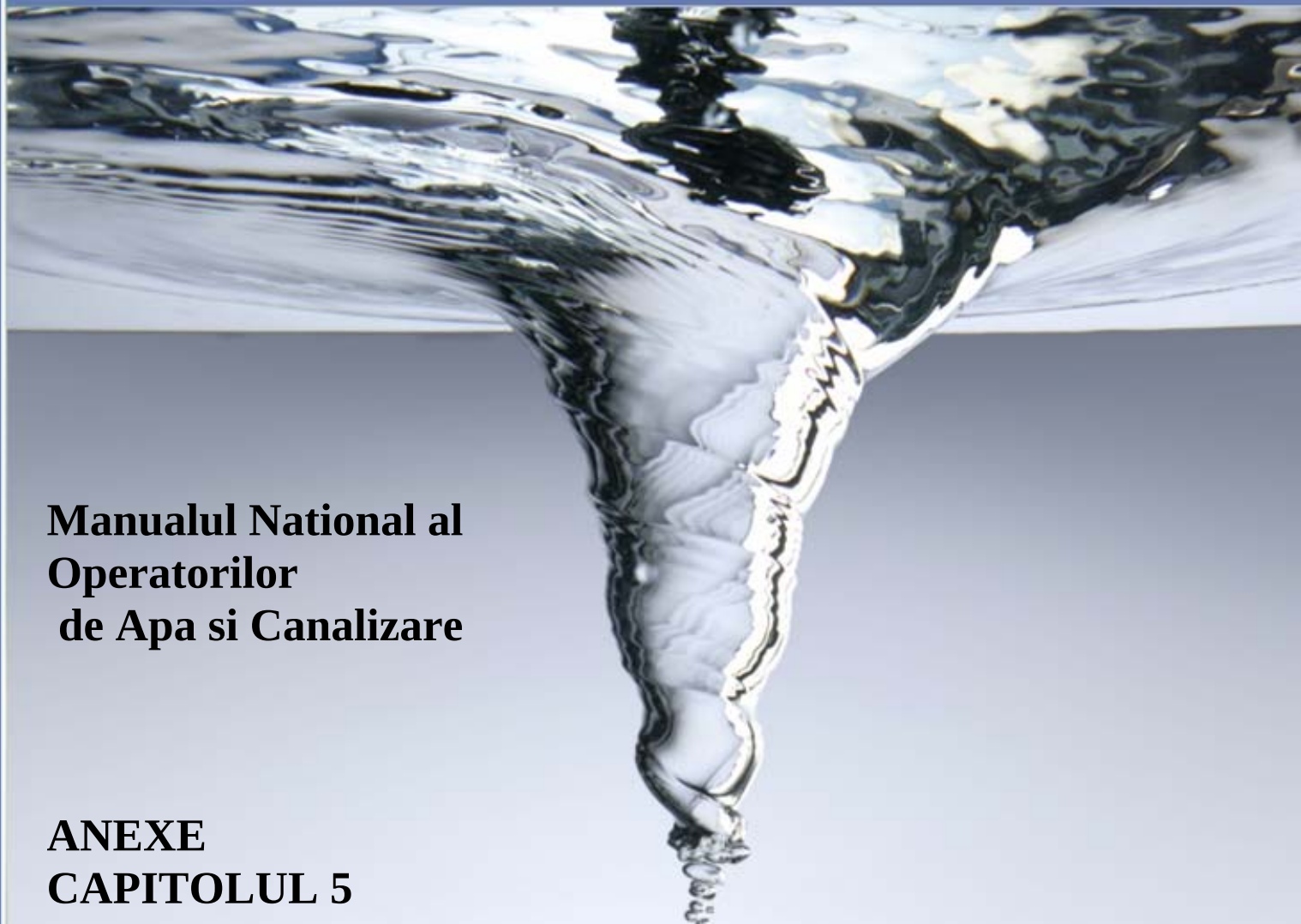


EUROPEAN UNION



GOVERNMENT OF ROMANIA



Manualul National al Operatorilor de Apa si Canalizare

ANEXE CAPITOLUL 5 GHIDURI PENTRU PREGATIREA PROIECTELOR

Bucuresti, Octombrie 2008

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B1: Guidance for Master Plan preparation

**GUIDE ON PREPARATION OF MASTER PLANS
FOR WATER AND WASTEWATER PROJECTS**

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**Technical Assistance for Strengthening the Programming Capacity of the Ministry of
Environment and Sustainable Development**

GUIDE ON PREPARATION OF MASTER PLANS FOR WATER AND WASTEWATER PROJECTS

A Master Plan (MP) for water and wastewater projects is a strategic long-term planning tool to help meet future demand (usually 20 or more years) for water and wastewater.

A MP typically includes:

1. Description and inventory of existing water and wastewater systems;
2. Population projections, service area projections, present and planned land use, water demand projections, and future water quality demand;
3. Water supply quantity and quality projections and new source identification;
4. Improvements needed to meet future water demand; hydraulic modelling approaches to estimate long-term needs with documentation of each option;
5. Justification of selection of particular system improvement (based on needs, cost effectiveness, constructability, reliability, operation, maintenance, etc);
6. Recommended system improvements;
7. Maps showing improvement components and service areas;
8. Documentation and description of costs of system improvements;

The MP should be re-evaluated and updated periodically (at least every five years) to keep up with changing system needs and technologies.

1. REVIEW OF EXISTING MP INDEXES

Romanian experience

To prepare this guide, the following MP and coordination documents have been reviewed:

- MESD's TOR for Master Plan and Macro-affordability assessment (Technical Assistance for project preparation in the Environment Sector, Romania – 2003 RO 16 P PA 013 – 4 Water, 2003 RO 16 P PA 013 – 5 water), (and 2003 RO 16 P PA 013 – 6 Waste);
- MESD's TOR for strengthening the programming capacity of the Ministry of Environment and Sustainable Development - 2003 RO 16 P PA 013 – 7;
- Proposal of Haskoning for Arges County MP for Water Supply and Sanitation (Arges Regional Water Project) – project financed by EU; infrastructure to be financed by EU;
- Proposal of Pell Frischmann & Romair for Water & Wastewater Infrastructure Applications – project financed by WB; infrastructure to be financed by EU;
- MP of Cluj County – Water & Wastewater Infrastructure Application – project financed by EU; infrastructure to be financed by EU;
- MP of Calarasi County – Water & Wastewater Infrastructure Application – project financed by EU; infrastructure to be financed by EU; and
- Proposal of Halcrow & Cowi (May 2004)/ translation by Mott MacDonald (April 2005) of the MP Guidelines for SAMTID small and medium towns water infrastructure

International Experience

The following water and wastewater MP have been reviewed:

- MP for Water Supply and Sewerage Systems in Anne Arundel County / Maryland, US;
- MP for Orange Water and Sewer Authority in Carrboro / North Carolina, US;
- Water Infrastructure MP for City of Surprise / Arizona, US (June 2004);
- Infrastructure MP for the City Ottawa / Canada (June 2003), prepared based on the existing local and regional legislation; and
- Water Supply MP for Kingston Urban Area / Ontario, Canada (June 2007)

2. MP GUIDE

This guide for preparing MP for water and wastewater project proposals that are candidates for financing/co-financing from the EU Cohesion Fund includes two sections:

- A comprehensive Index (Table of Contents) of the MP, and
- Scope and information to be included in each chapter of the MP.

The index is primarily based on the guidelines for developing an Infrastructure MP for projects to be financed by SAMTID (prepared by Halcrow and Cowi JV in May 2004, and translated by Mott MacDonald, Safege, ULGN and GIE JV in April 2004). We have modified this index based on the TOR for Master Plan and Macro-affordability assessment (as per the Technical Assistance for project preparation in the Environment Sector, Romania – 2003 RO 16 P PA 013 – 4 Water and 2003 RO 16 P PA 013 – 5 Water). We have also included some general and specific planning information from various regional and local infrastructure development MP (see chapter 2).

There are two annexes:

1. Terms and Definition of the Urban Wastewater Directive (91/271/EEC)
2. Template List for documents required for CF Application (EIA, land acquisition, “Urbanism Certificates”, etc.)

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- 1.1.4 Project Objectives
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2.2 SCOPE AND INFORMATION FOR MP GUIDE

EXECUTIVE SUMMARY

- Objectives and Scope of the Master Plan
- Current Situation and Deficiencies
- Projections
- National Objectives and County Targets
- Option Analysis
- County Strategy
- Long-term Investment Plan
- Financial and Economic Analysis
- Macro-affordability
- Priority Infrastructure Investments

1. INTRODUCTION

Describe the background of the MP.

1.1 Project Framework

- Information provided by MESD
- Reference to the Terms of Reference
- Stakeholders, beneficiaries, target groups
- Other relevant references

1.2 General Goal and Approach for Developing the MP

- Describe the goals, objectives, and policies for developing the MP (and on which the MP is based)
- Report needed changes to the objectives
- Briefly describe the approach for achieving the objectives

MP will be the basis to demonstrate that:

- Proposed investments are part of a long-term cost-effective development plan
- Operator is viable and efficient
- Investments are sustainable in time
- Investments will offer better services to the public and will improve environmental quality

Develop the MP at the county level, taking into account all urban and rural agglomerations in the designated counties.

1.3 Structure of Report

- A table of contents with chapters and a description of the content of each chapter

- Project deliverables and their distribution
- A list of documents making up the MP
- A list of Annexes and description of content

Note: Provide core information in a clear, transparent, and open form, easy to understand and to use by the administration. All other information is only needed to explain and justify the solutions presented.

2. ANALYSIS OF CURRENT SITUATION

Assess the current water and wastewater situation by:

- Collecting local and regional data on water and wastewater (current state, age, performance, population served, water consumed, water flow, non-billed water, wastewater, water losses, maintenance, conformity with quality and environmental standards)
- Analysing collected data (hydraulic modelling, treatment processes, structural state, maintenance state)
- Results (performance indicators and deficiencies)

Include the following information:

- Previous plans, studies, design reports, and a full picture of the current situation as well as background information for the project
- Objective review of available information, and additional measurements, analyses, and surveys deemed necessary
- As many as possible concrete and credible data, given that the EU financing institutions provide financial support based on reliable information
- Information sources

2.1 Abstract

Provide a short summary of all sub-chapters including:

- Methodology and assumptions
- Conclusions (deficiency and critical issues)
- Summary of all relevant base data relevant for projections, focusing on (i) key socio-economic data such as population and industrial trends; (ii) water resources; (iii) water pollution; (iv) water consumption; and (v) key infrastructure data (indicator table)

2.2 Project Area

Provide an overview of the project area (County) including:

- Location of the County
- Short description of the main characteristics (number of population, surface area, number of settlements, topography, county specific aspects, main economic activities, GDP/capita, etc.)
- Map with location of the County in Romania
- Map of the County

2.3 Natural Features

Give a general view/characterisation of the natural features in the project area (county, human settlements) and describe the natural features including:

- Environment
- Climate
- Landscape and topography
- Geology and hydrogeology
- Ecology and sensitive areas

Note: The input data for the MP are important for the correct outcome and conclusions. If the provided (official) data are deemed unreliable, conduct minimum surveys according to TOR requirements. In any case, always mention the data sources in the document.

Proposed subchapters:

- 2.3.1 Environment
- 2.3.2 Climate
- 2.3.3 Landscape and topography
- 2.3.4 Geology and hydrogeology
- 2.3.5 Ecology and sensitive areas

2.4 Infrastructure

Collect and evaluate information on relevant existing infrastructure, other than water infrastructure such as: transportation, district heating, solid waste, electricity, etc.

2.5 Socio-economic Assessment

Assess the socio-economic conditions at the local and regional levels; the data will be the basis for water demand and wastewater projections as well as the affordability of investments. Provide information with clear references on sources of information on:

- Population
- Distribution of human settlements
- National economy situation and projection (national and regional GDP growth, local inflation)
- Household income and expenditures considering the average household and the lowest income deciles
- Socio-economic profile of the county
- Employment and income
- Economic activity and main industrial activities

Analysing the current socio-economic situation should include, but not be limited to:

- Collect data in the county at minimum for the past five years;
- Review here the regional, county, and local statistics (e.g., censuses and estimations);
- Collect data on trends inside the county (e.g., migration trends of population from rural to urban area) and between neighbouring counties;
- Compare county trends to national trends;
- Collect also information (existing studies) on projections for the next decades.

Proposed subchapters:

- 2.5.1 Socio-economic Profile of Romania

2.5.2 Socio-economic Profile of x County

2.6 Assessment of Institutional and Legal Framework

2.6.1 General Administrative Framework

Briefly describe the general administrative framework in Romania at the national, county, and municipal levels.

2.6.2 Legal Framework

This chapter gives an overview of the legal framework. Pay particular attention to all legal documents relevant to achieve compliance with national and EU legislation in the water and environmental sector.

Briefly describe the relevant legal framework including:

- European legislation in water and wastewater sector
- Relevant national environmental legislation
- Legislation in the water sector
- Harmonisation of national legislation with EU Legislation (Accession Treaty)
- International Treaties and conventions (Danube River Protection convention, Ramsar Convention)

Note: Discuss strategy and policy documents (i.e. SOP) in Chapter 4.

2.6.3 Environmental institutions

Provide an overview of all relevant organisations involved in monitoring and regulating the water and environmental sectors in Romania at the national and county levels (ministries and other public institutions). Briefly describe the functions of each institution.

2.6.4 Water and wastewater institutions

- Main characteristics of the existing water and wastewater operators in the project region (County)
- Legal structure
- Legal status and ownership structure
- Functions and organisation structure
- Relationships with other institutions (contractual relationship, etc.)
- Institutional and financial capacity of water operators in the region
- Current operational and financial performance (provide key indicators such as staff efficiency, operating ratio, collection efficiency, etc.); compare performance of different operators and comment on the potential to achieve economies of scale
- Key deficiencies
- Recommendations for improvement

2.6.5 Current tariffs

- Past and current structure and level of water and wastewater tariffs for each water operator

- Analysis/comparison of different tariff systems applied within the County (and with tariff systems in other Counties)
- Key deficiencies
- Recommendations for Improvement

2.7 Water Resources

2.7.1 General

- Provide an overview of water resources (quantity and quality of groundwater and surface water resources) at County level
- Describe drainage area and main characteristics of rivers and lakes at County level
- Describe main characteristics of ground water resources (aquifer, hydrogeological situation, etc.)
- Provide a map showing available resources (i.e., thematic map with classification of water quantity and quality)
- Describe problem areas with scarcity of water or conflicts among various consumers

2.7.2 Surface water

- Provide an overview of available surface water resources in each agglomeration (water quantity and quality)
- Describe and quantify current water abstraction for water supply and other purposes (i.e. agriculture, industry) in each agglomeration
- Describe and quantify evolution of water production from surface water sources in the past 3-5 years
- Describe and quantify surface water fluctuation (monthly and yearly)
- Describe water quality monitoring practices (frequency, responsible institutions, reliability of analysis, etc.)
- Describe and quantify water quality of surface water resources (summary of statistical analysis of laboratory tests for raw water; evolution of water quality in the past 3-5 years; compliance with EU DWD) in each agglomeration; provide evidence of water quality (laboratory analyses) in annexes
- Describe key constraints for surface water exploitation in each agglomeration
- Summarise potential of surface water resources to meet current and future drinking water demand

2.7.3 Ground water

- Provide an overview of available ground water resources in each agglomeration (water quantity and water quality)
- For other information to be provided, see Chapter 2.7.2 “*Surface Water Resources*”
- Pay particular attention to water quality parameters defined in the EU Accession Treaty (nitrate, ammonia, etc.); thoroughly assess existing data and conduct own water quality analysis to provide a reliable basis for further decision on water resource development (i.e. option analysis); put in annex details on water quality analysis (laboratory tests)

2.8 Water Pollution

2.8.1 Major pollution sources

- Brief description of most important current pollution sources (industries, agriculture, etc.) in the County (summary of Chapter 2.8.4 industrial wastewater)
- Provide wastewater volume discharged to each sub-drainage area (broken down by category of economic activity)
- Estimate wastewater load discharged to the recipient (indicating treatment efficiency for existing WWTPs)
- Provide list of main polluters with quality indicators exceeding admissible limits

2.8.2 Impact of wastewater discharge

Describe and assess present effects (environmental impact) of treated and untreated wastewater and sludge discharges on receiving waters in case of direct discharge into surface water bodies and/or on environment and ground water in case of discharge to evaporation fields, appropriate sampling of effluents at selected points of sewer network, verify laboratory results.

2.8.2.1 *Impact on surface water*

Assess the impact of each main pollution source on the water quality of the recipient, indicating change (increase) of selected parameters (BOD, NH₄) downstream of the discharge point;

2.8.2.2 *Impact on ground water*

Assess the impact of each main pollution source (i.e., ex-filtration from sewer network, leaking septic tanks, agriculture, industry) on ground water quality, by identifying possible pollution sources and comparing with data on ground water quality (prepare thematic map with pollution sources and ground water quality).

2.8.3 Sludge management and disposal

- Briefly assess current sludge management in each agglomeration
- Assess compliance with national and EU legislation
- Assess impact of current sludge management practices on the environment in general and on water resources in particular
- Summarise key critical issues with regard to sludge management

2.9 Current Water Consumption

- Quantify current water consumption and development in the past 3-5 years for each agglomeration by using existing data and own measurements
- Carry out measurements (with portable ultrasonic flow meter) at representative consumer types (metered/un-metered, apartment blocks, individual households, etc.) and verify actual consumer readings with measurements
- Break down consumption by category of consumers (domestic, non-domestic, rural/urban, etc.)
- Comment on data reliability and key critical issues (exceptionally high or low consumption)

2.10 Existing Facilities and Current Performance

2.10.1 Water supply infrastructure

Investigate and assess current water system at county/regional level; include at least the following data:

- Assess current systems and facilities, including water sources and catchments, treatment plants, transmission mains, pumping, storage, and distribution system/s. Present a schematic map and include a detailed map for each agglomeration in Annexes
- Assess the main components of the system/s in terms of capacity, energy efficiency, performance, state of repair, maintenance practices, age, quality of materials and equipment (treatment plants, pipes, valves, pumps, etc.), adequacy, bottlenecks etc. Outline and assess leakage record and leakage detection/repair policy
- Assess the present and future operation and maintenance practices. Based on hydraulic assessment of flows and pressure in the primary distribution system, summarise and evaluate interaction of major system components (transmission, pumping, storage, distribution (pressure zoning)) and detect critical problems and bottlenecks
- Assess current monitoring and metering practices (SCADA system, etc.)
- Assess the current number of repair and development in the past years
- Calculate water balance (IWA standard water balance) and define key performance indicators (Infrastructure Leakage index, water losses per km of pipeline/ day, etc.)
- Assess compliance of infrastructure with EU legislation (safety standards, technological process, treatment efficiency, etc.)
- Summarise key deficiencies.

Proposed subchapters:

2.10.1.1	<i>Well fields</i>
2.10.1.2	<i>Water treatment</i>
2.10.1.3	<i>Water storage and pumping stations</i>
2.10.1.4	<i>Water transmission</i>
2.10.1.5	<i>Water distribution</i>
2.10.1.6	<i>Water metering</i>

2.10.2 Wastewater infrastructure

Investigate and assess the current wastewater collection system/s and wastewater treatment system at county/regional level, including the following components:

- Existing systems and facilities, including area served, length, diameter and type of main sewers, whether separate or combined, pumping stations, discharge points and storm water overflows, location of major wastewater contributors (industry); present a schematic map. Check infiltration into sewers at key points of the sewerage network
- Assess system components in terms of capacity, energy efficiency, performance, state of repair, reliability, adequacy, maintenance practices, infiltration/inflow, age and quality of materials and equipment (pipes, valves, pumps, etc.)
- Assess the sewerage network operation: based on hydraulic assessments (i.e., field measurement) of flows in the primary collection system, summarise and evaluate interaction of major system components (transmission, pumping, system storage) and detect critical problems and bottlenecks.

Proposed subchapters:

2.10.2.1	<i>Wastewater collection</i>
2.10.2.2	<i>Wastewater treatment</i>
2.10.2.3	<i>Sludge disposal</i>

2.10.3 Industrial wastewater facilities

Conduct an inventory of industrial wastewater facilities and describe and assess the present industries discharging effluents at the county level, including:

- Investigate quantity and type, extent of pre-treatment, institutional and legal framework
- Assess current mechanisms for licensing discharges to sewer (consider compliance with the Integrated Pollution and Prevention Control (IPPC) Directive (96/61/EC))
- Assess existing wastewater treatment facilities, including sludge handling and disposal
- Analyse compliance with applicable effluent standards and applicable regulations
- Recommend which investigations and investments are necessary to assure sustainability of the measure (i.e., reduce operation costs)
- Summarise key deficiencies

2.11 Sufficiency of data

Collect and verify all data needed for the MP; if such data are not enough or not reliable, develop further investigations or surveys.

- Describe availability of data and quality of existing data
- Prepare a table comparing required base data with available base data and comment on necessary investigations
- Investigation studies should include, but not be limited to:
 - Wastewater and infiltration, as well as industrial wastewater flows, including sampling and analysis, flow measurement and recording;
 - Topographical surveys, including field and hydraulic or engineering surveys along both water and wastewater systems networks and on WWTP site(s)
 - Geo-technical surveys, including drilling, foundation studies, and geo-technical studies
 - Hydrological and hydrogeological surveys;
 - Water losses.

2.12 Conclusions

- Summarise current deficiencies and critical issues.

3. PROJECTIONS

3.1 Abstract

Short summaries of:

- Methodology and assumptions
- Conclusion for water demand projection
- Conclusion for wastewater flow and load projection

3.2 Methodology and Assumptions

- Describe in detail the methodology and assumptions used for the projections given in the chapters below
- The source of all provided data shall be traceable (make reference to compilations and detailed calculation of base data provided in annexes or explanations for assumptions)
- Check base data for plausibility

3.3 Socio-Economic Projections

The socio-economic assessment at the local and regional levels will be the basis for:

- Affordability of investments
- Water demand projections
- Domestic and industrial wastewater flow projections
- Sludge management projections

Socio-economic projection should include, but not be limited, to the following aspects:

- Macro-economic outlook including projection of macroeconomic indicators (i.e., economic growth, foreign direct investments, inflation, employment rate and salaries, increase of industrial production)
- Demographic projections at national and county levels broken down by rural and urban areas
- Demographic projection for each agglomeration in the county concerned
- Projection of household income (minimum and average): gross/net household income, household expenditures, salaries
- Projection of economic activities (industry, commerce, construction, service sector) at county level

Prepare projections for the entire planning horizon of the MP (breakdown per year) based on the following scenarios:

- Pessimistic
- Optimistic
- Equilibrium

Projections should include data for the past 3-5 years at the beginning of each table.

Proposed subchapters:

- 3.3.1 *Macroeconomic trends and outlook*
- 3.3.2 *Demographic projections*
- 3.3.3 *Household income projections*
- 3.3.4 *Projections of economic activities*

3.4 Water Demand Projection

Based on data of the current situation (see Chapter 2) and results of socio-economic projections (see Chapter 3.3), develop a projection of water demand, considering the specific design criteria and assumptions given in the following chapters.

3.4.1 Domestic demand

Project water demand based on the following design parameters:

- House Connection: 110 litres/capita/day

- Yard connection: 80 litres/capita/day
- Public tap supplies: 50 litres/capita/day

Assume that:

- Current specific consumptions of domestic water will be reduced/increased to the levels above after introducing water metering and cost covering tariffs.
- Demand for small scale livestock and garden irrigation will be reduced to a minimum (replaced by local water sources if available) after introducing water metering and cost covering tariffs.

Justify any deviation from the assumptions and standards above, by providing sufficient data and agreeing with MESD prior to developing further steps of the MP.

3.4.2 Non-domestic demand

Base demand projection for non-domestic consumers (industry, commercial, public institutions) on specific investigations (for each type of industrial consumer) and/or standard values for water demand (commercial and public institutions). Agree on the applied values with MESD prior to developing further steps of the MP.

