0.19	-0.23	-0.28	0.13	1.00	
X10	0.03	-0.10	-0.05	-0.14	-0.07	-0.11	-0.07	-0.07	-0.02	0.05	1.00

Ver.E2	Y	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Y	1.00										
X1	0.09	1.00									
X2	0.16	0.20	1.00								
X3	0.16	0.07	0.13	1.00							
X4	0.15	0.15	0.14	0.06	1.00						
X5	0.32	0.13	0.22	0.19	*0.29*	1.00					
X6	-0.08	0.00	-0.01	0.00	-0.04	-0.12	1.00				
X7	0.30	0.06	0.03	0.01	0.06	0.27	*-0.51*	1.00			
X8	0.17	0.13	0.10	0.12	0.11	0.28	-0.04	0.12	1.00		
X9	0.10	-0.05	-0.02	0.00	0.01	0.05	0.05	-0.07	0.04	1.00	
X10	0.06	-0.12	-0.18	-0.03	-0.31	-0.20	-0.11	0.04	0.07	0.03	1.00

Ver.E3	Y	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Y	1.00										
X1	-0.03	1.00									
X2	0.19	-0.23	1.00								
X3	0.08	-0.09	0.08	1.00							
X4	0.09	0.03	0.01	-0.03	1.00						
X5	0.30	-0.06	0.15	0.18	-0.05	1.00					
X6	0.33	-0.04	0.15	0.18	-0.01	*0.42*	1.00				
X7	0.22	0.03	0.01	0.06	0.00	0.16	*0.35*	1.00			
X8	-0.06	0.08	-0.13	-0.12	0.01	-0.18	-0.05	0.02	1.00		
X9	0.14	-0.10	0.05	0.02	-0.12	0.23	0.12	0.07	-0.09	1.00	
X10	0.05	-0.06	0.00	-0.23	0.00	-0.04	-0.08	-0.14	-0.08	-0.05	1.00

In the above tables, the figures with bold italic are relatively high.

Following results are found out from the above tables.

- The result of Version E1 shows that correlation coefficients among three items, X5, X6 and X7, and between X7 and X9 are high.
- The result of Version E2 shows that correlation coefficients between X6 and X7 and between X4 and X5 are high.
- The result of Version E3 shows that correlation coefficients between X5 and X6 and between X6 and X7 are high.

To solve multi-collinearity problems, item X4, X6, X7 were eliminated.

As a result, six items, *i.e.* 'knowledge of environmental summit', 'the Danube Delta experience', 'monthly income', 'sex', 'number of household income', and 'place of residence', are employed for the quantification-1 analysis.

In the questionnaires, three subsidiary questions, 'year of last visit', 'frequency of visit', and 'length of visit' were asked to the respondents who told 'yes' for the question of 'the Danube Delta experience'. Based on the comparison of correlation coefficients with WTP, the question 'year of last visit' was selected to incorporate into the question 'the Danube Delta experience'.

2.6.3 QUANTIFICATION-1 ANALYSIS

Explanatory variables and categories were determined as shown below.

Item	Description	Category	
X1	Knowledge of Environmental Summit (Q4)	Yes	1
		No	2
X2	Experience of Visit to the Delta (Q5) and Last Visit to the Danube Delta (Q6)	No	1
		To 1980	2
		From 1981 to 1990	3
		From 1999	4
		Unknown	5
X3	Monthly Income (Q12)	Less than 1,000 thousand lei	1
		1,000 - 2,000 thousand lei	2
		2,000 - 3,000 thousand lei	3
		More than 3,000 thousand lei	4
		Unknown	5
X4	Sex (Q13)	Male	1
		Female	2
X5	Number of Family members (Q14)	1 member	1
		2 members	2
		3 members	3
		4 members	4
		5 members	5
		More than 5 members	6

Item	Description	Category	
X6	Sampling Place	Braila	1
		Galati	2
		Tulcea	3
		Constanta	4
		Brasov	5
		Bucharest	6

The quantification-1 of all samples calculates the range of each item's category scores as follows.

Item	Version E1	Version E2	Version E3
X1	579.24	2076.74	6373.56
X2	2456.56	11487.24	9165.13
X3	4269.01	7104.73	15476.41
X4	678.35	649.90	1442.99
X5	1564.99	5621.37	7266.88
X6	1151.74	2837.32	3447.33
Constant Term	5073.65	8671.74	14048.78

2.6.4 Result of Quantification-1 Analysis

Based on the result of the quantification-1 analysis, following facts are found out.