3.4.3 Water balance and water losses

The objective is to determine how much water is lost and where it is lost

- Apply IWA standards for preliminary assessment of water losses
- Estimate components of the water balance based on existing data, field measurements, and expert's estimates for each agglomeration
- Check carefully plausibility of existing data and organise measurement campaigns accordingly
- Estimate Real Water Losses (Technical Water Losses) based on various parameters indicating the physical network condition (pipe failures, age of pipes and material, etc.) and water pressure
- Use standard IWA indicators for network evaluation (Non-Revenue Water, Infrastructure Leakage Index, Water losses per length of pipe network and/or per connection)
- Classify agglomerations by category of network condition (see IWA standard classification) to determine the priority for improvement.

3.4.4 Summary of water demand forecast

Provide a summary table indicating the development of all water demand components with the following indicators:

- Specific water demand
- Domestic water demand
- Non-domestic water demand
- Real Water Losses (Technical Water Losses)
- Apparent Water Losses (Commercial Water Losses)

3.5 Projected Wastewater Flow and Load

Based on data of the current situation (see Chapter 2) and results of socio-economic projections (see Chapter 3.3), develop a projection of wastewater flow and wastewater

load, considering the specific design criteria and assumptions given in the following chapters.

3.5.1 Domestic wastewater

Base projection of domestic wastewater flow and load on the following design parameters:

- Wastewater Generation: 80 %
- Sewer Connection Rate: evolution to be determined for each agglomeration
- Wastewater load: 60 g BOD₅/capita/day

3.5.2 Non-domestic wastewater

Base projection of non-domestic wastewater flow and load on the following design parameters:

- Wastewater Generation: 90 %
- Wastewater load: based on inventory of industrial polluters
- Wastewater concentrations: in compliance with Romanian and EU standards

3.5.3 Infiltration

Base projection of infiltration into the sewer system based on the following parameters:

- Current physical condition of the sewer network
- Soil condition
- Ground water level
- Water losses (infiltration of losses from water network into the sewer network)
- Assumptions of the impact of future investments in the sewer network and future condition of sewer network (after depreciation) on reduction of infiltration. Develop a normative approach with clear and traceable assumptions.

3.5.4 Summary of wastewater flow and load

Provide a summary table indicating the development of the following indicators in each agglomeration:

- Wastewater flow (m³/d)
- Wastewater load (kg BOD₅/day)

3.6 Conclusion

Provide a summary for water demand and wastewater flow projection including:

- Main data (current situation and planning horizon)
- Interpretation of results

4. NATIONAL OBJECTIVES AND COUNTY TARGETS

4.1 Abstract

Short summaries of:

- Methodology and assumptions

- Conclusion for water demand projection

4.2 National Water and Wastewater Objectives

Summarise the relevant general environmental objectives, and more specifically the national water and wastewater policies, objectives, and strategies defined in the (i) Accession Treaty, (ii) Sector Operational Program Environment (SOP ENV), based on the relevant EU Directives (i.e. EU UWWTD 91/271/EEC and EU DWD).

Provide an overview of water and wastewater targets and deadlines defined in the Accession Treaty (compliance dates for different criteria in each sector).

Comment and conclude on the objectives and targets above, in particular with regard to difficulties expected in meeting the compliance deadlines, considering the current situation described in Chapter 2.

4.3 Cross-references with National, Regional, and other Relevant Strategies and Plans

Comment on relevant cross-references between objectives defined in:

- The water and wastewater sector at the national level
- The water and wastewater sector (SOP Priority Axis 1) and other sectors (SOP Priority Axis 2 – 6); i.e., cross-reference between sludge management and waste objectives
- The general policies, strategies, and plans at the national level (i.e. National Development Plan (NDP), Local Implementation Plan)

4.4 County Targets in Water and Wastewater Sector

Prepare realistic county targets in the water and wastewater sector, based on:

- National Objectives (SOP, Accession Treaty)
- Local Implementation Plan
- Other regional Master Plans and Development Plans
- Assessment of the current situation (see Chapter 2)
- Projections (see Chapter 3)
- Other relevant data

Define the targets with key indicators and deadlines. The table below gives a list of indicators defined in the SOP:

Indicator	Baseline (2007)	SOP Target (2015)	Mid-Term Target
Localities provided with new/rehabilitated water facilities in a regional system			
New/rehabilitated wastewater treatment plants compliant with EU acquis			
Population connected to basic water services in a regional system			
Wastewater treated (of the total wastewater volume)			

Other relevant Indicators			
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In addition to the objectives defined in the SOP (compliance with EU requirements), define the target level of service and agree with the beneficiaries of each agglomeration. The water supply targets should refer to indicators such as: service coverage, supply continuity (hours of water supply per day), pressure in the network, water quality, etc. The wastewater targets should refer to indicators such as: wastewater collection coverage, sludge management standards, etc.

Differentiate the targets by size of agglomeration:

- below 2000 inhabitations
- between 2,000 and 10,000 inhabitants
- between 10,000 and 100,000 inhabitants
- above 100,000 inhabitants

Developing targets is an iterative process and should be seen in relation with strategy development and option analysis.

4.5 Conclusion

Conclude and comments on the objective and targets defined in this chapter.

5. OPTION ANALYSIS

- The option analysis should explain how to reach the defined targets in the most cost efficient manner.
- Further, it should assess which size of agglomeration has to be included to reach the defined targets (i.e., is it possible to reach the defined average connection rates at the county level if only agglomerations above 2,000 inhabitants are considered?).
- The MP should include two components: water supply and wastewater (including collection, treatment and disposal). For both components, it should outline and compare different technical development alternatives. This includes (but is not limited to) use of water sources, treatment processes (for both drinking water and wastewater) and plant locations, networks layout, etc.

5.1 Abstract

5.2 Methodology and Assumptions

Describe the methodology and assumptions for the option analysis considering the following:

- Define criteria for identifying and evaluating options (cost, environmental risks, health hazards, implementation risks, compliance with EU and national standards)
- Defining an Agglomeration according to the EU UWWTD 91/271 is critical for the option analysis. Population density and concentration of economic activities are the most important indicators to assess whether central or decentralised solutions will be more cost efficient. Refer to the notes in the ToR regarding Agglomerations and the Document “Terms and Definition of the Urban Wastewater Directive (91/271/EEC)” attached to this document (see Annex 1). Note that the defined Agglomerations might not be equal for water and wastewater

- Clearly define assumptions for unit costs (i.e. costs per pers.-equiv., sewer cost per inhabitant for different size of agglomeration and population density), indicating source or calculation base
- In a first step, develop long-term strategic options. Considering the critical water quality (i.e., NO₃ and NH₄) in many regions in Romania, prepare a well founded assessment (based on sufficient water quality data and hydro-geological investigations) of strategic water supply options. Develop alternatives carefully, comparing decentralised water treatment plants with transportation of water from other sources, remediation of aquifer with surface water abstraction and treatment, different water treatment technologies. In addition to investment and operation cost criteria, consider reliability of the technology and capacity of the ROCs to operate more complex decentralised treatment plants (in particular for rural areas). For the retained long-term development option, prepare a strategy and action plan (see Chapter 6) to clearly define how and when compliance with EU and national drinking water standards will be achieved and how the achieved standard can be sustained. The action plan should clearly define which studies (i.e. hydrogeological investigations) and actions from authorities responsible for water resource protection (i.e. impose pre-treatment for industries) are necessary to implement the strategy. Discuss the action plan with the beneficiaries at an early stage of MP development in order to launch key actions - which might be beyond the scope of the Consultant - in time.

In a second step, assess short-term priority options to include in the CF application and ensure that the retained option is in line with the long-term development strategy. For example, if the long term option is groundwater abstraction after remediating the aquifer, and the only feasible short-term option is rehabilitation of surface water treatment, present a full justification, demonstrating that surface water abstraction is the least-cost option to comply in time; further, present the future function (after remediating the aquifer) of the short-term investment, demonstrating that the investment will not become obsolete after having implemented the proposed long-term supply option (i.e., standby water source).

- Develop an approach for clustering several smaller localities (less than 2,000 inhabitants) in agglomerations, or interconnecting them with larger agglomerations and analyse alternatives for all localities
- Consider a least cost and affordable solution for wastewater which meets or exceeds minimum EU environmental standards as follows: combined system relying on septic tank disposal for certain parts of the project area with low population density, along with a network of sanitary sewers and treatment in other sectors depending on the geologic conditions of the varying zones, and on the water sources protection constraints. To review this possible solution, assess the means and costs of cleaning and maintaining regularly septic tanks and treating/disposing of sludge to be collected
- Assess treatment systems appropriate for smaller agglomerations in rural areas. Consider lagoons and reed bed filters or other systems sufficiently robust and effective
- Assess different variants for connection rates (full / partial) in combination with other variants
- Clearly indicate on a map and table the proposed borders for agglomerations. Allocate each locality to one clearly defined agglomeration.
- The results of the option analysis should clearly show the required investment costs (and operation costs) to reach the defined targets for each alternative.

5.3 Evaluation of Options

Assess the following options:

- Central/decentralised solutions
- Location of sites
- Technological options (considering investment and operation & maintenance costs); compare life-cycle costs for different process alternatives for WWTP and Water Treatment Plants
- Compare most significant options based on costs considering investment and O&M costs
- When relevant, include in the cost comparison of significant options economic benefits and costs, especially for environmental externalities to justify the least cost solution(s)
- Assess institutional options for various “technical options” (i.e., a centralised system would require the establishment of a regional water company).

5.4 Proposed Option

- Present a summary table of the assessed options
- Propose the preferred option for each of the assessments above;
- Describe and comment the selected options.

5.5 Conclusion

Briefly describe the selected options

6. COUNTY STRATEGY

The main purpose of the strategy is to identify the least-cost priority measures (technical and institutional solutions) for achieving the defined county targets; the strategy should summarise:

- National objectives
- County targets and time frame
- Option analysis

and should be based on the *Assessment of the Current Situation* (Chapter 2) and the *Projections* (Chapter 3).

A General Strategy should:

- Address the most stringent problems at the county level (i.e., nitrates in ground water)
- Address specific problems for particular categories of agglomerations (i.e. below 2,000 inhabitants, above 2,000 inhabitants, etc.)
- Prioritise all agglomerations based on various criteria (cost efficiency, scarcity of water, physical condition of infrastructure, health risk, environmental risks). Develop a transparent methodology with weights for each criterion to rank all agglomerations (thematic maps and tables)
- Present selected technological options (i.e., type of WWTPs for various sizes of agglomerations)
- Present a schedule for implementing the proposed general measures based on the ranking of agglomerations, the general county strategy, and the specific strategies. The proposed strategy should be in line with the schedule defined in the Accession

Treaty (and the Local Implementation Plan). The following table provides an example of a *General County Strategy*

Year	Measure
2008 - 2009	Establish Regional Operators
2008 - 2009	Launch action plan for aquifer remediation: hydro-geological study including detailed investigation on origin of water pollution, etc.
2008 - 2015	Develop water supply systems in priority towns first (i.e. agglomerations with high number of population, low connection rate, high ranking of non-monetary costs, low specific investment costs)
2010 - 2012	Rehabilitate drainage system in agglomerations above 10,000 inhabitants to reduce infiltration
2012 - 2015	Increase connection rate to water supply systems for agglomerations between 2,000 and 10,000 inhabitants
2012 - 2015	Extend drainage schemes in agglomerations above 10,000 inhabitants
2010 - 2015	Construct WWTPs for agglomerations above 100,000 inhabitants
2015 - 2018	Construct WWTPs for agglomerations between 10,000 and 100,000 inhabitants
2015 - 2018	Increase connection rate to water supply systems for agglomerations below 2,000 inhabitants
2018 - 2028	Reduce water losses to 25 % by introducing Active Leakage Control Systems
	Etc.

- **Detailed Strategy:** Based on the general strategy, prepare a more *Detailed Strategy* for each section (water resource protection, water abstraction, drinking water treatment, water supply network, wastewater network, wastewater treatment, sludge disposal). For interrelationship between long-term strategy and short-term options, refer to Chapter 5.2 “*Option Analysis – Methodology and Assumptions*”. The strategy should provide enough details to draft the long term investment plan. Break down to the level of agglomerations the general targets and measures defined in the General County Strategy.

7. LONG TERM INVESTMENT PLAN

7.1 Abstract

7.2 Planning Context

Strategic development of water and wastewater systems should:

- Bring a substantial contribution to the national commitments (SOP objectives)
- Consider the regional/county approach to justify selection of priority investments
- Consider Romania’s relevant environmental commitments in the Accession Treaty; clearly indicate the deriving commitments of the target counties in water/wastewater
- Soundly justify compliance of the proposed improvements with the national SOP objectives and county water/wastewater Implementation Plans (Chapter 22)

- Describe the expected contribution of investment measures to achieve the Implementation Plans' objectives
- Demonstrate that the investment is part of a long-term cost-efficient water and wastewater development plan
- Demonstrate that the operator is viable and efficient
- Demonstrate that the proposed investments are sustainable and offer better services to the public and/or improve environmental protection

7.3 Long-term Investment Measures

- Identify the need for investments in water and wastewater services to achieve full compliance with relevant EC Directives, taking into account population affordability for investments and local and/or regional implementation and operation capacities
- Identify requirements for Technical Assistance to ensure adequate management capacity of the beneficiary to implement the measures and sustain the investments
- Justify each measure by summarising the findings of the current situation (and/or referencing to Chapter 2) and provide enough supporting data (i.e. increasing number of failures, supply security, water quality analysis)
- Describe each investment measure with enough details
- Describe possible options to be assessed in the subsequent feasibility study
- Identify implementation risks (i.e. availability of land)
- Identify operation and maintenance risks (i.e. insufficient capacity of beneficiary)
- Provide sketches and drawings with sufficient degree of detail (pre-feasibility level) for each measure
- Describe result of the measures based on selected indicators (connection rate, water quality improvement, treatment efficiency, reduction of wastewater load, etc.)

7.4 Basic Design Parameters and Pre-dimensioning

Prepare basic design parameters for the planning horizon of the MP, taking into account the transition periods agreed for compliance with the relevant EU Directives and the population size of the concerned localities.

The parameters should include (not exhaustive list):

- Domestic water consumption trends, idem for institutional, commercial, and industrial consumption
- Consumption elasticity rate for tariff variation and for income variation
- Quality and quantity standards to be met at each target year
- Water supply mean and peak flows
- Coverage rate for water and wastewater public services
- Mean household income, mean number of persons per household, discount rate
- Domestic and industrial wastewater flows, dry and wet wastewater flows (mean and peak values), ground water infiltration, total inflow to WWTP facilities, total industrial wastewater inflow to WWTP, total BOD load (domestic and industrial), etc.

Present in a table the proposed values for the target years with sound justifications. Pay particular attention to the robustness of the assumptions for water demand (current and future levels, both domestic and non-domestic). Reference is made to Chapter 3.4 “Water Demand Projection”.

7.5 Unit Costs

- Present data from tenders for similar projects in Romania and other Eastern European Countries to elaborate a database of unit costs for water and wastewater projects
- Use these unit costs –refined or adjusted when necessary– to estimate total costs
- Describe thoroughly the basis for unit costs (what is included in the unit cost, price base year)
- Provide a detailed Unit Cost Table in the annex expressed in the price base year corresponding to the year of submission of the MP to the client
- Provide an aggregated Unit Cost Table (investment cost for WWTP per person-equivalent; investment costs for sewer network extension /per inhabitant supplied /average per km of network extension; etc.); provide the data for different sizes of agglomerations.

7.6 Investment Cost

- Provide an investment cost table, based on the proposed investment measures and the unit cost table
- Express investment cost in the price base year corresponding to the year of submission of the MP to the client
- The table should be sufficiently detailed for pre-feasibility level (separated for each measure and each agglomeration)
- Present an aggregated cost table in real prices

7.7 Operation, Maintenance and Administration Costs

- Provide a table for operation and maintenance cost, based on the proposed investment measures and the unit cost table
- If existing data from water operators are insufficient or unreliable, use a normative approach, using standard unit costs from water utilities operating under similar conditions
- The table should be sufficiently detailed for a pre-feasibility level (separated for each measure and each agglomeration)
- Present an aggregated cost table in real prices

7.8 Implementation Schedule and Phasing of Measures

7.8.1 Criteria for phasing

Based on the strategy developed in Chapter 6, define criteria for preparing an implementation schedule and development phases. The implementation schedule should include, but not be limited to:

- Deadlines in the EU Accession Treaty
- Targets and deadlines in Chapter 4 “National Objectives and County Targets”
- General implementation schedule based on priorities in Chapter 6
- Capacity of beneficiaries (ROC/Municipalities) to implement the measures

- Capacity of the beneficiaries to operate and maintain the facilities
- Capacity of the beneficiaries to finance local contribution for the CF Investments and to finance future reinvestment cost for the facilities
- Institutional capacity (establishment of ROCs)
- Capacity and willingness of the consumers to pay for the improved service (affordability)

7.8.2 Implementation schedule and phasing plan

- Prepare an implementation schedule (up to the planning horizon of the MP) for the investment measures in Chapter 7.3, indicating start and end date for each measure. Provide also a Gantt chart with an overview of the proposed working schedule
- Discuss the proposed tentative schedule and agree with the beneficiaries (and MESD); organise a workshop with all involved stakeholders
- Develop an aggregated phasing plan based on the agreed implementation schedule.

7.9 Impact of Proposed Measures

Assess the impact (positive and negative) of the proposed investment measures on:

- Environment
- Public health
- Socio-economic environment (i.e., job creation)

7.10 Achievement of Targets

Present the expected output *for each phase* of the investment plan with the selected indicators for achieving:

- SOP Targets (see Chapter 4)
- Regional/County targets (see Chapter 4)

Present also the related investment costs necessary to achieve the targets in the table above with the following indicative list of indicators:

- Total investment costs for each phase
- Specific investment costs (i.e. per capita investment costs)

Note: The proposed measures have to be in line with EU and Romanian legal requirements and make clear reference to them. The reference points are the deadlines agreed for compliance in the Accession Treaty.

7.11 Institutional Requirements

Present recommended institutional arrangement for the operation of the ROC/ IDA

7.12 Conclusion

The main output of the MP shall be a list of investment measures, in order of priority for the planning horizon of the MP. The proposed measures should respect the criteria of affordability, institutional set-up and financial viability.

Conclude on the pre-feasibility of the implementation plan by describing:

- Summary of phased investment measures and costs

- Summary of output and impact of the investment measures (key indicators)
- Summary table with compliance dates (separated for water and wastewater) for each agglomeration
- Potential constraints: (i) economic, (ii) technical, (iii) environmental, (iv) institutional; (v) time
- Main assumptions and conditions relevant for implementing the measures

The assessment of the pre-feasibility will help identify any shortcomings (institutional, financial, technical, etc.) at an early stage of project development.

8. FINANCIAL AND ECONOMIC ANALYSIS

At this stage of MP development, the financial and economic analysis mainly aims at developing the necessary input data for the affordability assessment and preparing:

- Overall investment and reinvestment cost of the proposed measures over the defined evaluation period;
- Overall O&M cost as required for (i) sustainable operation and maintenance of the rehabilitated and extended water and wastewater systems, and (ii) meet expected service standards and (iii) the full technical lifetimes of the investment under the prevailing conditions (estimated and projected on an annual basis for the planning horizon of the MP)

The Feasibility Study will develop a more detailed Financial and Economic analysis.

8.1 Abstract

8.2 Assumptions

List assumptions made for projecting investment and O&M costs.

8.3 Investment Costs

The investment cost table should:

- be broken down per year for the planning horizon of the MP
- be based on the net investment cost tables presented in Chapter 7.6. (net of contingencies, engineering and design costs)
- include costs for contingencies (max. 10%), technical assistance for construction supervision (5%), final design (5%)
- be expressed in current prices taking as base year the year of submission of the MP to the client

8.4 Operation and Maintenance Costs

O&M costs (breakdown per year) should be based on:

- Financial assessment of existing water operators as described in Chapter 2.6.4 “Analysis of Current Situation / Water and Wastewater Institutions”
- Projections prepared in Chapter 3
- Costs defined in Chapter 7.7 “Operation, Maintenance and Administration Costs”

- Be expressed in current prices taking as base year the year of submission of the MP to the client

8.5 Net Present Value

Prepare a preliminary estimate of the Net Present Value of the overall investments (broken down in water and wastewater) for each agglomeration based on the following assumptions:

- Reinvestment after 15 years of components with limited useful lifetime (machinery and equipment) and 30 years for civil works and pipe works;
- Discount rate of 5%

Develop the Average Incremental Cost (AIC: discounted cash-flow of the system over the period of the project divided by the flow of environmental resources consumed or treated during the period) of the projected investment and O&M costs as proxy of the average tariff needed to cover the investment and/or O&M portion of the cost of the overall investment in the project area

8.6 Conclusion

9. AFFORDABILITY

Estimate the potential contribution capacity of different groups of consumers to investments and operation of water and wastewater services by:

- Comparing the maximum potential contribution capacity of the beneficiary community and the total investment programme costs, minus all available grants
- Developing a mathematical model (spreadsheet) to calculate the affordability for various investment programmes, both changing the amount and phasing of the investments and other related costs. The model should distinguish between different sizes of agglomerations (i.e. “smaller”/rural; “bigger”/ urban agglomerations) and different consumer categories (i.e. domestic, non-domestic)
- Considering the total investments proposed for the planning horizon of the MP
- Using AICs as proxy of average tariffs, differentiated for each agglomeration and comparing with current water tariffs highlighted in Chapter 2.6.5
- Estimating the maximum potential contribution capacity of the beneficiary community on the basis that the average monthly expenditure for water should not exceed 4% of the average monthly household income of the lowest income decile (for resident population) based on a consumption of at least 70 lcd, during all the period of analysis, plus the contribution of other categories of consumers (industrial, commercial)
- Indicating how current tariffs for each municipality can be progressively merged to a unique tariff for the system to be operated by a single regional operator

Proposed subchapters:

9.1 Abstract

9.2 Methodology and Approach

9.3 Assumptions

- 9.4 Tariffs**
- 9.5 Affordability**
- 9.6 Sensitivity Analysis**
- 9.7 Conclusion**

10. PRIORITY INFRASTRUCTURE INVESTMENT PROGRAMME

- The water and wastewater systems proposed for EU co-financing will be the first stage of a long-term phased investment programme designed to fully comply with the relevant EC Directives;
- This first stage will include the priority measures with a positive impact on quality and quantity of the provided services and on environmental protection, and will represent the project to be co- financed by EU Cohesion Funds
- The investment programme will take into account:
 - Transition periods for the relevant Directives
 - Affordability of the proposed investment for population
 - Local implementation capacity
- According to the SOP Environment (strategic document for 2007-2013), given the need to comply with the EU Acquis in the water sector in many agglomerations in a relatively short transition period, prioritise large-scale integrated water/waste water projects (not only drinking waster services), mainly in urban agglomerations.

10.1 Abstract

10.2 Prioritisation of Project Measures

10.2.1 Criteria

Select priority measures in two steps:

1. All obligatory measures necessary to be implemented to comply with EU Acquis and national laws
2. All non-obligatory measures (all measures improving the service level) based on a ranking of cost benefit ratio.

Explain the selected criteria clearly and use a rational and simple ranking system. The prioritisation system should include weights defined by the beneficiaries.

Note that full compliance (according to the deadlines defined in the Accession Treaty) should be achieved within the project period (Phase 1 – Priority Phase) for a prioritised agglomeration. Thus, it is not acceptable to shift part of the investments (necessary to achieve compliance) within one agglomeration to a subsequent phase (Phase II).

Further, prioritise projects considering the entire water cycle (water and wastewater). New extensions of the sewer network (resulting in additional wastewater load) will require adjusting the treatment capacity to avoid any deterioration of the existing water quality of the recipient. Thus, it is not acceptable to build sewer extensions in Phase 1 and shift construction of WWTPs to a subsequent phase (Phase II).

10.2.2 Results

Describe the results of the prioritisation process for each section (water abstraction, water treatment, water supply networks, sewer networks, wastewater treatment).

10.3 Key Performance Indicators

Present the benefit of the project with selected output indicators for achieving:

- SOP Targets (see Chapter 4)
- Regional/County targets (see Chapter 4)
- Other systems performance indicators and ratio (i.e. non-revenue water, length of distribution network, investment cost per population etc.)

Ensure that the proposed measures will have a significant impact on the defined targets.

10.4 List of Prioritised Investment Measures

Prepare a list of priority measures including:

- Investment component number
- Name of agglomeration
- Description of measure (incl. dimensioning, location, etc.)
- Population served with EU acquis compliant systems
- Justification of investment
- Implementation period
- Investment costs

A table should also summarise:

- Capital requirements for the priority phase
- A first recommendation for financing of capital investments (EU grant CF/Beneficiary/State and Local government)
- Affordability and Economic Analysis for Priority Measures

11. ACTION PLAN FOR PROJECT IMPLEMENTATION

Prepare a checklist for all requirements (documents or actions) to be prepared until submission of the application including:

- Deadlines for submission;
- Duration for preparation of documents;
- Current status of available documents;
- Responsible organisation;
- Comments on expected problems.

The checklist should refer to:

- Administrative Requirements (land purchase, etc.)
- Environmental Requirements (EIA)
- Institutional Requirements (establishment of ROCs);

Ensure that the responsible organisations are aware of all deadlines for submitting the requested documents. Report progress on preparing documents to MESD and the beneficiaries.

A sample summary of required documents (EIA, land acquisition, “Urbanism Certificates”, etc.) is attached to this Guidance document (see Annex 2).

12. ANNEXES

Example for ANNEXES:

Annex A: Sources of Information, Available Data and Documents Consulted

- Annex A1: Documents
- Annex A2: Official letters (Apele Romane, Environmental Protection Agency, County councils and City Councils)
- Annex A3: Summary of relevant Regulations
- Annex A4: Summary of MEWM Implementation Programme

Annex B: Environmental Documentation

- Annex B1: Method for Evaluation of Punctual Pollution on Water Resources
- Annex B2: Impact of Effluent Discharges on Recipients in Cluj County and Environmental Data sheets of the Project Region
- Annex B3: Results of Analytical Sludge Investigations
- Annex B4: Legal Background for Sludge Disposal and general Disposal Options and related Cost Structure
- Annex B5: Inventory of Industrial Wastewater

Annex C: Technical Documentation

- Annex C1: Hydrogeology
- Annex C2: Water Supply
- Annex C2.1: DW Water Balance
- Annex C2.2: DW Network Extension and Rehabilitation Options
- Annex C2.3: Water Treatment Components
- Annex C3: Wastewater Treatment
- Annex C3.1: Wastewater Treatment Technologies
- Annex C3.2: Rough Design of the WWTP
- Annex C4: County Strategy (Investment Cost per Commune)
- Annex C5: Measurement Campaign
- Annex C5.1: Measurements on Water Distribution Networks
- Annex C5.2: Measurements on Sewers
- Annex C6: Design Criteria
- Annex C6.1: Design Criteria
- Annex C6.2: Projections
- Annex C7: Assessment of Existing Works

Annex D: Analysis

- Annex D1: Costs
- Annex D1.1: Unit Costs
- Annex D1.2: O&M Costs
- Annex D2: Financial / Economic Analysis
- Annex D2.1: Population Forecast
- Annex D2.2: Income Forecast
- Annex D2.3: Analysis and Forecast of Economic Activity

Annex D2.4:	Contribution Capacity of Households
Annex D2.5:	Contribution Capacity of Economic Agents
Annex D3:	Project Components
Annex D3.1:	Components for ROC
Annex D3.2:	Components for Turda
Annex D3.3:	Components for Campia Turzii
Annex D3.4:	Components for Viisoara
Annex D3.5:	Components for Mihai Viteazul
Annex D3.6:	Components for Tritenii de Jos
Annex D3.7:	Components for Luna
Annex D3.8:	Components for Calarasi
Annex D3.9:	Components for Sandulesti
Annex D3.10:	Components for Petrestii de Jos
Annex D3.11:	Components proposed for Technical Assistance

Annex E: Maps

Annex E1:	General Layouts for Project Towns
Annex E1.1:	Water Supply Network
Annex E1.2:	Sewer Network
Annex E2:	County Strategy
Annex E2.1:	Principal Features
Annex E2.2:	Present Service Levels
Annex E2.3:	Water Sources and Facilities
Annex E2.4:	Wastewater and Sanitation
Annex E2.5:	Alternatives

B2: Guidance for Feasibility Study

**Ministry of Environment and Sustainable Development
Managing Authority for SOP Environment**

GUIDELINES FOR FEASIBILITY STUDIES FOR WATER AND WASTEWATER PROJECTS

TITLE
OF INVESTMENT PROJECT
(*E.G. MODERNISATION AND EXTENSION OF THE WATER AND WASTEWATER
INFRASTRUCTURE IN ARGES COUNTY*)

NOTE: DO NOT REFER TO TA PROJECT TITLE!

Volume I:	Feasibility Study Report
Volume II:	Annexes Feasibility Study
Volume III:	Drawings
Volume IV:	Financial and Economic Assessment – Cost Benefit Analysis (CBA)
Volume V:	Institutional Analysis
Volume VI:	Environmental Impact Assessment (EIA)

ANNEXES TO THIS GUIDE:

ANNEX 1: PERFORMANCE INDICATORS TEMPLATE

ANNEX 2: COST BREAKDOWN TEMPLATE

ANNEX 3: UNIT COST TABLE TEMPLATE

VOLUME I: FEASIBILITY STUDY REPORT

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(1) SUMMARY

To BE ADDED

Maximum number of pages: 10

(2) GENERAL DATA

Present general data necessary to understand the project context.

Introduction to the Feasibility Study (max. 1 page)

- Reference to the TA context - reference to Romania as new MS and the need to comply with EU standards, Accession Treaty commitments in the field of environment, scope of TA to prepare a project (or a number of projects) as part of the project pipeline for SOP Environment initiated by Romanian authorities
- Explain the structure of the FS report

Project Area

- Present the location of the project, the concerned county and agglomerations, population –total project beneficiary population (out of total county population), and breakdown per agglomerations (population and p.e.) (2-3 paragraphs only)
- Provide an overview map to indicate the project area (general map of Romania indicating the project area and a more detailed map of the project county/area)

(3) PROJECT BACKGROUND

Present in a concise manner the background of the project considering:

- The results of the Master Plan;
- Objectives and targets defined in the accession treaty, national development plans and sector plans (SOP ENV) as well as county targets defined in the MP;
- A short summary of the natural features, socio-economic and institutional framework.

Strategic national documents and objectives relevant for the project (1-2 pages)

- Summarize national objectives in line with **Accession Treaty** – include relevant chapters of Accession Treaty and outline compliance dates; mention that **National Implementation Plans** for compliance with the water and wastewater relevant acquis have been prepared by the relevant national authorities
- Reference to the **SOP Environment**, national strategic document that represents the basis for selection of environmental sector operations co-financed from Structural Funds in the period 2007-2013; prepared on the basis of the National Development Plan and National Strategic Reference Framework of Romania and in line with the Accession Treaty and the relevant national sectoral plans for environment (e.g. sectoral National Implementation Plans for compliance with water Directives as relevant for this project); Outline SOP Environment objectives and strategy

- Reference to the Master Plans prepared with the view to prioritize long term investment needs at regional/county level in line with national strategic documents in the water sector (in particular, National Implementation Plans for compliance with the water sector aquis and SOP Environment)

Results of the Master Plan (no more than 3-4 pages text excluding maps)

Summarise the **results** of the MP focusing on:

- Reference to the upstream MP document as basis for this project selection
- Reference to the MP **horizon time** (30 years), to the MP dynamic feature (to be updated regularly)
- Reference to the twofold scope of the MP (ask MESD if needed)
- Summarize the **results of the analysis** of the current situation at county level linked to the need to comply with the water and wastewater obligations of the Accession Treaty; highlight the main **deficiencies** and the **needs** to be addressed in order to bring the current situation to a point of compliance with the obligations. The presentation must be in specific terms – quantitative (no. of inhabitants in urban and rural area, no. and size of agglomerations defined in line with the relevant wastewater Directive, number and size of main infrastructure components, services provided, coverage rate, etc.), qualitative (environmental impact, conditions of available equipment for water management, status of infrastructure in terms of legal compliance – reference to Accession Treaty and Water Directives parameters, etc.) and investments needed for compliance (as list of main actions and major investment packages). *Note that **quantification** of the current situation and needs and the needs is the key word!*
- Include maps or refer to relevant maps in the Annexes to help understanding of the current situation (one for water, one for wastewater recommended)
- Briefly present the **forecasts** of socio-economic trends relevant to the county, including population, water demand, wastewater flows and loads, etc. and list the main **assumptions** (including affordability considerations); the projections and assumptions must be clear and comprehensible. Table format is preferable.
- State the **national objectives** and **county targets** relevant to the MP
- Present the **results of the options analysis** prepared at MP level; note that only relevant strategic options should be included here (e.g. one WWTP vs 2 WWTP to ensure adequate treatment in agglomerations; or centralised vs. local systems for compliance with the aquis in the rural area etc.)
- A summary of the **county's strategy** for the water and wastewater infrastructure development; simply list the main strategic directions as clear as possible, along with the period, the responsible, the results expected, as appropriate.
- Mention the **phases** of the MP investments linked with the **total amounts** needed: **i)** for the MP horizon time (30 years), **ii)** by 2018 – deadline for compliance with the aquis, **iii)** by 2015 for the first phase (short term priorities that may include investments financed by SOP and by other financing programmes) and **iv)** for the SOP project (if differs from iii);
- Indicate clearly the **main criteria** used for prioritisation and selection (for this topic, one can review the MESD presentations and instructions); indicate that the selected SOP agglomerations and investments, once identified as priorities, have been subject to a series of consultations with the relevant local authorities and agencies as well as with the relevant departments of the MESD (water department and MA)
- Briefly describe the **Short Term Investment Programme** (STIP) proposed for SOP financing – the agglomerations covered, the beneficiary population, the main actions

and package investments, the main results expected upon the implementation (aggregated tables as indicated in MP Guidelines should be attached)

- Include **maps** or refer to relevant maps in the Annexes to help understanding the SOP project components (one for water, one for wastewater recommended)

Natural Features in the project area (no particular requirement for the no. of pages as long as it is concise and specific)

Briefly describe the natural features in the project area including (main elements included in the MP Guidelines - Chapter 2.3):

- Environment
- Climate
- Landscape and topography
- Geology and hydrogeology
- Ecology and sensitive areas (refer also to any Natura 2000 sites where relevant)

Socio-economic Assessment (no particular requirement for the no. of pages as long as it is concise and specific)

Summarise the socio-economic assessment (main elements already prepared available in the MP) with focus on:

- Current and future development of population
- Current and future development of Economic and main industrial activities (non-domestic water consumers and pollutants)
- Other relevant elements – GDP, household income, etc.

Note: i) Common tables to reflect past, current and forecasted figures are recommended, for easy reference; ii) Refer to official statistics as much as available; challenge the data if different documents present different data; additional surveys and investigations should be performed where needed.

Institutional and Legal Framework

Present the general legal and administrative framework as well as the institutional set-up of the Romanian water sector.

1.1.1 Legislative Framework linked to environment – water sector (one page recommended)

- Briefly refer to the European legislation on environment and possibly refer to key elements relevant for this project (water and wastewater Directives, ref. to WFD, ref. to agricultural use of sludge, etc.)

Note: Description of the detailed provisions of the Directives is not needed

- Briefly present the relevant Romanian laws that transpose the relevant Directives mentioned above

Note: presentation of long lists of laws is not needed. Mention only the relevant laws and norms and comment on the correspondence of the Romanian laws with the related directives. If considered appropriate, a list of such Romanian laws and norms could be included in an Annex but not in the main text of the FS.

- Briefly present the relevant Romanian legislation on public services in the water sector (reference to Law 51 and the related legislation in particular)

1.1.2 General Administrative Framework (no more than one page)

Briefly describe the administrative framework in Romania at the national, county, and municipal levels relevant for the water sector, with reference to their role and responsibilities

- Environmental institutions
- Public water services

1.1.3 Regional Policy - Institutional Setup in the Romanian Water Sector

- Briefly describe the Regionalization Strategy in the Water Sector (1-2 pages)

Note: This section should refer to the national policy on regionalisation of water services (the rationale, the principles, the main provisions). Ask the MESD for easy reference summary, if needed, although this is available on MESD website. A detailed assessment of the institutional set up for this project is to be presented further in Chapter 12.

(4) ANALYSIS OF CURRENT SITUATION AND PROJECTIONS

The analysis of the current situation and projection of future development shall focus on the following key elements:

- Present the current situation and projections of water resources and water demand in order to assess the current water scarcity and future availability (water balance);
- Assess current and possible future pollution of water resources as key constraint to sustain water resources development;
- Assess the existing water supply and wastewater infrastructure in order to define the main deficiencies as a justification for the investment project;

The assessment shall be based on sufficient and reliable data. Field investigations and measurements are key elements of the assessment and are of the utmost importance for the next steps. Field measurements will in particular be important to assess water quality, water losses, infiltration water, wastewater load and hydraulic wastewater flow, and for any other field in which the data provided are insufficient or deemed unreliable or inconsistent.

Abstract

General Data on Water System

Provide sufficient information for each agglomeration and summarize for all agglomerations:

- Water quantity and water quality
- Current water consumption and development of water demand
- Assessment of current water losses
- Current and future wastewater flow and load including infiltration water
- Information on the recipient water and the impact of water pollution on downstream water users
- Level of service for all water and wastewater agglomerations
- Additional base data relevant for assessing the feasibility of the investment measures such as land availability, geotechnical studies, and other relevant basic studies

Key Note: Presentation of the relevant information in a concise manner by using quantified data is of particular importance. With this aim, a series of summary tables are presented in the following pages for easy reference and orientation by the TA consultants.

1.1.4 Water Resources

1.1.4.1 General

Provide an overview of current water resources in the project area (ensure coherence with chapter 2.7. of the MP)

1.1.4.2 Agglomeration x

o Water Quantity

Briefly describe current water resources available for water supply quantifying:

- Development of yearly water production for the past five years (split-up in water resources)
- Monthly variation of water production
- Replenishment of natural resources
- Deficit of water and constraints (water shortages)
- Tendency for availability of water resources (i.e., lowering water table)

Identify and quantify potential additional water resources for future development.

o Water Quality

Briefly describe current water quality of existing and potential water resources:

- Briefly describe current water quality monitoring system and comment on reliability of data below
- Summarise statistics on water quality analysis (development in the past years if available) in a table
- For each raw water source (indicator, unit, concentration measured, max. admissible value), provide table with water quality analysis

- Provide table with water quality analysis after treating raw water (indicator, unit, concentration measured, max. admissible value)
- Provide table with statistics on water quality analysis measured in the distribution system (i.e. consumer tap)
- Particularly focus on water quality parameters in the accession treaty and other parameters with high risk for non-compliance (pesticides, nitrates, ammonia, etc.)
- Describe current protection zones (deficiencies)
- Assess reason for inadequate water quality (geogenic, anthropogenic – industry, agriculture, sewer system, etc.)
- Conclude on compliance with Drinking Water Standards (EC DWD and Romanian Law 458/2002) and clearly indicate in a table the respective compliance dates to be respected for the non-compliant parameters.

1.1.4.3 Agglomerations y

4.1.1.4 Agglomeration z and so on - same structure as for 4.1.1.2.

1.1.5 Water Pollution

Provide an overview of current status and trends for development of water pollution in the County by summarizing Chapter 2.8 of the MP.

- Major pollution sources
- Impact of wastewater discharge

Provide more specific information on pollution load for each agglomeration concerned.

1.1.6 Current Water Consumption and Water Demand Projection

1.1.6.1 Current water consumption

Provide an overview of current water consumption for all agglomerations concerned by summarizing chapter 2.9 of the MP and consider the following:

- Quantify current water consumption and development in the past 3-5 years for each agglomeration by using existing data and own measurements
- Carry out measurements (with portable ultrasonic flow meter) at representative consumer types (metered/un-metered, apartment blocks, individual households, etc.) and verify actual consumer readings with measurements
- Break down consumption by category of consumers (domestic, non-domestic).

Table: Current water consumption

Water Demand	Units	Agglomeration x	Agglomeration y
Domestic Water Consumption	10 ⁶ *m ³ /y.		
Non-Domestic Water Consumption	10 ⁶ *m ³ /y.		
Total Water Consumption (Domestic + Non-Domestic)	10 ⁶ *m ³ /y.		
Specific Domestic Consumption	lcd		
Specific Total Water Consumption	lcd		

1.1.6.2 Water Losses

(5) Estimate current water losses as follows:

- Apply IWA methodology to determine the current water balance (see example below) and indicate data accuracy (error margin)
- Estimate components of the water balance based on existing data, field measurements, and expert's estimates for each agglomeration
- If no loss measurements are available, estimate real (physical) water losses by (i) night flow measurements and/or (ii) physical condition of the network/pipe failures (iii) estimate of apparent losses
- Calculate/estimate technological losses in the treatment plant
- Calculate Infrastructure leakage indexes (ILI) and losses in liters/connection/day (or m³/km of pipe per day)
- Conclude on the current losses indicating the importance for network rehabilitation (classification as per IWA)

Table: Example for Water Balance (IWA standard)

Home

(6) Set realistic targets for development of future water losses considering:

- Future investment measures (priority measures and long term investments)
- Improvement of water loss reduction practices of the ROC

(7) Provide data for the water loss indicator table given below:

Note: setting water loss targets will be necessary to calculate design water flows. As the proposed investment measures (network rehabilitation) will determine the future water losses, setting water loss targets is an iterative process.

Table: Water Losses Indicators

Item	Indicator	Unit	Current Losses	Target Losses
	Total system input (raw water input)	m ³ /d		
	Total non-revenue water (IWA standard: Total system input - total water sold)	m ³ /d		
	Percent of non-revenue water	%		
	Real water losses (physical losses) in the network (excluding technical losses in the WTP)	m ³ /d		
	Percent of real water losses (physical losses) in the network (excluding technical losses in the WTP)	%		
	Real water losses per number of connections (at average system pressure of 30 -40 m)	Liters/conn./day		
	Infrastructure Leakage Index (ILI as defined by IWA)*	-		

* Assumption: pressure 35 m; $L_p=0$

Note: The above indicators and other specific indicators are particularly required by the European Commission (through official communication)

1.1.6.3 Water Demand Projection

- (1) Provide a summary table with projection of future water demand components for all agglomerations as given in the table below:

Table: Summary of future water demand for the year ...

Water Demand	Units	Agglomeration x	Agglomeration y
Population	Number		
Specific Water Demand – Domestic	Lcd		
Domestic Water Demand	m ³ /year		
Non Domestic Water Demand	m ³ /year		
Total Water Demand (Domestic + Non-Domestic)	m³/year		
Real Water Losses	m ³ /year		
Total Water Demand incl. Water Losses	m³/year		

- (2) Prepare for each agglomeration a summary table with projection of future water demand components as given in the table below:

Table: Projection of future water demand for agglomeration x

Water Demand	Units	2007	2010	2015	2020	2025	2037
Population	10 ⁶ *Number						
Specific Water Demand – Domestic	lcd						
Domestic Water Demand	10 ⁶ *m ³ /y.						
Non Domestic Water Demand	10 ⁶ *m ³ /y.						
Total Water Demand	10⁶*m³/y.						
Real Water Losses	10 ⁶ *m ³ /y.						
Total Water Demand incl. Water Losses	10⁶*m³/y.						

(3) Prepare a summary table for design water demand/flow as given in the table below:

The design water demand is to be calculated based on the Romanian Standard SR 1343-1:2006 “Calculation of drinking water supply quantities in urban and rural sites” taking into consideration the design parameters given in Chapter 8 of this Guidance and the respective flow-coefficients defined in the Romanian Standard mentioned above.

Table: Summary of the design¹ water demand:

Water Demand	Units	Agglomeration x	Agglomeration y
Average daily flow	m ³ /day		
Maximum daily flow: Q _{max} , day	m ³ /day		
Maximum hourly flow Q _{max} , hour	m ³ /hour		
Average yearly flow	m ³ /year		
Design year	Year		

More detailed tables for calculating design demand for each agglomeration are to be attached to the FS as appropriate.

1.1.7 Wastewater Flows and Loads

- Present detailed methodology for calculation in the annexes
- Present summary of results in the chapters below

1.1.7.1 Domestic Wastewater

Wastewater Flow and Load:

- Calculate current average and maximum wastewater flow for domestic customers in m³/day (m³/hour) and P.E.
- Prepare scenario for development of domestic wastewater flow until the end of the planning horizon.
- Present results of wastewater flow measurements (detailed presentation in annex) in both dry weather period and wet weather (including peak flows).

¹ design horizon 2037 (maximum demand during the planning horizon; note: for decreasing demand the design year is the year after completion date)

- For (partially) combined wastewater networks, indicate measures foreseen to buffer rainwater inflow (i.e. rainwater overflow basins); the measure should be supported by an option analysis, taking into account the environmental impact of subsequent discharges. **As far as necessary and applicable, use dynamic sewer modelling for calculating rainwater overflow basins and indicate clearly overflow discharge quantity and frequency of overflow. Ensure that there is no overflow into the recipient water during dry weather flow**
- For separate systems, propose measures to avoid „illegal/wrong” connections (rainwater into sewer) in particular for main sewers in the future. The Action Plan for the ROC should include training in techniques for detecting „illegal/wrong” connections and provide appropriate equipment.

1.1.7.2 Non-domestic Wastewater

- Provide a table with all non-domestic (commercial/industrial) customers currently discharging wastewater into the sewerage network indicating wastewater flow in m³/day
- Prepare scenario for industrial development until the end of the planning horizon
- Prepare table with projected wastewater flow for non-domestic wastewater
- Present results of wastewater flow measurements (detailed presentation in annex).

1.1.7.3 Infiltration water

- Describe measurements to identify current infiltration rate into the sewer network
- Present results of wastewater flow measurements (detailed presentation in annex).
 - Carry out the measurement campaign for infiltration water during the dry and wet weather periods. Carry out also peak flow measurements during storm water periods.
 - Define infiltration rates based on appropriate assessment methods (i.e. day-night fluctuations, dilution of parameters such as TSS, BOD₅, P or N, etc.).
 - The result of the measurement campaign should provide data on the current volume of infiltration water (average volume per year) and the infiltration rate, the yearly fluctuation, the location of the highest/lowest infiltration rates in the network, the main reasons for high infiltration rates.
- **Develop a projection of infiltration volume and infiltration rate for scenarios (i) without project and (ii) with project, considering the length of sewer network replaced by the project measure and the reduction of water losses in the distribution network (indirect effect on infiltration).**
- **Infiltration rates for new or renovated sewer sections should be close to 0% during dry weather flow (after commissioning of works water tightness should be certified). However, a certain (small) percentage for infiltration water might still be reasonable in the assumption on wastewater flow.**
- **Provide indicators on the efficiency of the proposed rehabilitation measures (investment costs in € per quantity of infiltration water reduced => see unit cost table below). This should provide the Managing Authority with some benchmark to assess the opportunity of the beneficiary's request.**

1.1.7.4 Summary Hydraulic Wastewater Flow and Load

Present the current and projected hydraulic wastewater flow (supported by measurement campaign to be annexed to the FS).

Note: setting water flow targets will be necessary to calculate design wastewater flows. As the proposed investment measures (sewer network rehabilitation) will influence the future quantity of water infiltrating into the sewer network, setting wastewater flow targets is an iterative process.

- (1) Provide a summary table with projection of future wastewater flow components for all agglomerations as in the table below:

Table: Summary of future wastewater flow for the year

Category of Wastewater Flow	Units	Agglomeration x	Agglomeration y
Domestic Consumers	m ³ /year		
Industry	m ³ /year		
Commerce and Public Service	m ³ /year		
Total Wastewater Flow (Domestic + Non-Domestic)	m³/year		
Infiltration in the Sewer Network	m ³ /year		
Total Wastewater Flow including infiltration water	m³/year		

- (2) Prepare a summary table for design wastewater flow as in the table below:

Table: Summary of the design² wastewater flow:

Wastewater Flow Design Parameter	Units	Agglomeration x	Agglomeration y
Average daily flow	m ³ /day		
Maximum daily flow: Q _{max} , day	m ³ /day		
Maximum hourly flow Q _{max} , hour	m ³ /hour		
Average yearly flow	m ³ /year		
Design year	Year		

More detailed tables for calculating design wastewater flow for each agglomeration are to be attached to the FS.