- Relationship between WTP and monthly income is the highest and that between WTP and the Danube Delta experience is the second highest.
- Respondents who receive high income tend to pay high contribution.
- Respondents who went to the Danube Delta in recent years tend to pay high contribution.

It is considered that collected samples are reliable to estimate the project benefits because these facts can be explained easily based on the common sense.

2.7 Estimation of Economic Benefit

2.7.1 Estimation Method

The economic benefit of the project was estimated by the summation of beneficiaries' WTP. The summation can be calculated by the following equation.

$$\Sigma \text{ WTP} = \text{number of beneficiaries} \times \text{mean WTP}$$

As mentioned before, the beneficiaries of the project are all the Romanian citizens.

Please note that in the survey the project is defined as the construction of wastewater treatment plants in the seven cities. Thus, the economic analysis for a certain city requires calculating the city's distributive share of WTP. As the criterion of distributive shares, the proportion of design wastewater quantity was applied. This criterion is a substitute of the investment costs of WWTPs, which might be the best criterion of distributive shares.

2.7.2 ESTIMATION OF MEAN WTP

(1) Estimation Model

1) Background

There are several estimation models proposed for the analysis of double bounded dichotomous choice samples. This survey applies the willingness to pay function model (hereinafter "the WFM") proposed by Cameron in 1988, because this model can quantify the effect of downward bias.

In the WFM, it is assumed that respondents' WTP can be described as a willingness to pay function W. The function consists of an observable part f and an unobservable part ε.

$$W = f + \varepsilon$$

To simplify the explanation, the WFM for single bounded samples is descried below.

If the asked amount for the project T is higher than W of a respondent, the respondent will reject to pay T. Otherwise, the respondent will agree to pay T. Thus, the probability to agree the payment can be described as follows.

$$Pr[\text{Yes}] = Pr[f + \varepsilon > T]$$

Here, distribution function of ε is assumed a normal distribution $N(0, \sigma^2)$, then the probability can be described as follows.

$$Pr[\text{Yes}] = 1 - \Phi\left[\frac{T - f}{\sigma}\right] \quad \cdots\cdots\cdots\cdots [1]$$

Where, Φ is the cumulative distribution function of standardized normal distribution N(0,1).

Then, once the f is described as an expression, all the parameters can be optimized by the most likelihood method.

2) Applied estimation model

As mentioned before, the survey applied a double bounded procedure. For the double bounded samples the equation [1] is developed as follows.

$$Pr[\text{NN}] = \Phi\left[\frac{\log T_L - f}{\sigma}\right]$$

$$Pr[\text{NY}] = \Phi\left[\frac{\log T_0 - f}{\sigma}\right] - \Phi\left[\frac{\log T_L - f}{\sigma}\right]$$

$$Pr[\text{YN}] = \Phi\left[\frac{\log T_H - f}{\sigma}\right] - \Phi\left[\frac{\log T_0 - f}{\sigma}\right]$$

$$Pr[\text{YY}] = 1 - \Phi\left[\frac{\log T_H - f}{\sigma}\right]$$

Where, NN : reject both T_0 and T_L, NY : 'reject T_0 and accept T_L, YN : accept T_0 and reject T_H, and YY : accept both T_0 and T_H.

Please note that common logarithms of asked amounts are used in the above equations. It

means that respondents will agree to pay the asked amount T when W is higher than log T.

The observable part of the willingness to pay function f is assumed as follows.

$f = \alpha$ for Pr[NN] and Pr[NY]
$f = \alpha + \delta$ for Pr[YN] and Pr[YY]
where α is constant, δ is bias term.

The above expressions contain bias term δ to compensate the downward bias.

Parameters σ, α, and δ were estimated by the most likelihood method. Namely, these parameters were estimated to minimize the following log-likelihood function.

$$\ln L = \sum_i \left\{ d_i^{NN} \ln Pr[NN] + d_i^{NY} \ln Pr[NY] + d_i^{YN} \ln Pr[YN] + d_i^{YY} \ln Pr[YY] \right\}$$

where, i : sample code,
d_i^{NN}, etc. : dummy variables. For example, if sample i rejected both T_0 and T_L, d_i^{NN} is 1, otherwise 0.