- (3) Use the following indicators to summarise wastewater flow data (before and target after project implementation)

Table: Summary indicators – Hydraulic Wastewater Flow

Item* (indicative numbering)	Indicator	Unit	Agglomeration x ³	
			Current situation	Target
3.2.1	Total wastewater volume collected (average wastewater flow)	m ³ /d		
3.2.1.1	Wastewater volume collected from domestic customers	m ³ /d		
3.2.1.2	Wastewater volume collected from industry	m ³ /d		
3.2.1.3	Wastewater volume collected from commerce and public service entities	m ³ /d		
3.2.1.4	Wastewater volume from infiltration into the wastewater network	m ³ /d		
3.2.1.5	Percent of wastewater volume collected from domestic customers	% of 3.2.1		
3.2.1.6	Percent of wastewater volume collected from industry	% of 3.2.1		
3.2.1.7	Percent of wastewater volume collected from commerce and public service entities	% of 3.2.1		
3.2.1.8	Sewer Infiltration rate: Volume of infiltration water into the wastewater network / total wastewater volume collected	% of 3.2.1		

*Note: The indicators mentioned above are a subset of the "Performance Indicators" table to be included in Annex 1. The item numbers in the table above are identical to the item numbers in the table in the Excel sheet version.

- (4) For storm water flow from separated sewer systems, present data according to the following table and add other relevant data (before and target after project implementation):

Table: Summary indicators – Storm water Flow

Item* (indicative numbering)	Indicator	Unit	Agglomeration x ⁴	
			Current situation	Target
3.3.1	Total volume of storm water (from separated sewer system)	m ³ /d		
3.3.1.3	Percent of storm water discharging to WWTP	% of 3.3.1		
3.3.1.4	Percent of storm water discharging to receiving waters without treatment	% of 3.3.1		
3.3.2	Peak factor for storm drainage flow (Q24 max)	-		

*Note: The indicators mentioned above are a subset of the "Performance Indicators" table in Annex 1. The item numbers in the table above are identical to the item numbers in the table in the Excel sheet version.

Table: Current and projected Wastewater Load

Item* (indicative numbering)	Indicator	Unit	Agglomeration x	
			Current situation	Target
3.4.1	Total Biological load (BOD5)	kg BOD/d		
3.4.1.4	Percent from domestic customers	% of 3.4.1		
3.4.1.5	Percent from industry	% of 3.4.1		
3.4.1.6	Percent from commerce and public service entities	% of 3.4.1		
3.4.2.1	BOD5 concentration	mg/l		
3.4.2.2	COD concentration	mg/l		
3.4.2.3	Suspended solids	mg/l		
3.4.2.4	Total Nitrogen concentration	mg/l		

³ Add column for each agglomeration

⁴ Add column for each agglomeration

3.4.2.5	Total Phosphorus concentration	mg/l		
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*Note: The indicators mentioned above are a subset of the “Performance Indicators” table in Annex 1. The item numbers in the table above are identical to the item numbers in the table in the Excel sheet version.

1.1.8 Water Cycle Balance

Prepare a water balance for the entire water cycle (water and wastewater) including:

- Water production (surface water and groundwater)
- Water distribution (consumption + losses)
 - Water consumption (domestic and non-domestic)
 - Water losses (apparent losses and real losses)
- Wastewater collection
 - Domestic
 - Non-domestic (commercial, industrial)
 - Percolation (infiltration/exfiltration from/to groundwater + infiltration from water losses in the water supply network)
- Inflow to WWTP

An example is in the below table.

Example of Water Balance (2007, 2013, 2037)

Note – 2013 or the year of SOP project completion

Water Balance Components	2007		2013		2037	
	[m ³ /d]	%	[m ³ /d]	%	[m ³ /d]	%
Water Production						
- Ground water	25 693	38%	28 389	74%	17 409	70%
- Surface Water	41 140	62%	10 192	26%	7 617	30%
Sub-total Production	66 833	100%	38 581	100%	25 025	100%
Water Distribution						
Water Losses***	53 717	80%	22 219	58%	4 900	20%
Water Supply						
- Domestic	8 480	13%	11 460	30%	14 121	56%
- Industrial	4 636	7%	4 902	13%	6 004	24%
Sub-total Water Supply	13 116	20%	16 362	42%	20 125	80%
Sub-total Distribution	66 833	100%	38 581	100%	25 025	100%
Wastewater Collection						
- Domestic	7 632	15%	10 314	41%	12 709	43%
- Commercial	1 800	4%	1 900	8%	1 900	7%
- Industrial	2 179	4%	2 304	9%	2 700	9%
- Infiltration*	38 760	77%	10 497	42%	11 911	41%
Inflow WWTP:	50 371	100%	25 015	100%	29 220	100%

* from water losses in the water distribution network and infiltration from groundwater into the sewer network

1.1.9 Recipient Water

Present for each agglomeration) the following information:

- General description of the recipient and its drainage area (name, location, river course, etc.)

- Provide a map showing up-stream and downstream (i) water users (municipal and industrial or agricultural water users) as well as (ii) discharge points of other polluters (industrial, non-treated wastewater directly discharging from sewer network, etc.)
- Current water quality data (classification of river water quality “status of river”)
- Discharge volume of recipient water (seasonal flow variation)
- Dilution of wastewater (ratio of wastewater discharge / recipient water flow)

1.1.10 Impact of Wastewater Discharge on Downstream Users

Based on the results of the “Recipient Water” chapter, assess:

- Risk for downstream water quality degradation (i.e. eutrophication). In case of high risk for degradation (i.e., retention lake with reduced flow and high risk for eutrophication), assess alternative solutions for discharge points (see option analysis)
- Projected impact of wastewater measures on water quality of recipient (improvement of water quality status)

1.1.11 Level of Service

Present the current level of service for water supply applying the following indicators and draw conclusions:

Table: Level of Service Indicators for Water Supply and Wastewater

Item (indicative numbering)	Indicator	Unit	Agglomeration ⁵
Water Supply			
2.1	Level of water supply service coverage		
2.1.1	Total population in service area concerned (water supply zone)	capita	2
2.1.2	Service Coverage: Percent of population connected to water supply system (2.1.3/2.1.1)	% of 2.1.1	3
2.1.3	Population served (population connected to/served by a central water supply system through house/yard connections, public tap)	capita	4
2.3	Water consumption/demand*		
2.3.6	Specific domestic water consumptions	l/cd	
2.3.9	Depressed consumption (insufficient quantity)	yes/no	
2.6	Supply security and system failures		
2.6.2	Supply interruptions due to system failures per length of network per year	number/km/year	7
2.6.5	Hours of water supply per day	Number of	
2.9	Water Quality		
2.9.2	Population supplied with drinking water quality compliance with EC Drinking Water Directive 98/83/EC and transition treaty chapter 22	number	9
2.9.3	Percent of population supplied with drinking water quality compliance with EC Drinking Water Directive 98/83/EC and transition treaty chapter 22	% of 2.1.1	10
Wastewater			
3.1.1	Total population in agglomeration concerned	Capita	11
3.1.2	Service coverage: Percent of population connected to wastewater network	% of 3.1.1	12

⁵ Add column for each agglomeration

Item (indicative numbering)	Indicator	Unit	Agglomeration x ⁵
3.1.3	Population connected to a wastewater network	Capita	13
3.1.12	Percent of population connected to a WWTP compliant with EU UWWTD 91/271/EEC Article 4 (5)	% of 3.1.1	14

*Note: The indicators mentioned above are a subset of the “Performance Indicators” table in Annex 1. The item numbers in the table above are identical to the item numbers in the table of the Excel sheet version.

14.1.1 Land occupation and legal status

Describe status of land availability for the proposed infrastructure (current property of land; constraints for construction and future extension, acquisition of additional land (if any), risks for implementation.

14.1.2 Summary of Geotechnical Studies

Briefly summarise geotechnical investigations including:

- Underground condition along construction areas
- Seismic zones
- Assessment of risks due to unfavourable geotechnical conditions

14.1.3 Other Relevant Base Data

Briefly summarise other studies and investigations including:

- Hydrological data for assessment of flood risk
- Precipitation data
- Etc.

Detailed studies are to be presented in the Annex.

Existing Water Supply Infrastructure

For each agglomeration, assess the existing water supply infrastructure and present the results as follows:

- Give an overview of water and wastewater infrastructure for each agglomeration (i.e. maps with infrastructure)
- Describe and quantify the current water supply and wastewater system components
- Conclude on the key deficiencies for each system component and provide a summary for all agglomerations
- Briefly describe and quantify operation and maintenance efficiency for all system components

14.1.4 Agglomeration x

14.1.4.1 Location of Existing Infrastructure

- Describe the location of the concerned agglomeration
- Provide an overview map (A4 or max. A3) of the water supply agglomeration indicating the existing infrastructure:

- Detailed boundary of the agglomeration (defined in MESD's methodology)
 - Current and future settlement area (urban development plan or other investigations)
 - Administrative borders and general features (rivers, main roads, etc.)
 - Existing water intake / well fields
 - Existing pipe mains and important pumping stations
 - Existing water supply network
 - Existing treatment plants
- Additionally: wastewater discharge point(s) of municipal wastewater treatment plants or industrial polluters.

14.1.4.2 Description of Current Infrastructure

o General

- (1) Briefly describe and quantify current water supply system (from intake to consumers):
 - Water Abstraction
 - Pumping Stations
 - Water Treatment Plants
 - Water Transmission Mains
 - Water Distribution Network
- (2) Present an overview map (A4) showing location and key data of the current water infrastructure for the agglomeration. Additionally, indicate the location of the WWTP and other relevant elements (rivers, main roads, if possible topography, etc.).

o Water Abstraction

- (1) Briefly describe and quantify current endowment for raw water abstraction (from intake to treatment) indicating location/altitude, main parameters, current condition, for:
 - Water protection zones (zone 1 and zone 2)
 - Water reservoirs and dams
 - Surface water intakes
 - Wells and raw water pumping stations
 - Others endowments
- (2) Conclude on key deficiencies

o Pumping Stations

- (1) Briefly describe and quantify current endowment for pumping stations (for freshwater pumping stations) indicating location, main parameters, current physical condition and efficiency:
 - Civil structures
 - Electromechanical equipment (efficiency, risk for failures, etc.)
 - Automation system (SCADA system)
- (2) Conclude on key deficiencies

An example is given below:

- *Costs for repair of pumps increased substantially (x % during past y years) as pumps are highly depreciated*
- *Access to spare parts is not anymore assured (supply security)*
- *High costs for operation of the system due to over-dimensioning of the existing pumps and outworn pumps*
- *Civil structures are outworn and need capital renovation*
- *The existing SCADA system is old and does not provide comprehensive information to operate the system efficiently.*

o Water Treatment Plants

- (1) Briefly describe and quantify current endowment for treatment plants (for all steps of the treatment process) indicating location, main parameters, current physical condition and efficiency, for:
 - Civil structures
 - Electromechanical equipment (efficiency, risk for failures, etc.)
 - Automation system (SCADA system)

Describe efficiency of current treatment system by presenting input water quality and output water quality for critical parameters.

Describe the current sludge discharge (backwash water from Drinking Water Treatment Plant).

- (2) Conclude on key deficiencies

o Water Transmission Mains

- (1) Briefly describe and quantify current endowment for transmission mains indicating location, main parameters (length, diameter, material), current physical condition, for:
 - Conduit
 - Civil structures (bridge crossings, etc.)
 - Armatures (gate valves, etc.)

Quantify as much as possible the water losses in the transmission main and the development of pipe failures during the past i.e. five years (supply security).

- (2) Conclude on key deficiencies

o Water Distribution Network and Reservoirs

- (1) Briefly describe and quantify current endowment for the distribution system indicating location, main parameters (length, diameter, material), current physical condition, for the following elements:
 - Pipe network and armatures (see example below)
 - Reservoirs
 - House connections and metering

Example Table: Material and length of pipes in the Water Supply Network

Material	Diameter [mm]		Length [km]	Length [%]
	from	to		
Asbestos Cement	60	150	72.0	48%
	200	300	36.0	24%
	400	546	12.0	8%
Sub-total AC			120.0	80%
Steel	60	277	3.2	2%
	325	426	6.7	4%
	530	720	9.1	6%
Sub-total Steel			19.0	13%
Cast Iron	125		2.0	1%
Polyethylene (PE)	110	200	4.7	3%
	225	250	4.3	3%
Sub-total PE			9.0	6%
TOTAL Length			150.0	100%

Describe efficiency of the current distribution system by assessing the main reasons for the water losses quantified in Chapter 2.2.4 above. Describe the data used and measurements done to estimate the water losses. Critically comment on the quality of data (data provided by operator, consultants' estimate, consultants' own measurements, etc.).

Prioritise necessity for network renovation for different network zones and/or pipe materials (based on information provided by the operator, water loss data and data on pipe failures). For this reason, try to allocate water losses to zones and/or pipe materials (see table below).

Example Table: Distribution of water losses in network

Material of Pipes	L [km]	Before rehabilitation		
		[m ³ /year]	%	[m ³ /km*year]
"New" PE pipes				
AC old	120	14 536 606	95%	121 138
- High zone	65	10 075 000	66%	155 000
- Middle zone	55	4 956 282	32%	90 114
Other material	30	270 408	2%	9 014
- High zone	2	30 000	0.2%	15 000
- Middle zone	28	240 408	2%	8 586
Total	150	15 301 690	100%	102 011

(2) Conclude on key deficiencies

Example:

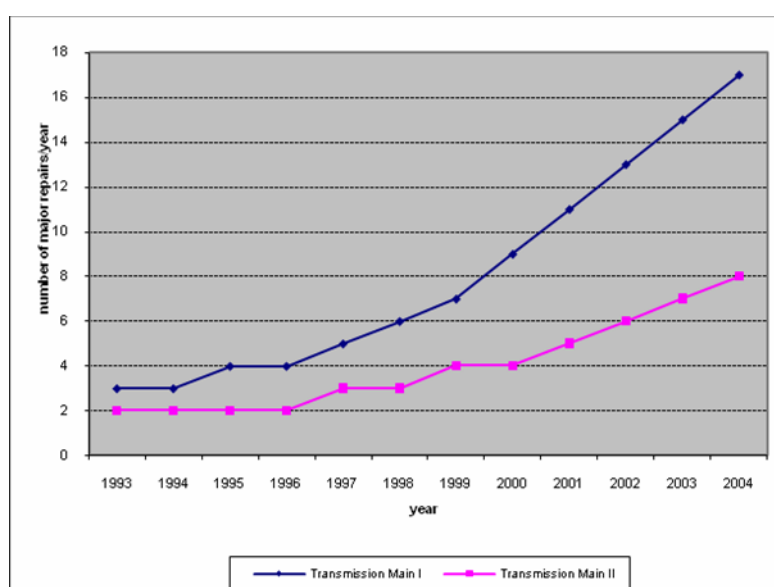
- *Outworn rubber gaskets of AC pipes causing frequent pipe breaks and high water losses.*
- *Low network pressure due to insufficient pipe diameters*
- *Galvanized steel pipes with small diameters (3/4" to 1 1/2") are heavily corroded and cause frequent failures and deteriorating water quality.*

14.1.4.3 Operation and Maintenance

(1) Briefly describe and quantify operation and maintenance efficiency for all of the above mentioned components of the water supply system as follows:

- **Water quality monitoring and preventions for accidental pollution**
- Monitoring and maintenance of protection zones
- Operation & Maintenance costs (energy, chemicals, staff, material) for all components
- Pipe failures (development during past i.e. 5 years) and supply security
- Water loss reduction practices and operating efficiency

Example Figure: Development of pipe breaks in the Transmission main I+II (1993-2004)



Example Table: Energy Consumption and Energy Efficiency in year x

Pumping Station	Production	Energy consumption	Energy Costs	Energy Coefficient	
	[m ³ *1000/year]	kWh*1000/year	€*1000/year	kWh/m ³	€/m ³
1					
n					
TOTAL					

(2) Conclude on key deficiencies with regard to Operation & Maintenance

14.1.4.4 Main Deficiencies in Water Supply System

Summarise conclusions of Chapter given above (Description of existing infrastructure and Operation and Maintenance) in the following tables:

Table: Summary of main deficiencies in water supply system

Item	Components	Main deficiency*
1	Water abstraction	-
2	Pumping stations	-
3	Water treatment	-
4	Transmission main	-
5	Distribution network	-

*Describe the deficiencies as specifically as possible and quantify as far as possible.

Summarise compliance with DWD 98/83/EC and other relevant directives.

14.1.5 Agglomeration y, z and so on...

Existing Wastewater Infrastructure

Assess for each agglomeration the existing wastewater infrastructure and present the results as described in Chapter 5.2. above.

14.1.6 Agglomeration x

14.1.6.1 Location of Current and Proposed Infrastructure

- Describe the location of the concerned agglomeration
 - Provide an overview map (A4 or max. A3) of the agglomeration showing the existing and proposed infrastructure. The map should clearly show:
 - Detailed boundaries of the agglomerations (defined as per MESD's methodology)
 - Current and future settlement areas (from urban development plan or other investigations)
 - Administrative borders and general features (rivers, main roads, etc.)
 - Existing and proposed mains collectors and important pumping stations
 - Existing and proposed wastewater network
 - Existing and proposed wastewater treatment plants
- Additionally: location of water intake or well-field

14.1.6.2 Description of Current Infrastructure

o Wastewater Network

- Describe wastewater main collectors, secondary wastewater network, and storm water network including rainwater overflow structures (length, capacities, location, combined system/separate system, etc.)
- Provide detailed table with current sewerage network lengths, materials, and diameters

Table: Material used in wastewater network (current situation)

N°	Diameter	Length of Network			
		Concrete	Asbestos Cement	PVC/PE/PP	Total Length

- Assess physical condition of infrastructure (as far as possible apply CCTV inspection to identify critical sections)
- Summarize wastewater network system parameters using the following indicators table:

Table: Current wastewater network system parameter

Item* (indicative numbering)	Indicator	Unit
3.6.1	Total length of wastewater network (incl. stormwater & main collectors)	km
3.6.1.1	Percent of length of combined system	% of 3.6.1
3.6.1.2	Percent of length of separated system	% of 3.6.1
3.6.1.3	Percent of length of partially combined/separated system	% of 3.6.1
3.6.2	Length of main collectors	km
3.6.2.2	Percent of main collectors rehabilitated (related to existing main collectors)	% of 3.6.2
3.6.3	Number of wastewater pumping stations	number
3.6.4	Capacity wastewater pumping stations	1000 m ³ /d
3.6.5	Length of wastewater network (without storm water and main collectors)	km
3.6.5.1	Length wastewater network rehabilitated	km
3.6.5.2	Percent of wastewater network rehabilitated (related to existing network)	% of 3.6.6
3.6.7	Population served per length of wastewater network	capita/km
3.6.9	Capacity of storm water retention basins	1000*m ³

*Note: The indicators mentioned above are a subset of the “Performance Indicators” table in Annex 1 (the selected indicators are highlighted in there). The item numbers in the table above are identical to the item numbers in the table in the Excel sheet version.

o Wastewater Pumping Stations

Describe existing pumping stations:

- Table showing electro-mechanical equipment (capacity of pumps; Q, H,P)
- Assess current physical condition of electro-mechanical equipment of pumping stations (indicators for energy efficiency – kWh/m³)
- Assess physical condition of civil structures of pumping stations

Table: Assessment of existing pumping stations in Agglomeration xx

N°	Name of Pumping station	Number of pumps	Q ⁶	Hp	P	Energy efficiency	Year of installation	Rating of physical condition of E&M equipment	Rating of physical condition of Civil Structures
			m ³ /h	M	kW	kWh/m ³	year		

o Wastewater Treatment Plants

Describe main components of existing wastewater treatment plant(s):

- Inlet pumping station
- Pre-treatment
- Primary sedimentation
- Biological Treatment

⁶ Sum of nominal capacity of pumps in the pumping station (more details might be provided in the annex)

- Secondary clarifier
- Sludge treatment
- Other components (discharger, etc.)

Table: Assessment of physical condition of electro-mechanical equipment and civil structures in Agglomeration xx

N°	Component	Description ⁷	Year of installation	Rating of physical condition of E&M-equipment	Rating of physical condition of Civil Structures	Need for renovation ⁸

Evaluate treatment performance using the following table:

Table: Assessment of current treatment efficiency in Agglomeration xx

N°	Parameter	Unit	Influent WWTP	Effluent WWTP	Treatment Performance

Summarise performance of WWTP with the following indicators (before and after project implementation):

Table: Performance Indicators for Wastewater Treatment

Item*	Indicator	Unit	Current situation	Target
3.2.1	Total wastewater volume collected (average wastewater flow)	m ³ /d		
3.7.2	Hydraulic design capacity of WWTPs	m ³ /d		
3.7.3	Biological design capacity	kg BOD/d		
3.7.5	Percent of biologic design capacity used (3.4.1 / 3.7.3)	%		
3.7.7	Capacity of WWTPs in Population equivalent	p.e.		
3.7.8	Total volume of wastewater treated in WWTPs (yearly average at the outlet of WWTP)	m ³ /d		
3.7.8.10	Volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC	m ³ /d		
3.7.8.11	Percent of volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC Article 4 (5)	% of 3.2.1		
3.7.8.12	Total BOD treated / removed	kg BOD/d		
3.7.8.13	Total COD treated / removed	kg COD/d		
3.7.8.14	Total N treated / removed	kg N/d		
3.7.8.15	Total P treated / removed	kg P/d		

*Note: The indicators mentioned above are a subset of the "Performance Indicators" table in Annex 1.

14.1.6.3 Operation and Maintenance

- (1) Briefly describe and quantify operation and maintenance efficiency for all of the above mentioned components of the wastewater system as follows:
 - Wastewater effluent quality monitoring
 - Monitoring of industrial wastewater pollutants (reason and frequency of operating problems in the WWTP due to infringement of legal requirements regarding industrial discharge)

⁷ Main deficiency of component (i.e. insufficient capacity, outworn, etc.)

⁸ Short comment on extend of renovation (i.e. full renovation, partly - %, no renovation necessary)

- Describe current procedures with regard to maintenance of equipment, civil structures and network and main consequences on the existing infrastructure (degradation of infrastructure due to inadequate maintenance)
 - Network failures such as sewer overflows, sewer clogging (development during past i.e. 5 years, reasons for failures i.e. incorrect design, construction, damages or insufficient operation)
 - Current treatment performance (reasons for inefficient performance i.e. insufficient operation of air-blowers, etc.)
 - Current procedures in place to improve operating efficiency (i.e. measurement campaigns for sewer infiltration or treatment process optimisation)
- (2) Assess current operation & maintenance costs (energy, chemicals, staff, material) for all components (see table below):

Table: Current Operation & Maintenance Costs Wastewater

Cost Item	Amount [€/year]	% of Total
Energy costs		
Chemicals costs		
Staff costs		
Material costs		
Others ⁹ costs		
TOTAL		100%

- (3) Conclude on key deficiencies with regard to Operation & Maintenance
- Briefly summarise the key deficiencies identified
 - Summarise current operation performance using the following indicator table for efficiency of sewer system

Table: Efficiency of sewerage system

Item* (indicative numbering)	Indicator	Unit
3.9.1	Number of sewer blockages per year	number/year
3.9.2	Number of sewer blockages per km of sewer network per year (3.9.1 / 3.6.1)	number/km/a
3.9.3	Number of days with flooding caused by sewerage system	number
3.9.4	Number of days with flooding caused by sewerage system per km per year (3.9.3 / 3.6.1)	days/km/a
3.9.5	Average electricity consumption per year	kWh/a
3.9.6	Average electricity consumption per volume of wastewater treated (3.9.5./3.7.8)	kWh/m ³

*Note: The indicators mentioned above are a subset of the “Performance Indicators” table in Annex 1. The item numbers in the table above are identical to the item numbers in the table in the Excel sheet version.

- **Make sure that the proposed action plan for the ROC includes measures (sufficient training) to improve operation & maintenance of the assets**

⁹ ie. costs External Services (excavation, construction, etc.)

- Additionally, consider in the procurement strategy outsourcing of operational tasks (including intensive training) as an option (i.e. Design-Built-Operate - DBO contract)

14.1.6.4 Main Deficiencies in Wastewater System

(1) Summarise conclusions in Chapter 2.3.6 and Chapter 2.3.7 as follows:

Table: Main Deficiencies in Wastewater System

Item	Components	Main Deficiencies*
1	Wastewater network	-
2	Wastewater Pumping stations	-
3	Wastewater treatment Plant	-
5	Distribution network	-

**Describe the deficiencies as specific as possible and quantify as far as possible.*

(2) Summarise compliance of current situation with UWWT Directive 91/271 EEC and other relevant environmental directives (i.e. Water Framework Directive).

Note: most of the investments on networks are justified by the obsolescence of the current assets. To avoid similar situations in the future, propose (action plan for ROC) a streamlined maintenance and replacement strategy with dedicated financial resources.

14.1.7 Agglomeration y, z and so on

Prepare sub-chapters as defined in Chapter 45.3.1. above.

(8) INDUSTRIAL WASTEWATER DISCHARGE

Key note: The below requirements are prepared having in view that a Industrial Wastewater Report and Action Plan is a specific output according to the TA contract. We recommend that a separate document should be prepared for this purpose and then include the summary of the Industrial Wastewater Report in the chapter 5 of the FS.

Scope of work as defined in the ToRs:

- Investigate quantity and type, extent of pre-treatment, institutional and legal framework (e.g. what kind of arrangements exists between industries and the city/water company concerning discharge and treatment of industrial wastewater).
- Assess existing wastewater treatment facilities, including sludge handling and disposal: type of process, capacity, flow, technological appropriateness, treatment effectiveness, condition, maintenance practices, suitability, bottlenecks, and quality of materials and equipment.
- Quality standards: analyse compliance with applicable effluent standards and applicable regulations
- Sustainability: what investigations and investments are recommended to ensure the sustainability of the measure in reducing operational costs?
- The Consultant's review of industrial loads and characteristics should include a review of current mechanisms for licensing and enforcing discharge to the sewer network, with a view to managing the risk that future pollution incident damages the new plant, or substances harmful or toxic to the process might be discharged. Consider

compliance with the Integrated Pollution and Prevention Control (IPPC) Directive (96/61/EC) covering pollution from large industrial installations.

- Prepare a report on industrial wastewater discharge and draft an action plan. Acceptable templates for the **report** and the **action plan** are available at MESD.

Note: the industrial wastewater report is a specific output according to the TA contract

The following structure of the report is recommended:

ABSTRACT

Introduction

Objectives

Prepare a report on industrial wastewater discharge and draft an action plan with the following objectives:

- Adequately pre-treat industrial wastewaters in compliance with EC Directives and Romanian legislation and/or recycled as appropriate;
- Pre-treatment to be monitored and enforced by competent environmental authorities;
- Industrial effluent loads not to hamper the designed technology of the WWTPs;
- Introduce appropriate wastewater charges for industries, based on quantity and quality of effluent produced and on cost of treatment.

Legal regulation on Industrial Wastewater

- EU Directives and Romanian laws
- Prevention and control of accidental pollution
- Polluters pays principle
- Restrictions Concerning Wastewater Discharge into Municipal Sewerage Systems

Approach and Methodology

Briefly describe the approach and methodology to carry out the study:

- Inventory of industrial activities (data base with specific data on production and pollution)
- Current performance of ROCs
- Impact of industrial discharge

Investigations of Wastewater Discharges

14.1.8 Inventory of Industries

Table: Existing industrial companies in agglomeration x discharging wastewater into the municipal sewer network

Item	Economic unit/industry	Field of activity

14.1.9 Wastewater Volume and Load

Table: Pollution Load and wastewater characteristic for selected industries

Item	Parameter	Value industry	Value industry y	Value industry z	etc
------	-----------	----------------	------------------	------------------	-----

		x	etc	

14.1.10 Industrial Wastewater Pre-treatment Plants

Prepare list of industries currently endowed with a pre-treatment plant (see table below):

Table: Pre-treatment facilities of the industrial agents

Item	Economic unit/industry	Status	Technical information	Efficiency
1	1 S.C. ROFEP S.A.	functional	mechanical treatment clarifying tanks	Satisfactory
2	S.C. PRIMA COMPANZ S.R.L.	-	Clarifying tanks	Unsatisfactory

Current Performance of Service Operators with regard to Control of Industrial Wastewater Discharge

- Describe performance of service operators with regard to monitoring industrial polluters (monitoring programme in place)
- Monitoring frequency and quality analysis facilities (laboratory, etc.)
- Contracting and billing of industrial agents
- indicate what has been done to identify industrial discharges: agreement signed to buffer the quantity and quality of discharges, monitoring under the control of the ROC of subsequent data, paying particular attention to heavy metals

Impact of Industrial Wastewater Discharges on WWTP Influent and Downstream Users

- Impact of industrial pollution on sewer network and WWTP (impact of missing pre-treatment)
- Impact on downstream users (agricultural users, water intake for DWTP, etc.)
- Impact of industries not yet connected to the sewer system

Proposal for Managing and Monitoring Wastewater discharges

Describe briefly roles of:

- ROC to monitor industrial discharge
- EPA as controlling body
- SGA (“Apele Romane”) as controlling body for WWTP effluents discharge
- EG as responsible body for controlling and inspection, subordinated to the National Authority for Control.

Action Plan to Control Industrial Wastewater Discharges

Elaborate an action plan to reduce/control wastewater discharges, with short and medium term actions and responsibilities. The Short-term Action Plan defines the Goals and Activities to be undertaken, addresses the responsibilities, and sets out the deadlines for its execution during this period.

- Data base elaboration
- Defining the polluting substances and potential
- Initiating the monitoring programme

- Elaborating and implementing a plan for unforeseen (accident) situations

In conclusion, the Short-term Action Plan will focus on creating an effective data collection system and implementing appropriate monitoring programmes. The complexity of the measures needs strong cooperation among all involved authorities.

Conclusions and Recommendations

Conclusions and recommendations with particular focus on:

- Potential impact on downstream users
- Potential impact on WWTPs
- Pre-treatment facilities (existing and required)
- Polluters pay principles

Use the following table to summarise the data for industrial pollution for all ¹⁰agglomerations (current and future¹¹):

Table: Performance Indicators Industrial Pollution

Item* (indicative numbering)	Indicator	Unit	Current	Future
3.5.1	Total number of industrial units in agglomeration	Number		
3.5.2	Percent of industrial units NOT connected to the wastewater system	% of 3.5.1		
3.5.3.1	Number of connected industrial units with pre-treatment facilities	Number		
3.5.3.2	Percent of connected industrial units with pre-treatment (compliant with EC/RO regulations)	% of 3.5.3		
3.5.4.1	Percent of industrial pollution load reduced by pre-treatment (3.5.4./3.4.1.2)	% of 3.4.1.2		
3.5.5	Number of industrial units discharging dangerous substances into the aquatic environment	number		

*Note: The indicators mentioned above are a subset of the “Performance Indicators” table in Annex 1. The item numbers in the table above are identical to the item numbers in the table in the Excel sheet version.

(9) SLUDGE MANAGEMENT

Key note: The below requirements are prepared having in view that a Sludge Management Strategy is a specific output according to the TA contract. We recommend that a separate document should be prepared for this purpose and then include the summary of the Sludge Management Strategy in the chapter 6 of the FS.

Scope of work as defined in the ToR:

- Prepare a specific study on the sludge disposal strategy. This study needs particular emphasis and development in conjunction with the Environmental Impact Assessment study.

¹⁰ Detailed tables for each agglomerations are to be presented in the annex of the FS

¹¹ Indicate year and assumptions for projected future development of industrial pollution

- There are significant costs associated with this aspect. National guidelines for sludge use in agriculture are not yet developed; therefore, adapt European practice to local use.
- Prepare an environmentally sound and sustainable sludge disposal strategy in line with applicable EU directives and in co-ordination with other solid waste projects developed in the area.

NOTES:

- Appropriate Sludge management is an important element of the FS and should not be considered as a “side problem” of wastewater treatment.
- Clear and specific sludge disposal options for each county are important
- Discuss the options with local authorities – urge for decision before the application is submitted; decision must be clearly reflected in the application along with the reasons for the decision (option analysis) and steps/actions to be undertaken during the project implementation (before the WWTP is commissioned); please review the EC letter and the MESD instruction in this regard
- Agricultural reuse of sludge should be the preferred solution (sufficient storage capacity has to be foreseen).

ABSTRACT***Introduction******Objectives******Legislative Framework***

- Legislative transition process (Romanian Laws)
- EU Directive 86/278 EEC and Romanian Minister’s Decree 344/2004
- Parameters subject to the provisions of the Directive
- Revision of EU Directive 86/278 EEC and future aspects (recent research development with regard to dangerous substances in the sludge and measures for prevention)

Approach and Methodology

- Existing sludge management
- Approach and methodology
 - economic, technical, and ecological parameters
 - specific criteria (practicability, flexibility, environmental acceptability, safety and viability, cost efficiency)

Current Sludge Disposal

- Describe current sludge disposal and quantify as far as possible
- Current problems regarding sludge disposal (environment, etc.)

Sludge Volume and Sludge Quality

- Prepare a table with current and projected sludge volume (yearly development) based on generated load for each agglomeration and DS content
- Assess current sludge quality for each WWTP (sludge quality analysis at WWTP as far as possible a series of at least three analyses)
- Assess source of pollution (type of industry discharging particular hazardous substances to the sewer network)
- Comment on development of sludge quality (development of sludge quality if measures proposed in the action plan will be implemented – i.e. disconnection of/pre-treatment for critical industries). Assess the risk for degradation (or non improvement) of sludge quality (i.e. socio-economic consequences if polluter pays principle will be applied for some important industries). For planned WWTPs, assess the potential risk of sludge quality degradation and prepare reasonable assumptions for projection (i.e., classify according to degree of industrialization and if possible type of industries).

Available Capacities for Sludge Disposal

Assess current and future capacities for:

- Municipal landfills:
 - Assess the current and future capacity of landfills taking into consideration the projects for regional landfills currently under preparation (CF-Applications). In particular, pay attention to the requirements of the landfill directive (max. admissible volume of biological waste per year) which will limit the capacity for sludge disposal in the future.
- Re-use in agriculture:
 - Assess current and potential application of sludge on agricultural land depending on surface area of agricultural land suitable for sludge reuse (criteria: types of crops, type of soil, inclination of fields, soil texture, etc.). Data for these parameters are available at the national soil research institute ICPA and its local branches (OSPA);
 - Assess current willingness of farmers to use sludge (of quality compliant with standards) and make assumption for future development of willingness; include in the TA-measures a campaign to improve the willingness of farmers to apply sludge;
 - Assess current (and foreseen) agreements between ROC and farmers (farmers associations) or landfill operators to receive sludge;
 - Based on maximum potential sludge use and assumptions on willingness of farmers, prepare a sound projection for demand of sludge in the future;
- Thermal reduction (incineration/co-incineration):
 - Consider co-incineration (i.e., cement industry) as a potential short-term alternative; a long-term development of sludge incinerators might cover the deficit between total projected sludge volume and projected use for landfills and agriculture.
- Re-use in reforestation (surface of forest suitable for sludge re-use)
- Composting
- Other types of reuse (i.e., use of sludge for land re-cultivation or specific products)

Strategic Sludge Disposal Alternatives

- Assess sludge disposal alternatives above and compare current and future capacities for sludge disposal with the sludge volume and quality produced (current and future development);
- Describe legal constraints for each option and assess environmental and health impact (advantage, disadvantage);
- Options such as recycling and agricultural re-use are encouraged by EC Directive 86/278/EEC (Law no. 426/2001 for approval OUG. no. 78/2000 regarding sludge disposal), but others will need to be studied. The disposal costs define and limit the treatment options that might be developed;
- **Foresee sufficient storage capacity** (in case of agricultural use for 6 months storage period). Indicate the estimated dewatering performance;
- **Make sure that there is no odour nuisance due to sludge disposal (sufficient distance to settlements);**
- **Compare option analysis considering the following methodology:**
 - Compare NPV for different options retained (i.e. landfill and agricultural reuse)
 - Select the most cost effective solution (least cost option)
 - Prepare action plan to assure viability of selected measure (i.e. if agricultural reuse is the most cost effective solution, measures such as (i) disconnect/pre-treat industrial polluters (ii) campaign to increase willingness of farmers to receive sludge, etc.)
 - Full justification is necessary if another option (not the least-cost option) is selected (i.e. socio-economic and political constraints are too high to implement stringent measures – i.e. disconnect).

Sludge Disposal Costs

Assess current and future costs (yearly development of costs for each agglomeration) for sludge dumping and sludge transport for the selected sludge disposal alternatives and relevant combinations of it (sludge scenarios).

Proposed Sludge Disposal Strategy

Evaluate sludge disposal alternatives based on the following criteria (or similar ones):

- Practicability
- Environmental impact acceptable
- Clear regulations and control mechanisms implemented?
- Acceptable from potential users
- Costs
- Tendency in other European countries

Make sure that, before tendering of works, a final decision on the selected sludge disposal alternatives is taken as the investment costs (storage capacity will be needed in case of landfill solution only) and operation & maintenance costs will strongly depend on the selected alternative (agricultural reuse in many cases will have lower operation costs for the ROC compared to landfill alternative (high transport costs and disposal costs).

Conclusions and Recommendations

Conclusions and recommendations based on the results of the Chapters above. The summary should briefly present the proposed sludge management concept and should focus on:

- Sludge disposal alternatives
- Quantities and ratios for each of the proposed alternatives
- Costs for sludge disposal

Summarise the result of the sludge disposal strategy (present details for each agglomeration in the annex) based on the following indicators¹² (current and projection of future development¹³):

Table: Performance Indicators Sludge Management

Item * (indicative numbering)	Indicator	Unit	Current	Future
3.8.2	Sludge volume	tons/a		
3.8.3.1	Dry solids content	%		
3.8.3.2	Total number of parameters NOT-compliant with RO/EC regulations	number		
3.8.4	Sludge disposal and reuse			
3.8.4.1	Sludge reuse in Agriculture	tons/a		
3.8.4.2	Sludge reuse in Reforestation	tons/a		
3.8.4.3	Sludge composting	tons/a		
3.8.4.4	Sludge disposal at sanitary landfill	tons/a		
3.8.4.5	Sludge Incineration	tons/a		
3.8.4.6	Others (please specify)	tons/a		
3.8.4.7	Sludge reuse in Agriculture	% of 3.8.2		
3.8.4.8	Sludge reuse in Reforestation	% of 3.8.2		
3.8.4.9	Sludge composting	% of 3.8.2		
3.8.4.10	Sludge disposal at sanitary landfill	% of 3.8.2		
3.8.4.11	Sludge Incineration	% of 3.8.2		
3.8.4.12	Others (please specify)	% of 3.8.2		
3.8.6	Sludge storage capacity in months (i.p. for agricultural reuse)	months		
3.8.7	Total volume of sludge end-disposed in compliance with EU directives	m ³ /day		

(10) DESIGN PARAMETERS

Prepare the design parameters for preparing the FS for the following sub-sections:

Note: Justify any deviation from the assumptions and standards above, by providing sufficient data and agreeing with MESD prior to developing further steps of the FS.

Population growth

Data base: National statistic institute, projection of the population of Romania on averages until 2025 issued in 2005; county official statistics.

¹² And/or graphs based on these data

¹³ Iterative estimation of situation after project implementation based on estimated wastewater flow and design of WWTP

Water Supply

Prepare basic design parameters for the planning horizon of the MP, taking into account the transition periods agreed for compliance with the relevant EU Directives and the population size of the concerned localities.

14.1.11 Domestic Water Demand

Base for flow calculation is the revised Romanian standard STAS 1343-1/2006.

- Specific water consumption,
 - House Connection: 110 litres/capita/day
 - Yard connection: 80 litres/capita/day
 - Public tap supplies: 50 litres/capita/day
- Variation coefficients to be applied based on STAS 1343-1/2006
 - Daily variation coefficient (average value) – $K_{day} = 1.25$
 - Daily variation coefficient (average value) – $K_{hour} = 1.40$

Assumption:

- Current specific consumptions of domestic water will be reduced / increased to the levels above after introducing water metering and cost covering tariffs
- Consumption elasticity rate to be considered

14.1.12 Non-domestic Water Demand

Determine specific flow and variation coefficient based on specific data on type of industry/commercial/institutional entity:

- Specific flow – according to the specific type of industry;
- Daily variation coefficient – according to the working days per week;
- Hourly variation coefficient – according to the working hours per day.

Assumption:

- Reduce demand for small scale livestock and garden irrigation to a minimum (replaced by local water sources if available) after introducing water metering and cost covering tariffs.

Present in a table the proposed values for the target years with sound justifications. Pay particular attention to the robustness of the assumptions for water demand (current and future levels, both domestic and non-domestic).

14.1.13 Hydro-geological Data:

When there are available geological surveys, use them to determine the main parameters of the ground water intakes. If surveys are not available, collect data related to existing wells in the area or carry out measurements and investigations.

14.1.14 Water Quality and Treatment:

The quality of drinking water for human consumption is defined by the Drinking Water Law 458/2002, amended by Law no. 34/2005. Collect sufficient water quality data to conclude on current compliance with the EC DWD 98/83/EC and the respective Romanian laws. If there are no sufficient data, carry out a quality analysis campaign. In particular, compliance with the parameters in the accession treaty should be ensured.

Present in the annex the design parameters for each treatment step (pre-oxidation, coagulation and flocculation, sedimentation, filtration, post-oxidation adsorption, and final disinfection). When designing a Treatment Plant, consider:

➤ **Precautions for sludge from Treatment Process (environmental impact)**

- For the sustainability of the plant, ensure that the ROC has enough capacity and know-how for operating the plants (avoid complex treatment plants for small agglomerations, ensure that the ROC is sufficiently supported in the first years of operation of the system (i.e. DBO contracts, sufficient technical assistance, contractor's training).

14.1.15 Transmission Mains:

Present the design criteria used for dimensioning the transmission main:

- Optimise the pipe diameter with regard to investment and operation costs.
- Design flow is the maximum daily flow.

Recommended pipe material (to be agreed with the operator):

- For smaller diameters (i.e. up to DN 500 mm), select HDPE or protected steel pipes as preferred materials
- For larger diameters (above DN 500 mm), select GRP or Ductile Iron as preferred materials

14.1.16 Pumping stations and reservoirs:

Present the key design criteria used for dimensioning the pumping stations:

- Foresee enough standby capacity
- Automatic steering of pumps in the SCADA system should allow for continuous monitoring of water quantity data and energy data
- Give high priority to reducing energy (high efficiency pumps, pressure losses, etc.) and maintenance costs when selecting the design parameter. Select high efficiency pumps
- Consider frequency converters for pump operation in cases of flow and/or pressure fluctuations
- Provide enough reservoir capacity to ensure supply security (depending on risk of accidental pollution of water).

14.1.17 Distribution Network:

Present the key design criteria used for dimensioning the network:

- Maximum velocity
- Design flow is the maximum hourly flow
- Agree with operator on preferred material for smaller diameters (HDPE) and for larger diameters (protected steel or Ductile Iron or GRP).

Wastewater

14.1.18 Wastewater collection system

Present the key design criteria used to dimension the sewer network:

- The design flow of the sewerage network is $Q_{u,h,max}$, the maximum hourly flow
- Interconnections between the rain-water and sewer networks
- New sewer networks should be designed as separate system
- If the network is too long, with intermediary pumping stations, provide information on the risk of H_2S creation and the possible subsequent corrective measures taken (oxygen injection), in particular, when the material of the pipe is vulnerable to such risk
- The preferred pipe material smaller diameter (below 600 mm) is HDPE/PP and GRP or concrete for large diameters
- The minimum diameter for sewers in a separate system is 250 mm
- Admissible velocities in the sewers: $0.7 \div 3$ m/s; if the minimum admissible value of 0.7 m/s (self-cleaning rate) cannot be reached due to the low flows in some sectors, manholes should be cleaned in the respective sectors of the sewer
- Inspection manholes should be built every 60 m according to Romanian standards
- Admissible minimum invert slopes: 0.5%

14.1.19 Wastewater Treatment

The treated wastewater should comply with the Romanian standard NTPA 001 – 011, which transposes the Urban Wastewater Treatment Directive 91/271/EEC.

Table: Treated wastewater quality according to NTPA 001-011.

Parameter	Concentration	Minimum percentage of reduction (%)
Biochemical oxygen demand (BOD_5 at $20^\circ C$), without nitrification	25 mg O_2/dm^3	70 – 90 40 in special condition
Chemical oxygen demand (COD)	125 mg O_2/dm^3	75
Total suspended solids	35 mg/ dm^3 (more than 10,000 p.e.) 60 (2,000 – 10,000 p.e.)	90 (more than 10,000 p.e.) 70 (2,000 – 10,000 p.e.)
Total Phosphorus	2 mg / dm^3 (10,000 – 100,000 p.e.) 1 mg / dm^3 (more than 100,000 p.e., or sensitive area)	80
Total Nitrogen	15 mg/ dm^3 (10,000 – 100,000p.e.) 10 (more than 100,000 p.e., or sensitive area)	70 - 80

The treatment complies with the Romanian standards for WWTPs (NP 032-1999), biological treatment (NP 088-03), advanced treatment (NP 107-04), and sludge treatment. Describe the type of WWTP (treatment technology) depending on the biological and hydraulic loads.

14.1.20 Sludge digestion and disposal

- Present design criteria for sludge digestion and disposal.

(11) OPTION ANALYSIS

The option analysis in the feasibility study should be based on the general strategic options prepared in the MP. The option analysis compares alternative solutions to ensure that the most cost-effective solution is chosen.

- Start by reviewing the strategic options at the County level prepared in the MP.
Option analysis is closely related to the definition of agglomerations. Review the

borders for the priority agglomerations and define them in more detail based on the option analysis at the feasibility stage.

- Develop general options (different technological options) applicable for all agglomerations;
- Finally, for each agglomeration, prepare an option analysis by (1) screening the options and (2) conducting a detailed evaluation of the retained options;
- Justify the selected option with a detailed financial and economic assessment.

Note:

- *Differentiate between options required at MP level (county strategic related) and options required at FS level (compare relevant technical options, compare investment and operational costs etc.)*
- *Ensure consistency with options presented in the CBA document.*

Abstract

Water Supply Options

14.1.21 Strategic Options and definition of agglomeration borders

Summarise the strategic options presented in the MP:

- Use the abstracts of each chapter focusing on aggregated tables for the options analysed at the MP level;
- Revise the strategic options for the selected priority agglomerations based on new information available;
- Define in more detail the borders of agglomerations based on a more detailed assessment (define in detail which parts of the settlement areas are to be connected to the water supply network);
- Present on an overview map the strategic options (i.e. centralized versus decentralized option)
- Present map with revised/confirmed borders of agglomerations taking into consideration the results of the option analysis for each agglomeration (i.e. centralized versus decentralized option).