Furthermore, there are three versions of the questionnaires, E1, E2, and E3. Thus, the most likelihood function is written as $L = L_{E1} + L_{E2} + L_{E3}$.

(1) Result of Parameter Estimation

Result of parameter estimation is shown in *Table AI.2.1*.

Mean WTP is calculated by the following equation.

$$Mean\ WTP = \int_0^{Max} xP(x)dx$$

where,
Max : Maximum level of WTP,
x : asked amount (lei/household/month), and
P(x): probability of acceptance to pay x.

P(x) can be expressed as follows.

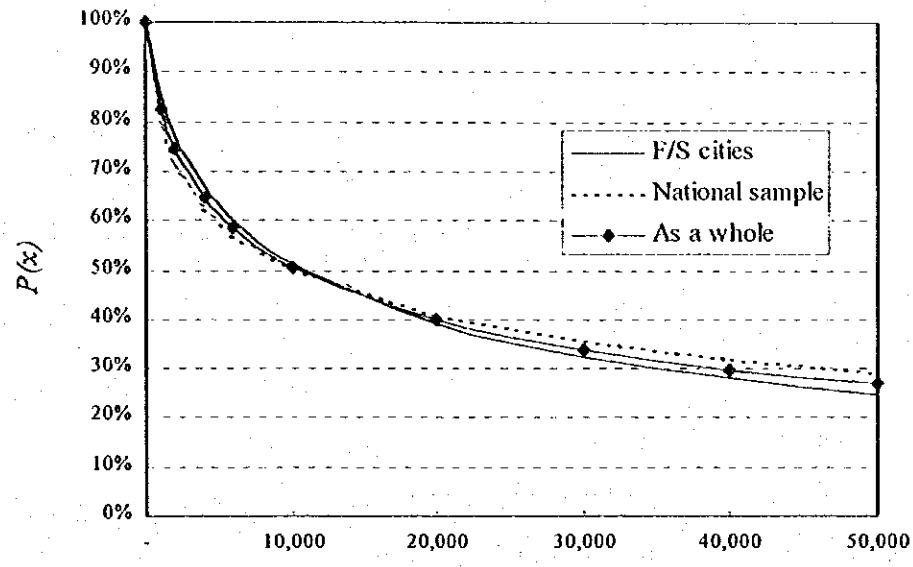
$$P(x) = 1 - \Phi\left[\frac{\log x - \alpha}{\sigma}\right]$$

The *Max* is set at the highest asked amount, 50,000 lei. Then, the estimated Mean WTP is obtained as follows.

Unit : lei/household/month

Braila	20,754	Constanta	22,234
Galati	21,336	Brasov	20,585
Tulcea	18,705	Bucharest	20,086
F/S cities	20,309	National sample	20,973
As a whole	20,604		

The following graph shows the relation between x and *P(x)*.



There are no significant difference of mean WTP between the F/S cities and the national samples. It proves the validity of assumption to define the beneficiary of the project as all the Romanian citizens.

As a result, the mean WTP is estimated at ROL 20,604 per household per month.

2.7.3 Result of Economic Benefit Estimation

According to the Romanian Statistical Yearbook 1998, the Romanian population was 22,503,000, and average household size is 3.2. Based on these figures, the number of beneficiary households is estimated as 7,032,188 households. The annual economic benefit of the project is estimated as ROL 1,738,694 million/year.

ROL 20,604 hh/month × 7,032,188 hh × 12 months/year = ROL 1,738,694 million/year

In the questionnaire it is mentioned that the respondent is expected to pay the asked amount every month for five (5) years. The total economic benefit of the project is estimated as ROL 8,693,470 million/year.

As a result, the economic benefit of wastewater treatment plant construction for each city is calculated as follows.

City	Wastewater Quantity (m^3/day)	Distribution factor	Annual distribution (million ROL)	Total distribution (million ROL)
Tulcea	43,000	0.0700	121,720	608,598
Galati	235,000	0.3826	665,212	3,326,059
Braila	115,000	0.1872	325,529	1,627,646
Calarasi	55,730	0.0907	157,754	788,771
Giurgiu	82,100	0.1337	232,400	1,161,998
T.Magrele	20,000	0.0326	56,614	283,069
D.T.Severin	63,400	0.1032	179,466	897,328
Total	614,230	1.0000	1,738,694	8,693,470