14.1.22 General Options

Briefly assess general options valid for all agglomerations (if any) such as:

- Technological process for water treatment
- Comparison of different materials , if considered relevant

14.1.23 Options Agglomeration x

(1) Identified Options

- General Supply Options (based on general assessment at MP stage)

Example:

- *Option 1: Ground water source*
- *Option 2: Surface Water source*

- *Option 3: River bed filtration and groundwater recharge (mix between ground water and surface water)*
- *Option 4: Transport of water from agglomeration xxx*

➤ **Specific Technical Options**

For specific system components (water abstraction, water treatment, water distribution) identify relevant technical options:

Example:

- *Horizontal well versus well field with vertical wells*
- *Depth of wells (hydro geological layer)*
- *Floating intake versus fix intake for surface water abstraction*
- *Location of water abstraction*
- *Submersible pumps versus horizontal pumps*
- *Rehabilitation versus construction of new abstraction facilities*
- *Etc.*

(2) **Description of options**

Briefly describe each of the identified options and present the following information:

- Summary of base data (i.e. water quality, hydro-geology)
- Refer to unit cost data in the annex (unit investment, unit operation & maintenance costs)
- Cost estimation (investment and operation costs)
- Main characteristic of option

(3) **Screening of options**

- Screening of options (first step for elimination of non-feasible option)
- Compare advantages and disadvantages of options (as in the example table below)

Example of Option Screening

Existing assets	Description of key deficiencies	Identification of options	First screening	Justifications for selection
WTP for surface water (Standard Process: coagulation/flocculation, sedimentation, filtration, disinfection)	- Water quality does not meet EU directive - WTP built in 1960 - Old electromechanical installations - All structures need significant improvement - Capacity of WTP is above water demand - Poor automation and control - Poor chemical handling: (storage, preparation, dosage, etc.) - Poor safety standard by handling of chemicals - sludge treatment is not performed	1)- Use other water source (ground water, lakes, other river, etc.)	rejected	- <u>Advantages</u>: xxxxxxxx - <u>Disadvantages</u>: xxxxxx - <u>Justification</u> for selection
		2)- Connect to other water producer	rejected	- <u>Advantages</u>: xxxxxxxx - <u>Disadvantages</u>: xxxxxx - <u>Justification</u> for selection: xxxxx
		3)- Rehabilitate existing WTP	retained	- <u>Advantages</u>: xxxxxxxx - <u>Disadvantages</u>: xxxxxx - <u>Justification</u> for selection
		4)- Construct new WTP	retained	- <u>Advantages</u>: xxxxxxxx - <u>Disadvantages</u>: xxxxxx - <u>Justification</u> for selection: xxxxx

(4) **Detailed evaluation of options**

For the retained options, prepare a more detailed assessment with regard to:

- technical advantages and disadvantages
- investment cost breakdown (detailed cost calculations to be presented in the annex)
- operation cost calculation (detailed cost calculations to be presented in the annex)

Present maps and sketches to support understanding of the options.

(5) Financial and economic evaluation

For the retained options, prepare a financial evaluation that will calculate Financial Net Present Value (for different quantities) of O&M and investment costs.

Assumptions (please check also a more detailed table in the CBA guidelines, for various components, in line with legal requirements):

- Proposed discount rate: 5%
- Reinvestment for equipment: after 15 years
- Reinvestment for network: after 40 years
- Reinvestment for civil structures: 30 years

Prepare an economic evaluation that will take into account externalities for a particular option (ENPV):

- Health impact
- Development effects
- Resource effects (land use, effects on value of real estate)
- Job effects
- Environmental effects

If monetizing externalities (ENPV) is not possible, assess if there is a significant difference of externalities for the considered options (qualitative assessment).

(6) Selected option

Compare the retained options based on the results of the FNPV for investment and operation costs. Externalities and technical arguments (supply security, etc.) may also be used to justify the selected option.

14.1.24 Options Agglomeration y

Prepare option analysis for all agglomerations as defined in the Chapter above.

Wastewater Options

Prepare an option analysis similar to the one presented in previous Chapter for Water Supply.

Specific examples for wastewater are given below:

14.1.25 Strategic Options and definition of agglomeration borders

- Define in more detail the borders of agglomerations based on a more detailed assessment (define in detail which parts of the settlements areas are to be connected to the sewer network and which parts will remain outside of the agglomeration for individual treatment systems).

- Use the abstracts of each chapter focusing on aggregated tables for the options analysed at the MP level
- Revise the strategic options for the selected priority agglomerations if new information is available;
- Define in more detail the borders of agglomerations based on a more detailed assessment (define in detail which parts of the settlements areas are to be connected to the sewer network and which parts will remain outside of the agglomeration for individual treatment systems).
- Present on an overview map the strategic options (i.e. centralized versus decentralized option)
- Present map with revised/confirmed borders of agglomerations taking into consideration the results of option analysis for each agglomeration (i.e. centralized versus decentralized option).

14.1.26 General Options

14.1.27 Options Agglomeration x

(1) Identified Options

➤ General Options

Based on general assessment at MP stage, confirm or revise the initial option preparing a more detailed technical and economic assessment of the following options:

1. *Centralised wastewater system (one treatment plant for “cluster” agglomerations)*
2. *Decentralised wastewater system (one treatment plant for each agglomeration)*
3. *In exceptional cases for insufficiently concentrated areas within an agglomeration: individual and other appropriate treatment (septic tanks, etc.) according to Chapter 2.3 of “Definitions of the Urban Wastewater Treatment Directive 91/271/EEC” might be considered.*

Note: for a defined agglomeration, to comply with the UWWTD, at least 90 % should be connected to a sewer network, the remaining max. 10 % might be served with individual and appropriate systems (i.e. septic tanks).

Note: in case of increasing demand (if additional supply capacity is required), compare increase of supply capacity with alternative options to reduce water losses or to interconnect with other water supply systems.

The result of the option analysis is a confirmation/revision of “cluster” agglomerate borders showing whether interconnection with a trunk sewer and treatment in one wastewater treatment plant (WWTP) is the most favourable solution¹⁴ or if individual wastewater treatment plants are more cost effective.

Base (but not limit to) the detailed technical and economical assessment on the following criteria:

- (i) Topographic features (altitude, distance between agglomerations)
- (ii) Size of agglomerations
- (iii) Existing trunk sewers and WWTPs

¹⁴ Economies of scale

- (iv) Investment costs for trunk sewers and treatment plants
- (v) Operation costs for trunk sewers and treatment plants
- (vi) Available land for WWTPs and trunk sewers

➤ Examples of specific technical options for wastewater:

- *Combined sewer network versus separated sewer network*
- *Relining (trenchless systems) versus conventional sewer pipe laying (trenching)*
- *(Partly) Rehabilitation of WWTP versus new WWTP*
- *Type of WWTP (technological process)*
- *In-situ construction or prefabricated (compact) WWTPs*
- *Comparison of different pipe materials (Concrete/PVC/GRP/PE/PP)*
- *Different locations and discharge points for WWTPs*
- *Sludge dewatering (centralised dewatering, decentralised, mobile dewatering units)*
- *Deep sewer trenches and low number of pumping stations versus shallow sewer trenches and high number of pumping stations*
- *Pressure mains versus gravity sewers*
- *Etc.*

(2) Description of options

(3) Screening of options

Example for Screening of Options

<i>Existing assets</i>	<i>Description of key Deficiencies</i>	<i>Identification of options</i>	<i>First screening</i>	<i>Justifications for selection</i>
WWTP with x p.e.	- Effluent quality does not meet requirements of UWWTD - outworn electromechanical installations (all structures need significant improvement) - Insufficient Capacity of WWTP - Poor automation and control - Poor chemical handling: (storage, preparation, dosage, etc.) - Poor safety standard by handling of chemicals - sludge treatment is not performed	1)- Construction of new WWTP for all agglomerations (cluster)	retained	- <u>Advantages:</u> xxxxxxxx - <u>Disadvantages:</u> xxxxx - <u>Justification</u> for selection
		2)- Construction of x individual WWTPs for each agglomeration	retained	- <u>Advantages:</u> xxxxxxxx - <u>Disadvantages:</u> xxxxx - <u>Justification</u> for selection: xxxx
		3)- Rehabilitation of existing WWTP for larger agglomeration and construction of new individual WWTPs for small agglomerations	rejected	- <u>Advantages:</u> xxxxxxxx - <u>Disadvantages:</u> xxxxx - <u>Justification</u> for selection

(4) Detailed evaluation of options

(5) Financial and economic evaluation

(6) Selected option

14.1.28 Options Agglomeration y

Prepare option analysis for all agglomerations as defined in the Chapter above.

Summary of Option Analysis

Summarise the options developed in Chapter 9.2 above for all water supply and wastewater agglomerations.

- Technical comparison of options
- Financial and economic evaluation
- Selected option

(12) PROJECT PRESENTATION

Present the investment project by describing

- Overall characteristics, justifications, and impact of the project;
- Investment measures including a justification for each investment measure;
- Technical assistance measures proposed to accompany the investment measures
- Cost breakdown of all investments
- Operation and maintenance costs before and after project implementation
- Unit costs in an aggregated form as a result of investment costs and quantities of implemented infrastructure.

Abstract

Overall Project Presentation

Present the overall project summarizing

- Main characteristics of investments
- Main justifications
- Investment strategy
- Main impact of investment measures.

A breakdown of investments per agglomerations and per contracts should be provided.

The rationale to group the investments should be adequately explained in the FS.

The investments should be presented for each agglomeration with respect to the following requirements.

14.1.29 Water Supply

Summarise the investment measures proposed for improving the water supply system:

- Main characteristics of investment components applying the following structure:
 - water abstraction
 - pumping stations
 - water treatment
 - water mains
 - distribution network
- Quantities of infrastructure components proposed (output indicators)
- Main justification for each investment component (i.e. water losses, number of pipe failures, condition of pipes, etc.); quantify as far as possible relating the key deficiencies identified in previous Chapters to the proposed investment measures.
- Describing the technical features (of the selected option) with sufficient detail (refer to more detailed presentations in the annex)

With the view to present and justify the investments, the following recommendations/indications should be taken into account.

Water Abstraction

Indicate preventive measures to:

- Track and reduce polluting sources (Technical Assistance for Project Management should include assistance to the Beneficiary in implementing an action plan for protecting water sources). The action plan will:
 - Prepare a programme for permanently monitoring the raw water quality,
 - Implement a sound information system on possible pollution sources,
 - Improve the contact with the Water Administration (Apele Romane) incorporating the water monitoring system of Apele Romane to be continuously informed about water quality upstream.
- Guarantee security of supply in case of accidental pollution (security storage capacity, upstream warning system, interconnection, ...). In particular, in case of vulnerable resources (river intakes).

Pumping Stations

- Proposed measures should take into account increased efficiency of the PS.

Water Treatment Plants

- Describe the proposed sludge discharge/disposal of backwash water from Drinking Water Treatment Plants (untreated discharge to receiving water or any other environmentally harmful solution is not permitted).

Water Transmission Mains

- Proposed measures should be adequately justified in terms of key priority, cost-efficiency and insufficiency of water for the project area or non-compliant water quality (if so, which parameters are not compliant?)
- Any investment which is not sufficiently justified will be not eligible for SOP financing.

Water Distribution Network

Note:

- Priority should be given to *extension* of networks to ensure full compliance with the Directive and Accession Treaty in the selected agglomerations (full coverage population and quality water requirements)
- *Rehabilitation* of networks should be based on a critical assessment of the existing infrastructure and prioritisation of needs; the amount of proposed rehabilitation should have in view the critical priorities needed to ensure an optimal operation of the system.
- For rehabilitating the distribution network:
 - provide information on the metering measures supporting the identification of main leakages
 - indicate the outputs expected in terms of reducing the losses' rate on the network
 - indicate the measures to be taken by the operator to detect more “diffuse” leakages and keep a reasonable performance in this respect. If needed, foresee the necessary equipment in the application (metering, SCADA, acoustic detection material, etc.).

- if no investments for replacing the pipe network are proposed to reduce water losses (i.e. low priority in the MP), give high priority to water loss reduction in the Action Plan for ROC and foresee enough leak detection equipment in the project to assure that the ROC will be able to reduce water losses to an acceptable level (i.e. 20 – 30 %) after completing the subject CF investments.
- Provide indicators on the efficiency of the proposed rehabilitation measures (investment measures in € per quantity of water losses reduced => see unit cost table in annex 3). This should provide the Managing Authority with some benchmark to assess the opportunity of the beneficiary's request. If the indicator shows high unit costs for rehabilitating the network (i.e. because water losses are already at a relatively low level, and further reduction of losses through pipe replacement may not be cost efficient), one should consider that the investment is not financially opportune or that leakage's reduction is an operational issue, under the responsibility of the operator.
- Recommend measures for water loss reduction (active leakage control, pressure management, etc.) to continuously improve water losses in the network after project implementation
- Define realistic water loss target after CF-project implementation and continuous reduction of water losses)

SCADA System

14.1.30 Wastewater

Summarise the investment measures proposed to improve the wastewater system:

- Main characteristics of investment components using the following structure:
 - Wastewater network,
 - Wastewater pumping stations
 - Wastewater treatment plant
 - Sludge treatment
- Quantities of infrastructure components proposed (output indicators)
- Main justification for each investment component (i.e. water losses, number of pipe failures, condition of pipes, etc.); quantify as far as possible relating the key deficiencies identified in previous Chapters to the proposed investment measures.
- Describing the technical features (of the selected option) with sufficient detail (refer to more detailed presentations in the annex)

With the view to present and justify the investments, the following recommendations/indications should be taken into account.

Wastewater Network

- Give priority to *extension* of networks to ensure full compliance with the Directive in the selected agglomerations (minimum 90% wastewater collection coverage)
- *Rehabilitation* of networks should be based on a critical assessment of the existing infrastructure and prioritisation of needs; the amount of proposed rehabilitation should have in view the critical priorities needed to be addressed in order to ensure adequate design and operation of the WWTP.

Wastewater Pumping Stations

- Proposed measures should take into account increased efficiency of the PS.

Wastewater Treatment Plants

- Ensure measures to ensure full compliance with the WWTD and Accession Treaty; the level of compliance needed for each selected agglomeration should be checked.
- Coherence with other programmes should be checked and describe in the FS (e.g. if extension of networks are proposed for SOP financing and WWTP is foreseen in a parallel programme, the FS should address the coherence of the 2 investments; in particular, the design and the level of compliance of the WWTPs prepared within other programmes should be checked)
- Describe clearly what is foreseen for grit and grease generated by the WWTP (washing of sand, grease recycling etc.) and how *sludge from sewer cleaning is treated*.
- *Review the requirements for sludge management and ensure adequate justification and description of sludge treatment facilities as part of the SOP project.*

Sludge Management

- *Include investment measures necessary to assure proper sludge management (i.e. storage facilities in case of agricultural reuse of sludge)*

14.1.31 Investment Strategy

Describe the proposed investment strategy for improving the water supply system:

- Reference to priorities for implementing investment components. Coordination of proposed measures. Provide an overview of all investment components (summary list of aggregated investment components).
- Reference to implementation strategy (i.e. combine water and wastewater network construction to avoid double trenching)
- General time frame for implementation (key milestones)
- Main difficulties and constraints expected during implementation of the water system (i.e. capacity of the operator, etc.)
- Particularly highlight important implementation risks and propose mitigation measures – e.g. refer to adequate implementation capacity, TA needs, land availability, complementary measures needed, political support for the project etc.

Note: confirm land availability at feasibility stage.

Expected Impact of the project and Performance Indicators

Present the main impact of the investment measures as follows:

- Describe the main result of the investments and quantify as far as possible by using relevant performance indicators for the proposed measures (i.e., increase of connection rate, reduction of infiltration, population benefiting from the measure, etc.)
- Present the expected improvements after implementing the selected investment components with the performance indicators in the next table below (before and after project implementation):
- Describe the contribution of the measures to the Targets in the Accession Treaty (Percentage for intermediate targets).

Note: Do not mix Country targets with county targets (i.e. it is not acceptable that only 60 % will be connected in an agglomeration referring to the intermediate targets in the Accession Treaty).

A series of indicative tables for the presentation of the project performance and impact, in line with EC requirements for 2007 projects, is presented below:

Table: Performance Indicator Water Supply

Item (Indicative numbering)	Indicator	Unit	Before Project	After Project
2.1.1.	Total population in service area concerned (water supply zone)	capita*		
2.1.2	Service Coverage: Percent of population connected to water supply system (2.1.3/2.1.1)	% of 2.1.1		
2.3.6	Specific domestic water consumptions	lcd		
2.4.14	Population served per length of water supply network (distribution network + water mains)	capita/km		
2.4.15	Production capacity installed (minimum capacity of wells, pumping stations, WTP)	1000 m ³ /d		
2.4.7	Length of transmission mains	km		
2.4.8	Percent of transmission mains rehabilitated	% of 2.4.7		
2.4.10	Length of distribution network	km		
2.4.11	Percent of distribution network rehabilitated	% of 2.4.10		
2.5.1	Total non-revenue water (IWA standard: Total system input - total water sold)	m ³ /d		
2.5.2	Percent of non-revenue water (2.5.1/2.2.1)	% of 2.2.1		
2.5.4	Percent of real water losses (physical losses) in the network (excluding technical losses in the WTP)	%		
2.5.5	Real water losses per number of connections (at average system pressure of 30 -40 m)	liters/con/day		
2.7.1	Average electricity consumption (treatment plant + pumping stations)	1000 kWh/a		
2.7.2	Average electricity consumption (treatment plant + pumping stations) per volume of water produced (per 100 m of pressure)	kWh/m ³		
2.8.4	Metering level (2.8.1. Total number of connections with water meter / 2.4.19 Total number of water service connections)	% of 2.4.19		

*Note: the indicators mentioned above are a subset of the "Performance Indicators" table in Annex 1.

- Present the estimated impact of each investment measure aiming at cost reduction on operation costs (i.e., energy savings through replacement of pumps and other electro-mechanical equipment or reduction of network losses) on energy costs. Do not consider additional costs due to improvement of the level of service (i.e., increase of quantity of water supplied to customers or increase of network pressure) in the following tables.

As an Example, the impact of water supply network renovation on water losses is in the table below. Similar tables should present the impact of other investment measures on efficiency improvement (i.e. renovation of pumps on electricity consumptions).

Example table: Impact of Pipe Renovation on Reduction of Real Water Losses

Material of Pipes / Zones	L* [km]	Real Losses before rehabilitation			L [km]	Real Losses after rehabilitation			Reduction of water losses	
		Yearly Water losses [m³/year]	% of total network length	Yearly Water Losses per length of network [m³/km*y]		Yearly Water losses [m³/year]	% of total network length	Yearly Water Losses per length of network [m³/km*y]	Yearly Water losses [m³/year]	[%]
Renovated Pipes					81.5	252,863	6	3 103	-252,863	
AC old	120	14,536,606	95	121,138	38.5	3,469,397	87	90 114	11,067,208	76
- High zone	65	10,075,000	66	155,000	0.0	0	0	155 000	10,075,000	
- Middle zone	55	4,956,282	32	90,114	38.5	3,469,397	87	90 114	1,486,885	
Other material	30	270,408	2	9,014	30	270,408	7	9 014	0	0
- High zone	2	30,000	0.2	15,000	2	30,000	1	15 000	0	
- Middle zone	28	240,408	2	8,586	28	240,408	6	8 586	0	
Total	150	15,301,690	100	102,011	150	3,992,668	100%	26 618	11,309,022	74

L= Length of water supply network

- Summarise the impact of investment measures on electricity costs as given in the table below:

Indicative Table: Impact of each investment measure on energy costs - Water Supply

Investment measure	Energy costs before project [€/year]	Energy costs after project [€/year]	Energy savings [€/year]	% Reduction
Replacement of pumps in agglom. Xx				
Replacement of xx km of network				
Etc.				
TOTAL				

- Summarise the impact of all investment measures on operation & maintenance costs in the table below.

Table: Impact of all investment measures ¹⁵on Operation & Maintenance Costs Water Supply

Cost Item	Amount before project [€/year]	Amount after project [€/year]	Savings [€/year]	% Reduction
Energy				
Chemicals				
Staff				
Material				
Others ¹⁶				
TOTAL				

Table: Performance Indicators for Wastewater (WW)

¹⁵ Impact of all investment measures aiming at efficiency improvement

¹⁶ ie. costs of External Services (excavation, construction, etc.)

Item * (Indicative numbering)	Indicator	Unit	Before Project	After Project
3.4.4	Total generated load in agglomeration	P.E.		
3.4.6	Connection rate of generated load: connected load to collection system / total generated load (UWWTD Art.2(5))	% of 3.4.4		
3.2.1.8	Sewer Infiltration rate: Volume of infiltration water into the wastewater network / total wastewater volume collected	% of 3.2.1		
3.4.1	Total Biological load (BOD5)	kg BOD/d		
3.6.1	Total length of wastewater network (incl. stormwater & main collectors)	km		
3.6.5.2	Percent of wastewater network rehabilitated	%		
3.6.8	Population served per length of wastewater network	capita/km		
3.7.7	Capacity of WWTPs in population equivalent (p.e.)	p.e.		
3.7.8.10	Volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC Article 4 (5)	m ³ /d		
3.7.8.11	Percent of volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC Article 4 (5)	% of 3.2.1		
3.9.5	Average electricity consumption per year	kWh/a		
3.9.6	Average electricity consumption per volume of wastewater treated	kWh/m ³		

*Note: The indicators mentioned above are a subset of the "Performance Indicators" table in Annex 1.

- Present the estimated impact of each investment measure aiming at reducing operation costs (i.e., energy savings through replacement of pumps and other electro-mechanical equipment). Do not consider additional costs due to improving the level of service (i.e., improvement of effluent quality) in the following table.

Table: Impact of each investment measures on Energy Costs - Wastewater

Investment measure	Energy costs before project [€/year]	Energy costs after project [€/year]	Energy savings [€/year]	% Reduction
Replacement of pumps in agglom. Xx				
Replacement of xx km of sewer network				
Etc.				
TOTAL				

- Summarise the impact of all investment measures on operation & maintenance costs in the table below.

Table: Impact of all investment measures ¹⁷on Operation & Maintenance Costs Wastewater

Cost Item	Cost before project [€/year]	Cost after project [€/year]	Savings [€/year]	% Reduction
Energy				
Chemicals				
Staff				
Material				

¹⁷ Impact of all investment measures aiming at efficiency improvement

Cost Item	Cost before project [€/year]	Cost after project [€/year]	Savings [€/year]	% Reduction
Others ¹⁸				
TOTAL				

A more detailed table for performance indicators of all agglomerations is in Annex 1.

Technical Assistance

Technical Assistance should help implement the project by putting in place a reliable system and effectively improving the water service. The Technical Assistance will focus on:

- Project Management
- Works Supervision.

Based on the identified risks and needs assessment, the proposed SOP project may include Technical Assistance to ensure an efficient implementation of the proposed works and sustainability of the programme.

A proposed Technical Assistance for **Project Management** may include:

- Support the Beneficiary in Project Implementation, Reporting and Publicity
- Support the Beneficiary in documenting the waster supply networks and in developing hydraulic network models and carrying out calibration measurements (with the view to ensure sustainability of the proposed measures and to prepare a second phase investment as needed)
- Develop sewer network models including the survey of all existing manholes, the preparation of digital record, impermeability surveys, flow measurements with associated rainfall measurements, CCTV inspection, model development and its verification(with the view to ensure sustainability of the proposed measures and to prepare a second phase investment as needed)
- Support the Beneficiary in equipment procurement
- Training in new technologies, equipment, and instruments.

A proposed TA for **Construction Supervision** may also be included in the SOP project. The related TA will be responsible for managing and supervising the works contracts and in general will fulfil all duties of the Engineer as similarly defined in the FIDIC Yellow and Red Book Conditions of Contract for Construction.

Estimated Project Costs

14.1.32 Investment costs

The scope of work is defined in the ToR:

- Provide in annexes detailed construction cost estimates (in EUR) for the proposed project components. Cost estimates should be sufficiently detailed, subdivided into logical project elements, and supported by assumptions and bases for figures in adequate details to permit detailed analysis. The estimates and any revisions thereon should be dated, and should show local and foreign costs, local duties and taxes,

¹⁸ ie. costs for External Services (excavation, construction, etc.)

design, supervision, legal and administration costs associated with the projects, consultant's fees and allowances for prices increases and contingencies.

- Provide an estimated schedule of expenditures, by year, for each project. Dates of expenditures should be the dates payments are due. Subdivide the schedule to show requirements for the major parts of the projects and coordinate with the estimated construction schedule.

Summarise investment costs based on the templates in Annex 2 – to be provided.

Prepare a detailed investment cost breakdown for each agglomeration separated in the main project components. Complete and attach to the FS the template for investment cost breakdown (see template in Excel in Annex 2, separate document to be submitted to MESD).

14.1.33 Operation and Maintenance Costs

Present Operation & Maintenance (O&M) costs considering the following aspects:

- Give details on the cost of and operation and maintenance (O&M) and operator management
- Give details on the expected variation of O&M costs in the future
- Consider the cost calculation below as the basis for calculations in the Financial and Economic Sections of the FS

Operation and Maintenance Costs for Water Supply System

- Provide O&M cost calculation before and after¹⁹ project implementation, and at the end of the planning horizon (clearly explain assumptions for development) for each agglomeration and a summary table for all agglomerations,

Indicative presentation of the O&M costs is presented in the template below:

Table: Operation & Maintenance Costs for Water supply – Agglomeration x²⁰

Cost Item	Before Project	After Project	End of Planning Period	Comments
Energy				
Chemicals				
Staff				
Material				
Others				
TOTAL				

Constant Prices in EURO cost base 2008

Provide more detailed cost calculation for each cost component (i.e. water abstraction, water treatment plant, water mains, pumping main, distribution system) in the annex.

¹⁹ i.e. in the year 2013

²⁰ Prepare one table for each agglomeration and a summary table aggregating data of all agglomerations

Operation and Maintenance Costs for Wastewater System

- Provide O&M cost calculation before and after²¹ project implementation as well as at the end of the planning horizon (clearly explain assumptions for development) for each agglomeration and prepare a summary table for all agglomerations.

Indicative presentation of the O&M costs for wastewater system is presented in the template below:

Table: Operation & Maintenance Costs for Wastewater – Agglomeration x²²

Cost Item	Before Project	After Project	End of Planning Period	Comments
Energy costs				
Chemicals costs				
Staff costs				
Material costs				
Others costs				
TOTAL				

Constant Prices in EURO cost base 2008

Provide more detailed cost calculations in the annex (i.e. split in cost components: WWTP, sludge management, main collector, pumping stations, wastewater network).

Summary of Operation and Maintenance Costs

Provide a summary table for Operation and Maintenance Costs for water and wastewater (aggregated for all agglomerations). Present more detailed data in the annex.

The table below separates change of O&M costs (before and after project) into two components: (i) due to efficiency improvement (i.e. reduction of specific energy costs) and (ii) increase of O&M costs due to increase of service level (increase of supply, increase of pressure, etc.).

Table: Operation & Maintenance Cost – separation of change of O&M costs

Cost Item	Water Supply	Wastewater	Total
Total O&M costs before Project			
Total O&M costs after Project			
Difference in O&M costs between before and after Project			
O&M cost decrease due to efficiency improvement			
O&M cost increase due to increase of service level			
TOTAL			

Constant Prices in EURO cost base 2008

14.1.34 Aggregated Unit Costs

²¹ i.e. in the year 2013

²² Prepare for each agglomeration

Based on the results of cost estimates in the chapters above,

- Prepare a table with specific costs to provide a benchmark for the investment components proposed;
- Compare data between all agglomerations and comment on major deviations of unit costs and compare data with international benchmarking data;
- Present summary table for unit investment costs at county level (minimum, maximum, average of all agglomerations for selected indicators);
- Complete the summary table below in the attached Excel sheet (see Annex 3) and submit to MESD in Excel format.

Table A: Unit Investment Costs

Item *	Indicator	Unit	Unit costs per agglomeration		
			x	y	Average ²³
1.	Unit Investment Costs Water Supply				
1.1	Total per capita investment costs water supply	€ / capita			
1.2	Investment costs per capacity of water treatment plants installed	€ / capita			
1.3.	Investment costs per length of distribution network	€ / km			
1.4	Investment Costs for wastewater pumping stations per capacity installed	€/ (l/s)			
2	Unit Investment Costs Wastewater				
2.1.	Total investment costs wastewater system per P.E. in agglomeration	€ / P.E.			
2.2.	Investment costs for WWTP per P.E.	€ / P.E.			
2.3.	Investment costs per length of sewer network	€ / km			
2.4	Investment costs for wastewater pumping stations per capacity installed	€/ (l/s)			

Table B: Unit Operation & Maintenance (O&M) Costs

Item *	Indicator	Unit	Unit costs per agglomeration		
			x	y	Average
1.	Unit Operation & Maintenance (O&M) Water Supply				
1.1	Yearly O&M costs water supply systems per capita	€ / capita.			
1.2	Yearly O&M costs water treatment plants per capacity installed	€ / (l/s)			
1.3.	Yearly Operation & Maintenance costs per length of water supply network	€ / km			
1.4	Yearly O&M costs per capacity of water pumping station installed	€/kW			
2	Unit Operation & Maintenance (O&M) Costs Wastewater				
2.1.	Yearly O&M costs wastewater systems per P.E.	€ / P.E.			
2.2.	Yearly O&M costs wastewater treatment plant per P.E. excl.	€ / P.E.			

²³ weighted average of all agglomerations in the county if applicable (meaningful)

Item *	Indicator	Unit	Unit costs per agglomeration		
			x	y	Average
	sludge management				
2.3.	Yearly O&M costs per length of sewer network	€/ km			
2.4	Yearly O&M costs wastewater pumping stations per capacity installed	€/ kW			

(13) RESULTS OF FINANCIAL AND ECONOMIC ANALYSIS

TO BE ADDED – A SUMMARY TO PRESENT MAIN RESULTS OF THE CBA (PREPARED AS A SEPARATE SUPPORTING DOCUMENT)

Maximum number of pages: 20

(14) RESULTS OF INSTITUTIONAL ANALYSIS

TO BE ADDED - A SUMMARY TO PRESENT MAIN RESULTS OF THE INSTITUTIONAL ANALYSIS (PREPARED AS A SEPARATE SUPPORTING DOCUMENT)

Maximum number of pages: 20

(15) RESULTS OF ENVIRONMENTAL IMPACT ASSESSMENT

TO BE ADDED - A SUMMARY TO PRESENT MAIN RESULTS OF THE EIA (PREPARED AS A SEPARATE SUPPORTING DOCUMENT)

Maximum number of pages: 20

(16) PROCUREMENT STRATEGY AND IMPLEMENTATION PLAN

Scope of work as defined in the ToR:

- Recommend (based on a thorough risk assessment) the most appropriate conditions of contract and consequent tendering/contracting approach for each works contract. The Managing Authority will decide, in consultation with relevant partners based on the Consultant's proposal.
- Prepare the procurement strategy and implementation plan after the design, cost, scope of work, and objectives of each project have been clearly defined in the earlier phases of the assignment and after the project has received favourable opinion by the competent authorities.
- Draw up a procurement plan ensuring that the project is implemented in the fastest and most efficient manner. Both open and restricted tender procedures are acceptable; recommend an optimal procedure for the circumstances of the project and agree with relevant stakeholders.

Abstract

Introduction

14.1.35 General

14.1.36 Definitions

Define the most important terms such as:

- Implementation plan
- Procurement plan
- Procurement strategy
- Etc.

14.1.37 Legislation

Refer to the procurement rules applicable to Cohesion Funds. In particular, consider the new public procurement law: “Government Emergency Ordinance GEO no.34/2006” for preparing the procurement strategy.

14.1.38 Procurement Process

Summarise the procurement process defined in the Romanian legislation and list the steps and time constraints defined in the “Guidelines for application of Romanian Procurement Law”:

- Develop annual program of public procurement
- Issue award / selection documentation
- Contract finalization – final taking-over

Procurement Strategy

14.1.39 Criteria for Grouping of Tenders

Define the criteria to group the tenders considering:

- Nature of procurement- i.e. whether for services, works or supplies;
- Value - i.e. whether open or restricted and if local or international.

For the planned scope of works, use the following types of *works contracts*:

- “Design - Build” to rehabilitate existing water and wastewater treatment plants;
- “Construction” to rehabilitate and extend existing water distribution and sewerage systems.
- The size and number of works contracts will determine the potentially interested bidders. In principle, larger value tenders should result in lower prices due to economies of scale and reduced costs. If, for some reason, smaller contract packages (and large number of contracts) are considered as the most favourable option, measures should be foreseen in the procurement process to avoid excessively high bidding prices (i.e., ensure that there is enough competition in place).
- To ensure that contractors can offer all the requirements, it is necessary to divide the works into lots, or packages, containing similar kinds of works or supplies, as the case may be, which can be more easily provided by companies specialising in such packages.
- It is necessary to do this carefully, on a case by case basis, taking into account also the market conditions for the works concerned, the limitations of contractors, the

geographical aspects of the project, capacity of supervision & monitoring and the management capacity of the ROC.

- **Note: design the procurement strategy in light of the expected market reply: as far as possible, group simple and identical contracts (i.e., network extension / rehabilitations) to foster competition (and avoid local agreements).**

14.1.40 Potential of National Construction Companies

- Assess the experience, general capacity and available capacity of local construction companies during the foreseen implementation period.
- Use the amount of similar works (i.e., relevant for network construction) performed during previous years as an indicator of the general capacity of local construction companies. The second criterion is the financial capacity of construction companies in Romania (estimate the number of companies and their capacity which would meet i.e. minimum turnover criteria).
- Further, use the interest of construction companies to participate in similar tenders and/or other criteria to assess the potential of national construction companies and their interest to participate in the subject tender procedures.

14.1.41 Proposed Procurement Strategy

Based on the criteria above for grouping projects and the potential of construction companies, propose a strategy for:

- Procurement procedures (to be agreed with MESD – i.e. open tendering or restricted tendering)
- Size/value and number of contracts
- Standard conditions of contract (CHECK with MESD applicable conditions of Contract)
- Type of Contract ((i) Plant & Design-Build Type; (ii) construction type; (iii) supply contracts; and (iv) service contracts Technical Assistance contracts)
- Sequence and timing for implementation (minimum timing for each step as defined in the procurement law depending on type of contract and works, proposed timing considering the overall implementation strategy and justification for selected timing)

Proposed Tenders

List all contracts including the following minimum information:

- Contract code name
- Short description
- Condition of contract (i.e., design and build book)
- Type of contract (i.e., works contract, service contract)
- Tendering procedure (i.e., international open)
- Works to be performed (i.e., WWTP)
- Location of work (i.e., agglomeration xx)
- Proposed separation in Lots
- Estimated Contract Value of works

Proposed Procurement and Implementation Plan

Prepare:

- Overall procurement plan for all contracts

- Specific and detailed procurement plan for each contract
- Overall implementation schedule for all contracts
- Specific and detailed implementation schedule for each contract
- Summary milestone table

The procurement plan should include:

- Contract code/name
- Date of Procurement Information Notice (PIN)
- Date of submission of tender documents by Consultants to MESD
- Approval of tender documents by MESD and ROC
- Date of contract participation notice
- Preparation of proposals by selected bidders
- Evaluation of proposals
- Approval of evaluation report by MESD and ROC
- Notification of award
- Contract signature

The implementation schedule should include:

- Contract/activity name
- Duration of task
- Start date
- End date
- Gantt chart with duration of activities

The milestone table should include:

- Contract/activity name
- Start date
- End date

Documents required for project implementation

- Prepare a list of permits or authorizations required for project implementation before starting construction.
- Indicate which permits are already available and at which implementation stage other documents shall be provided.
- Copies of available documents are to be presented in an Annex to the FS.

Assumptions and Risks

Describe all assumptions related to the implementation of contracts and the risks that may affect the successful execution of the project, such as:

- Availability of funding
- Difficulties due to lack of cooperation
- Late commencement of the works contract due to difficulties in tendering and selecting contractors

Conclusions and Recommendations

Summarise the chapters above and present a table including:

- Contract code/name,
 - Type of contract
 - Short description of works
 - Estimated Contract Value
 - Provisional date of Tender Launch
- 

VOLUME II: ANNEXES THE FS – TO BE COMPLETED

For easy reference, please check also the Required Documents According to Romanian Standard

1. Base Data

Population, Urban Development Study, etc.

2. Water Supply System

- 3.1 Hydro-geological Investigations and Water Quality Analysis
- 3.2 Unit Cost Data Base (detailed unit costs as basis for investment cost calculation)
- 3.3 Design Standards
- 3.4 Flow Measurements
- 3.5 Calculations and Design Requirements
 - 3.5.1 *Water Abstraction*
 - 3.5.2 *Pumping Stations*
 - 3.5.3 *Water Treatment Plants*
 - 3.5.4 *Water Transmission Mains*
 - 3.5.5 *Water Distribution Network*
 - 3.5.6 *SCADA System*
- 3.6 Option Analysis

3. Wastewater System

- 4.1 Geo-technical and Hydrological Investigations
- 4.2 Unit Cost Data Base (detailed unit costs as basis for investment cost calculation)
- 4.3 Design Standards
- 4.4 Flow Measurements
- 4.5 Calculations and Design Requirements
 - 4.5.1 *Wastewater Network*
 - 4.5.2 *Wastewater Pumping Stations*
 - 4.5.3 *Wastewater Treatment Plants*
- 4.6 Option Analysis

4. Technical Assistance

5. Detailed Investment Cost Breakdown

- 6.1. Assumptions for calculation of Investment Costs
- 6.2. Benchmark Unit ²⁴Investment cost table (as presented in Annex 3-Table 1 of the Guidance document)
- 6.3. Template as presented in Annex 2 of this Guidance document
- 6.4. Other investment cost break-downs (as required by the Romanian standards for preparation of FS)

6. Operation and Maintenance Costs

- 7.1. Assumptions for calculation of Operation & Maintenance Costs
- 7.2. Benchmark Unit ²⁵ Operation & Maintenance Costs (template presented in Annex 3-Table 2 of this Guidance document)
- 7.3. Detailed Calculation of Operation & Maintenance Costs (in compliance with the summary tables presented in the guidance text - i.e. Chapter 8.2.2.)

²⁴ Specific costs to benchmark the investment costs

²⁵ Specific costs to benchmark the operation & maintenance costs

7. Performance Indicators

Templates presented

8. Industrial Wastewater Discharge**9. Sludge disposal strategy****10. Institutional Analysis****11. Procurement Strategy and Implementation Plan****VOLUME III: DRAWINGS****VOLUME IV: FINANCIAL AND ECONOMIC ANALYSIS - COST BENEFIT ANALYSIS (CBA)**

Present entire Cost Benefit Analysis (CBA Report) in a separate volume

VOLUME V: ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Present entire Environmental Impact Assessment Report (EIA Report) in a separate volume

B3: Guidance for Cost Benefit Analysis

ROMANIA –GUIDELINES FOR COST BENEFIT ANALYSIS OF WATER AND WASTEWATER PROJECTS SUPPORTED BY THE COHESION FUND AND THE EUROPEAN REGIONAL DEVELOPMENT FUND IN 2007- 2013

15 1. Introduction

The Council Regulation (EC) 1083/2006 of 11 July 2006 lays down the general provision ruling programmes and projects financed by the European Regional Development Fund (ERDF), the Cohesion Fund (CF) and the European Social Fund (ESF).

In particular, as indicated in Art. 40 (e) of the Regulation, major projects seeking financial support from the Cohesion Fund (CF) and the European Regional Development Fund (ERDF) require the preparation of a Cost-Benefit Analysis (CBA) as part of the applications:

“Article 40. - The Member State or the managing authority shall provide the Commission with the following information on major projects:

[...]

(e) a cost-benefit analysis, including a risk assessment and the foreseeable impact on the sector concerned and on the socio-economic situation of the Member State and/or the region and, when possible and where appropriate, of other regions of the Community;”

At the same time, the Regulation required the European Commission to develop indicative guidance regarding the methodology to perform CBA.

For the programming period 2007-2013, the Commission has provided a set of working rules to promote consistency in the CBA for CF and ERDF applications (see Working Document 4: Guidance on the methodology for carrying out Cost-Benefit Analysis²⁶, from now on the WD4). The general methodological framework to carry out CBA in the context of EC Funding is provided in the Guide to Cost-Benefit Analysis of Investment Projects²⁷, a manual published by the Commission in 2002 which has been recently updated.

The WD4 provides for generic guidance, and recommends the Member States to produce more detailed CBA guidelines, with the goal to ensure consistency across projects presented for financing in the various sectors, and ‘*taking account of specific institutional settings, particularly for the transport and environment sectors.*’

In line with the above regulations, Romanian Government Ordinance HG nr. 28 of 9th January 2008 “on the methodological rules for elaboration and approval of technical and economic documentation for investment projects” requires CBA as part of the technical-economic documentation related to public investments. More specifically, HG 28/2008 requires the following steps to be performed and presented as part of the documentation of the proposed investment:

1. investment identification and definition of objectives, including specification of reference period;
2. option analysis;
3. financial analysis, including the calculation of financial performance indicators: cumulated cash - flow, NPV, Financial Rate of Return (FRR) and B/C;

²⁶ Available at http://ec.europa.eu/regional_policy/sources/docoffic/2007/working/wd4_cost_en.pdf

²⁷ Available at http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide02_en.pdf

4. economic analysis, including the calculation of economic performance indicators: NPV, Economic Rate of Return (ERR) and B/C;
5. sensitivity analysis
6. risk analysis

The Government of Romania, in response to this, has asked Jaspers to support the development of national CBA guidelines, which, once finalised, will be applied consistently in project preparation. The Authority for Coordination of Structural Instruments (ACIS) of the Ministry of Economy and Finance has been entrusted with the coordination of this task, as well as with the provision of expert support to JASPERS.

Given the number of sectors involved and the fact that the existing EU Guide to Cost-Benefit Analysis has been revised in June 2008²⁸, it has been agreed that the methodological framework will take the form of a modular set of documents and spreadsheets that could be eventually updated on a case by case basis as required, without having to update the whole framework.

It is also envisaged that rather than a exhaustive set of detailed documents and spreadsheets to cover all possible circumstances for the individual projects, the methodological framework will provide the guidance that will make it possible for the consultants working on the different projects to adapt the provided documents and spreadsheets to their needs but always in compliance with the EU regulations and requirements.

These national CBA Guidelines build on the following framework:

- Romanian legislation comprising provisions related to the cost benefit – analysis (in particular, the government decision HG28/2008 on the methodological rules for elaboration and approval of technical and economic documentation for investment projects)
- the national programming documents for the implementation of actions to be co-financed by structural instruments (ERDF and CF), namely the National Strategic Reference Framework (NSRF) and the relevant Sectoral Operational Programmes (SOPs);
- the relevant EC regulations and guidelines,
- statistics, forecasts and other documents that may provide information to be considered for the development of suitable methodological framework to carry out the CBA.

The National CBA Guidelines are organised as follows:

- a General Guidance document, describing the rationale and objectives pursued in performing CBA, as well as a general methodological approach to be followed across all sectors.
- specific Sectoral Guidelines, describing in detail how the CBA will have to be performed for projects in the following sectors:
 - o Water and wastewater
 - o Solid Waste
 - o Transport
 - o Energy

16 2. Rationale and Objectives of the Guidelines

2.1 Rationale of these Guidelines

The present document refers to **Sectoral Guidelines for Water and Wastewater projects**, and has been prepared in the general context of the water management projects included in the Action Plans between JASPERS and the beneficiary Member States. The intention was to close the gaps between the existing guidance and the specifics of the projects in the sector, with focus on the information and outputs required in the major project applications.

To that extent, while consistent with the general CBA framework mentioned above, the document is based on the experience of project appraisal for the first round of water/wastewater projects applications assessed during 2007, and the early part of 2008. It reflects the intense discussion with MESD and its consultants on the practical details of CBA analysis, as well as the detailed guidance and clarifications received from the Romanian Desk and the Evaluation Unit in DG REGIO.

²⁸ Now available at http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide2008_en.pdf

2.2 What is CBA and why to perform it

CBA is an analytical tool which is used to estimate the socio-economic impact (in term of benefits and costs) related to the implementation of certain policy actions and/or projects. The impact must be assessed against predetermined objectives and the analysis is usually made from the point of view of the society as whole, intended as the sum of all individuals concerned. Typically, CBA analysis works with national boundaries so that the word “society” usually refers to the sum of the individuals in a nation state.

The objective of CBA is to identify and monetise (i.e. attach a monetary value to) all possible impacts of the action or project under scrutiny, in order to determine the related costs and benefits. In principle, all impacts should be assessed: financial, economic, social, environmental, etc. Traditionally, costs and benefits are evaluated by considering the difference between a scenario with the project and an alternative scenario without the project (the so called “incremental approach”).

Then the results are aggregated to identify net benefits and to draw conclusions on whether the project is desirable and worth implementing. To that extent, the CBA could be used as a decision-making tool for assessing investment to be financed by public resources.

The term CBA within these guidelines and according to EU requirements encompasses both the financial and economic analysis of the project. More specifically, within the framework of preparation and appraisal of CF and ERDF project, the European Commission requires a CBA to:

(1) *To assess whether a project is **worth** co-financing.*

The goal is to answer to the questions: does it contribute to the goals of EU regional policy? Does it foster growth and boost employment? In simple words, if the net benefits for the society (benefits minus costs) of the project are positive, then society is better off with the project because its benefits exceed its costs. The project should therefore receive the assistance of the Funds and be co-financed. If not, it should be rejected. This assessment is performed using an **Economic Analysis**.

(2) *To assess whether a project **needs** co-financing.*

Besides being desirable from an *economic* standpoint a project may also be financially profitable without EU assistance, in which case it would not be co-financed by the Funds.

To check if a project *should* be co-financed requires a **Financial Analysis**: if the financial value of the investment (project revenues minus project costs) without the contribution of the Funds is negative, then the project can be co-financed. In this case, the EU grant should not exceed the amount of money that makes the project break even, so that no over financing occurs.

The CBA is therefore needed to provide evidence that, while fitting within the framework of EU regional policy objectives, the project is both desirable from an economic point of view and needs the contribution of the Funds for it to be financially feasible.

Projects in the environment sector result in economic benefits like the “improvement of quality of life” or the “improvement in ambient quality”, which are difficult to quantify in monetary terms. For this reason, it is anticipated that CBA for this type of projects is especially challenging and the problem becomes more evident during the calculation of the project’s Economic Net Present Value (ENPV) or the Economic Rate of Return (ERR).

2.3 When to perform a CBA

When submitting an application for funding under the CF and ERDF funds, information on the results of CBA is required only for Major Projects, which are defined as operations accomplishing a precise and indivisible task whose total costs is in excess of:

- EUR 25 million for environmental projects
- EUR 50 million for all other fields.

To that extent a full CBA (comprising both a Financial and an Economic Analysis along with a risk assessment) is compulsory only for Major Projects.

However, for smaller projects which are not subject to a preventive appraisal and approval by the European Commission, the relevant Managing Authority could decide to include a requirement for results of CBA to be assessed as part of the selection criteria. In those cases, the methodology described by these Guidelines, or a simplified version of it, will apply.

Details of the methodology to be followed for smaller projects will be discussed with the Managing Authority and will be reflected in relevant calls for proposal and applicant's guides.

17 3. General methodological approach

3.1 Steps to be performed within the CBA

The proposed sequence for the CBA in the framework of project preparation, which is consistent with the recommendations of the European Commission, is the following²⁹:

- Strategic approach and definition of objectives
- Identification and selection of the most suitable alternative (in most cases, deriving from the master plan and the feasibility study)
- Financial Analysis
- Economic Analysis
- Risk and Sensitivity analysis
- Reporting conclusions

Most, if not all of the inputs for the definition of project objectives, the identification of alternatives and even the selection of the most suitable alternative will come from other parts of the project feasibility studies, and more specifically from the analysis of the project's technical, environmental and institutional feasibility. For these sections, what is expected in the CBA is a summary and a presentation of those findings in a rational and consistent way.

The following sections provide the general recommendations on the actions to be taken when performing each of the steps mentioned above.

3.2 Strategic approach and definition of objectives

The basic strategic documents for the implementation of actions to be co-financed by the CF and ERDF are the National Strategic Reference Framework (NSRF) and the relevant Sectoral Operational Programmes (SOPs)

As any other Member State, Romania has prepared a National Strategic Reference Framework (NSRF), coherent with the Community Strategic Guidelines on Cohesion³⁰, which gives the strategic dimension to the Funds in line with the priorities of the Union. The NSRF is the document that defines the strategy chosen by Romania to contribute to achieving those priorities, and lists the SOPs that it endeavor to implement.

The SOPs present the priorities of the Member State (and/or regions) as well as the way in which it will lead its programming³¹. Each SOP summarises the overall objectives and targets sought at a sectoral level, as well as identifies the priority areas of interventions (priority axes), which, in turn, lists specific objectives.

Table 1 summarises the objectives of SOP Environment³² agreed with the European Commission, while table 2 provide the details on the objectives of Priority Axis 1, under which water and wastewater projects have to be submitted.

Table 1: Objectives SOP Environment

Priority Axis 1	Improve the quality and access to water and wastewater infrastructure, by providing water supply and wastewater services in most urban areas by 2015 and by setting efficient regional water and wastewater management structures;
Priority Axis 2	Develop sustainable waste management systems, by improving waste management and reducing the number of historically contaminated sites in a minimum of 30 counties by 2015
Priority Axis 3	Reduce the negative environmental impact and mitigate the climate change caused by urban heating plants in most polluted localities by 2015.
Priority Axis 4	Protect and improve the biodiversity and natural heritage by supporting the

²⁹ The concept of CBA here has been expanded from the traditional economic analysis to the wider concept used in the relevant EU regulations and related guidance documents.

³⁰ Available at http://ec.europa.eu/regional_policy/sources/docoffic/2007/osc/index_en.htm.

³¹ Please see http://ec.europa.eu/regional_policy/atlas2007/romania/index_en.htm for links to the approved NSRF and summaries for the SOPs.

³² Available at http://www.mmediu.ro/integrare/comp1/POSmediu/POS_Mediu_EN.pdf

	protected areas management, including Natura 2000 implementation.
Priority Axis 5	Reduce the incidence of natural disasters affecting the population, by implementing preventive measures in most vulnerable areas by 2015.

Table 2: Specific objectives Priority Axis 1 – SOP Environment

Objective 1	Provide adequate water and sewerage services, at accessible tariffs
Objective 2	Provide adequate drinking water quality in all urban agglomerations
Objective 3	Improve the purity of watercourses
Objective 4	Improve of the level of WWTP sludge management
Objective 5	Create innovative and efficient water management structures

The objectives of the proposed actions and projects have to be defined in a manner consistent with the overall objectives and priority axes of the SOP, including defining the extent the propose projects will contribute to achieving the results the SOP is aimed at.

To that extent, as much as possible, reference shall be made to the set of indicator included in SOP Environment for priority Axis 1. A detailed list of indicators will be provided by Managing Authority.

To provide a concrete example, the general objective of a project in the field of water management will typically be defined along the lines of the example in Table 3.

Table 3: Example of definition of the project's general objective

General Objective: to develop a sustainable water and wastewater system in the county of [...] by improving the quality of the existing services and reducing the negative impact of wastewater discharges in line with EU practices and policies and in the context of the Priority Axis 1 of the SOP Environment.

Having defined the general objective, the specific objectives of the project will be formulated in a manner consistent with the specific objectives of the referred Priority Axis (see Table 4):

Table 4: Example of definition of the project's specific objectives

Specific Objective	Values without project (*)	Expected value after completion
1. Increase in coverage of water and sewerage services	[Percentage of population in beneficiary county, and localities connected to the water supply system and to the sewerage system],	[Percentage of population in beneficiary county, and localities connected to the water supply system and to the sewerage system],
2. Improvement of quality of drinking water in order to meet the standards in the EU Drinking Water Directive 98/83/EC	[indication of compliance with required quality standards in term of number of urban agglomerations] and/or [percentage of population covered by complaint water supply]	[indication of compliance with required quality standards in term of number of urban agglomerations] and/or [percentage of population covered by complaint water supply]
3. Increase of the coverage of wastewater treatment, with standards in accordance to Urban Wastewater Treatment Directive 91/271/EEC	[Number of agglomerations in the beneficiary county with population above 100,000 p.e. between 10,000 and 100,000, p.e. between 2,000 and 10,000 and below 2,000 p.e. with adequate treatment]	[Number of agglomerations in the beneficiary county with population above 100,000 p.e. between 10,000 and 100,000, p.e. between 2,000 and 10,000 and below 2,000 p.e. with adequate treatment]
4. Establishment of efficient operators and associated structures (i.e.: Regional Operating Companies and Associations of Municipalities)	[number of ROC/IDA with adequate institutional setting and capacity for the sustainable operation of the water and wastewater system]	[number of ROC/IDA with adequate institutional setting and capacity for the sustainable operation of the water and wastewater system]

(*) Refers not to the current situation but to the projected situation at the date of the foreseen completion of the project if the project is not implemented (business as usual)

It is recommended that each proposed project will carefully present both its overall and specific objectives according to the example developed above.

3.3 Option Analysis and selection of the most suitable option

The presentation of a project proposal for co-financing from the CF and ERDF requires performing a full feasibility study to justify that the project is a well thought series of works, activities and services aimed at the achieving the objectives mentioned above. The results of the feasibility studies need to be presented as

part of the Application for Major Investment Projects according to the requirement of Art. 40(c) of Regulation 1083/2006, as well as of HG 28/2008.

Typical feasibility studies for Major Projects will include information on the economic and institutional context, forecasted demand and/or utilisation (either market or non-market), flows and loads for the wastewater, available technology, the production plan (including the utilisation rate of the infrastructure), personnel requirements, the scale of the project, its location, physical inputs, timing and implementation, phases of expansion, financial planning, environmental aspects. In many cases, detailed support studies are also needed (engineering, marketing, etc.).

While all the studies above are not formally part of the CBA, the results of feasibility studies are the basis upon which the CBA shall be performed.

In particular, as indicated in the WD 4:

“Evidence should be provided that the selected project is the most suitable alternative between the options considered. This information should typically be found in the results of the feasibility studies that have to be presented to the Commission under Art.40(c).”

The identification of options will normally start at the level of a Master Plan or equivalent planning document, which should provide the general context in terms of, inter alia, specific problems in the existing infrastructure in term of adequacy to serve the projected demand in compliance with the relevant standards, socio-economic conditions in the project area, main technological options and indicative costing.

It is expected that the Master Plan will identify a long term investment plan for the area under consideration, as well as a priority short term investment plan to achieve the objectives highlighted in the section above.³³ As a result of the Master Plan analysis, a list of selected alternatives, divided according to each agglomeration under consideration, will be retained for further assessment in the feasibility level.

Please note that HG 28/2008 requires that at least three options are taken into account: a zero option (without investment), a maximum investment option and a minimum investment option. It is anticipated that more investment options can be considered in the analysis, depending on the characteristics of the project.

Selection of options will focus on the different alternatives to achieve the specific objectives (and standards after completion) of the project. This is typically done within the framework of the technical feasibility study and, if properly done in the first place, there is no reason to duplicate it just for the purposes of the CBA.

At feasibility study level, it is expected that the selection of the option to be retained for the subsequent steps will be performed according to the following:

- 1) check all identified alternative strategic options, based on the identified problems and technological options to be included in the project to achieve the intended objectives; the process of defining and screening of the possible options for each agglomeration or group of agglomerations should consider different technological options balancing advantages and disadvantages of the options analyzed, etc. In most of the cases this level of option analysis can be considered as sufficient. The analysis of options should be carried out in separate for water and wastewater systems, plants and networks (i.e. different locations for the plants, rehabilitation of plant components vs. demolishing and new construction, re-lining against replacement, sludge final destination, etc). It has to be noted that purely "technical" option analysis, such as material for pipe, process for WWTP would not be sufficient to provide the strategic assessment required.

³³ *The preferred long term investment programme shall be divided into subcomponents in a manner that allows a prioritisation based on available funding. For example, treatment capacity may be possible to divide into phases if the treatment plant is of a sufficient size to make this viable and if the expected demand projections show that full capacity will not be required for some time.*

The identification and grouping of the short term investments is a pragmatic exercise, taking into account:

- *A logical sequence for implementation of components (i.e. treatment capacity must be available for new connections);*
- *The expected maximum programme size as a function of the availability of funds, taking into account macroaffordability constraints; and*
- *The need to balance investments in new capacity with a wish to see greater coverage.*

- 2) screen the identified list against eventual qualitative criteria (to be established in light of overall policy orientations and/or technical considerations – this needs to be agreed with the MESD) with the aim of eliminating unsuitable options. This should be duly justified in the analysis and applied consistently across projects. The result of the screening process is a short list of suitable alternatives which will be then subject to cost effectiveness analysis (see step below);
- 3) proceed to assess retained suitable alternatives in term of their cost effectiveness by:
 - i) quantifying overall investment costs, as well as operating and maintenance costs related to each retained alternative³⁴. All costs will be estimated on an annual basis, in real terms, for a period covering the economic life of the project facilities (hereafter the “reference period”).
 - ii) Subtracting (i) any revenues obtained from the sale of sub-product generated during the operation of the facilities, like compost or electricity in the case of wastewater treatment plants; and (ii) the residual value of the different facilities at the end of the reference period.
 - iii) Ranking the options using an established least cost methodology.
- 4) assess if the alternatives differs in term of possible external impacts to society that are not captured by the least cost analysis (e.g., disruption of urban traffic when rehabilitating networks, impact of choice of location and number of wastewater treatment plants, etc.)
 - i) if the overall impact expected from each of the considered alternatives can be justified as being similar, then retain the least cost option as the preferred one.
 - ii) if differences in term of external impact are identified across alternatives, adjust the least cost analysis to incorporate the identified externalities (this will require monetising the external impact) in order to establish a final ranking that takes into account those externalities.

The option analysis performed according to the steps detailed above it is expected to identify the alternative that achieves the intended objectives at the minimum overall cost to society and that will be assessed in the framework of the CBA.

3.4 Financial Analysis

17.1.1 3.4.1 Objectives and scope of the analysis

The purpose of the financial analysis is to assess the financial performance of the proposed action and/or project over the period under consideration, with the view to establish the extent of financial self-sufficiency and long term sustainability of the proposed project, its financial performance indicators, as well as the justification for the amount of EU assistance being sought.

More specifically, the financial analysis has to cover the following steps: (i) estimate the project revenues and costs and their implications in terms of cash-flow; (ii) to determine the funding gap of the selected option and subsequently calculate the eligible expenditure that can be co-financed by the Funds (iii) define the project financing structure and its financial profitability; (iv) verify the sufficiency of the projected cash flow to ensure the adequate operation of the project and meet all investment and debt service obligations;

17.1.2 3.4.2 Calculation of financial flows

The analysis is typically made up of a series of tables that collect the financial flows of the project, broken down as total investment, operating costs and revenues, sources of financing and cash flow analysis for financial sustainability.

Water and wastewater projects will typically fall within the boundaries of an existing infrastructure, where a clear cut separation of the revenues and costs directly generated by the project might be problematic. To overcome this difficulty, the recommended methodology is the discounted cash flow analysis (DCF)³⁵,

³⁴ This needs to cover at least the following items:

- a. Land property costs, like in the case of purchase, expropriations and/or compensation paid for changes in land use.
- b. Design and construction costs for the different facilities.
- c. Purchase cost of equipment to operate the different facilities, with the corresponding replacement cost if applicable when its economic life is lower than the reference period.
- d. Operation and maintenance cost for the different facilities involved in the alternative, including the cost of the final disposal of sub-products, like sludge from wastewater treatment plants.
- e. Costs associated to the measures to mitigate the environmental impact of the project, which are normally proposed as part of the project's Environmental Impact Assessment.

³⁵ The DFC method has the following features:

which uses an incremental method that compares a scenario with the project with an alternative scenario without project.

The incremental method is applied as follows:

1. Projections are produced of the overall operation's cash-flows (in term of expected revenues and costs, as well as other investments planned or needed in any case, for each year of operation) in absence of the proposed project (*without project scenario*). When the proposed project is entirely new, the without project scenario is a scenario of "no operations".
2. Similar projections of the operation's cash-flows are produced taking into account the proposed projects and its impact in term of operations (*with project scenario*). The project promoter shall take into account the whole investment plan, account for changes in O&M costs; adjusts tariffs (if relevant), taking into account affordability of services.
3. A cash flow for the investment is the difference between the cash flows in the "with project scenario" and the "without project scenario". In case the proposed project is entirely new, the with-project scenario is the basis for the incremental cash-flow.

The result of the process above is the "incremental" impact of the proposed projects in term of a financial cash-flows statement for all years of operation.

In light of the methodology used, particular care shall be used in the definition of the without and with project scenario. For each scenario, key assumptions shall be made regarding:

Service performance indicators: service area and population served, demand development by category of customers, connection rates, metering rate, specific water consumption by category of customers, physical losses and infiltration to the sewerage network.

Operation and maintenance costs: projections of O&M costs split in fixed and variable costs, and by category. They also include, whenever applicable, savings generated by the project.

Clear assumptions shall also be made on financial performance indicators and tariff evolutions (on the latter, see section 3.4.5 below).

It is anticipated that the without scenario will have to be one of efficient operations, based on a realistic estimate of the continuation of the status quo. To that extent, it could cover some minor necessary investments, if estimated as needed anyhow, duly justified in the analysis and financed by the operator, but not to a level comparable to the ones envisaged in the with project scenario³⁶.

All the assumptions mentioned above shall be clearly defined in a tabular format as an annex to the final CBA report, specifying the situation in the with and without scenario.

The beneficiaries are also requested to present a summary of the underlying assumptions for unitary investments and operating costs as used in the financial analysis following the format attached in Annex 1. This shall include details on the specific cost savings that the project will allow to achieve³⁷.

-
- Only cash flows are considered; i.e. the actual amount of cash being paid out or received by the project. Non-cash accounting items like depreciation and contingency reserves must not be included. Cash flows must be considered in the year in which they occur and over a given reference period
 - When adding or deducting cash flows occurring in different years, the time value of money has to be considered using a predetermined discount rate.

³⁶ If the without scenario involve penalties for non compliance with prevalent legislative requirements, the level of those penalties needs to be based on the current level of penalties imposed by the relevant authorities, and projected according realistic and well defined assumptions.

³⁷ One way to calculate OM&A cost savings of individual project measures is by comparing the OM&A cost of two scenarios:

- with-project scenario as proposed in the application
- alternative (even if purely hypothetical) scenario, in which all project measures BUT the analyzed measure(s) are implemented (i.e. the with-project scenario without the analyzed measure).

In the alternative scenario, all model variables not directly affected by the measure remain as in the with-project scenario (i.e. connection rates, specific water demand, etc.). The difference in term of costs between these two scenarios is an estimate of the cost savings directly linked to the individual project measure.

This assumptions need to be equivalent to those used in the feasibility studies to estimate the investment and operating cost of the proposed priority investment.

Please note that failure to duly present, as an annex of CBA reports and in the required format, the assumptions used for the financial analysis can result in delays in project approval and, ultimately, in the rejection of the Proposal.

17.1.3 3.4.3 Principles to follow in developing financial projections

The financial projections for the project should be prepared on the basis of a financial model under the following principles:

Reference period and life of equipment

The period of projection is the same as the project's reference period, which is typically **30 years** in the case of water and wastewater projects.

As regards to the technical life of equipment, which has an impact on the level of replacement costs that needs to be taken into consideration during the reference period, please refer to Annex 2.

Financial discount rate

The financial discount rate (in real term) to be used is 5%, as recommended by the European Commission in WD4.

Macroeconomic assumptions

Macroeconomic inputs shall be based on the relevant statistical sources and be consistent across project proposals. The assumptions to be used for the forecasts, as well as the main sources for the data to be used are detailed in Annex 3.

Features of the financial model

One single set of consolidated projections shall be developed for the whole project, as opposed to a number of sets reflecting different components or geographical areas of the project.

All inputs should be concentrated in one spreadsheet, with data entered in local currency and real terms, and inflation being considered separately and added later on for the projections. The projection in local currency is done in nominal terms in order to reflect more accurately the reality under the assumption made for inflation.

The translation into euros is done using the so-called "all-current method", by which income statement values are translated using the average exchange rate for the year, balance sheet values are translated using the ending exchange rate for the year (with the exception of the shareholder's equity, which is translated at the historical rate), and the translation gain or loss is recorded directly into the shareholders' equity as *comprehensive income*.

17.1.4 3.4.4. Analysis of financial projections

The relevant aspects to be considered for the analysis of the output of the financial model in order to ensure that the financial projections for the project are acceptable are the following:

1. Justification and consistency of data: All relevant input data should be justified (in the CBA or with reference to other parts of the project feasibility studies) and consistent with the conclusions of the feasibility studies, the project description and the rest of the data in the financial projections. In particular, this refers to the following: (i) beneficiaries; (ii) demand; (iii) investment costs; (iv) revenues; (v) operating costs; and (v) expected changes of those variables during the projection period. For investment and operating costs, the applicant is requested to detail its underlying assumptions, by filling the form presented in annex 1. Also, there should be sufficient certainty regarding the financial arrangements for the financing of the project, and in particular in the case of direct contributions from national authorities and beneficiaries and loans from local lenders or international financial institutions.
2. Polluter pays principle: The chosen scenario for tariffs should reflect the correct application of the Polluter Pays Principle. In the case of the water and wastewater projects and according to Art. 9 of the Water Framework Directive 2000/60/EC, this means that

“Article 9. – Member States shall take account of the principle of recovery of the costs of water services, including environmental and resource costs, having regard to the economic analysis conducted according to Annex III, and in accordance in particular with the polluter pays principle.”

3. **Affordability:** Art. 9 of the Water Framework Directive 2000/60/EC also states that *“Member States may in so doing have regard to the social, environmental and economic effects of the recovery [...]”*. In addition, Art. 55 of regulation 1083/2006 allows for *“considerations of equity linked to the relative prosperity of the Member State concerned”*, which for all practical purposes implies that the total charges paid by the users for water and wastewater services should not exceed certain commonly accepted thresholds.

In order to ensure that the affordability of tariffs for low income households is taken into account, the following steps are required in the analysis:

- a. Estimation of the average household income for those households subject to the payment of tariffs.
- b. Estimation of the number and income of low income households based on the lowest decile of a distribution of income for those households subject to the payment of tariffs.
- c. Verification that the total water and wastewater charges including indirect taxes for the lowest income household do not exceed 4.0% of their household disposable income (when calculated on the basis of an average per capita consumption of 75 lcd)³⁸.

The determination of the average household income as well as the income distribution by decile shall be based on data sourced according to the recommendation of Annex 3. In any case, the CBA report shall duly specify the source of the data used.

The calculation above implies the definition of a tariff rates that are affordable for all customers, but this does not mean that the same rates apply to all customers. That is, an affordability constraint for low income customer can be overcome with a tariff structure with lower rates for low income customers and/or progressive rates for higher levels of consumption, but the rest of the customers and in particular the non-residential ones can be subject to higher rates that are more consistent with the Polluter Pays Principle³⁹.

4. **Financial sustainability:** The verification of the project financial sustainability implies a cumulative positive cash flow for each one of the year of the projection. This shall ideally valid when performing the analysis at project’s level, but surely at operator’s level. Temporary shortfalls can be covered by a revolving credit (embedded in the model’s cash flow statement) provided that the assumptions behind this revolving credit are reasonable with regards to the local financial markets. Also, when the financing structure of the project includes a long-term loan to be paid with revenues within the scope on the financial projections, a debt service coverage ratio (operator level)⁴⁰ of at least 1.2 will be required for each year of the loan amortization period⁴¹.

17.1.5 3.4.5. Considerations on tariff increases

- 17.1.6 In light of the points raised above, incremental tariff increases shall be considered in the financial analysis with the goal to ensure an adequate level of recovery of the cost of providing the service, as well as financial sustainability of operations once the project is implemented, while at the same time respecting affordability constraints that might apply. Nevertheless, as stated in WD 4, tariffs shall be set at a level adequate to cover operating and maintenance costs, as well as a significant part of the asset’s depreciation (meant as a proxy of the cost needed to replace the infrastructure in the future).

To that extent, the following approach is recommended:

³⁸ This needs to be consistent with the assumptions and parameters used in the feasibility study to establish the size of the investment and its operating costs.

³⁹ This is in line with the affordability policy adopted by the Ministry of Environment and Sustainable Development for Cohesion Funds projects in the water and wastewater sector. According to this policy, higher tariffs are allowed for in case the general affordability limit threatens the financial sustainability of the operator or the project.

⁴⁰ Measured as EBITDA/DebtService, with EBITDA being the earnings before interest, taxes, depreciation and amortization

⁴¹ Or higher as per already existing loan covenants or if required by the IFI co-financing the project, when applicable.

- in the without project scenario: tariff shall be set at a level of full cost recovery of the existing systems, therefore allowing for coverage of O&M, as well as depreciation of existing assets. If current tariffs do not achieve this, then the necessary tariff increase shall be assumed in the analysis, conditional upon existing affordability constraints.

- in the with project scenario: tariffs shall be increased to the level needed to a) cover O&M cost for the existing and new (project) assets, including depreciation according to Romanian legislation requirements; b) allowing for the necessary cash flow to meet the financial sustainability requirements detailed above; c) taking into account affordability constraints, allow the operator to build enough cash reserves to ensure the future replacement of all assets, starting from the ones with the shortest economic life^{42,43}.

Please note that tariff increases shall be implemented with the goal of achieving unification of tariffs in the service area of the operator by the time the project become operational, if not earlier.

Also, tariff increases needs to be designed taking into account realistic phasing which are socially acceptable, and to limit the risk in revenue reductions (do to affordability problems).

This is valid not only for the tariff increases needed to finance the investments envisaged in the short term priority investment (proposed for funding under this programming period) but also for the overall implementation of the long term investment plan agreed at Master Plan level.

To that extent, the beneficiaries are requested to complement the affordability analysis of the tariff increases proposed for the current investment, to be performed according to point 3 of the previous section, with an update of the macroaffordability analysis performed at Master Plan level, which takes into account the investments to be implemented within the same agglomerations after the current programming period (or phase of investment). This updated macroaffordability analysis shall aim at highlighting the remaining financial capacity of customers within the same service area to sustain further tariff increases for the implementation of investments in the following phases.

It is anticipated that this will require establishing clear assumptions about the corresponding timetable (linked to compliance with EC Directives) as well as the future rate of public contribution (assumed to stay at comparable level as in the current programming period, i.e. 90 per cent).

Tariff increases affect demand due to demand elasticity effects. To that extent, assumptions on such elasticities needs to be presented as part of the analysis and expected impact on demand duly assessed.

Whenever the area suffers, or is expected to suffer from water scarcity problems, the beneficiary is requested to consider the implementation of alternative tariff policy approaches to promote an efficient water allocation and use⁴⁴, as for example increasing block tariff systems, increasing the tariffs with the consumption.

The same recommendation is valid for those cases where due to low affordability levels, the application of the affordability ceiling detailed in section 3.4.4. above, will cause tariffs to be set at a level that endanger the financial sustainability of the project (and operator) or do not ensure full cost recovery of operation.

In such cases, alternative or cumulative options shall be explored in order to address the problem and ensure sustainability. It is anticipated that such options shall include, as a minimum:

⁴² The beneficiary shall explain in detail the method used in the analysis to identify the tariff increases needed to achieve the coverage of such costs, as well as its consistency with the approach required by the relevant Romanian regulations.

⁴³ One possible approach for setting tariffs in the with project scenario is to make reference to the levelized unit cost (or dynamic prime cost) as a proxy of the long term cost of the proposed project. This is calculated by dividing the discounted value (net present value) of the related cost flows (both investment and OM&A cost) by the discounted volume of billed water consumption. The period of reference and the discount rate to be used shall be consistent with the ones used in the analysis. The investment cost items that are taken into account in the calculation are: a) Initial investment cost of the system; b) Reinvestment cost for replacement of assets at the end of their economic lifetime; c) Residual value of all infrastructure at the end of the period of analysis.

Only cash-flows are taken into account in the calculation (i.e. no depreciation cost of the assets). Cash-outflows are entered in the year in which they occur. The residual value of the project infrastructure is entered as a cash- inflow in the last year of the period of analysis (even if the infrastructure is not liquidated). In the case of pre-existing infrastructure (i.e. extension projects), the residual value of existing infrastructure is entered in the first year.

⁴⁴ On this topic, see the Communication from the Commission to the European Parliament and the Council "Addressing the challenge of water scarcity and droughts in the European Union" published in July 2007, available at http://ec.europa.eu/environment/water/quantity/scarcity_en.htm

- a political decision to set tariffs above the affordability thresholds, while considering specific measures at the level of IDA to reduce the affordability burden on the poorest households (vouchers, lower “social” tariffs, etc)

- alternative and more sophisticated tariff systems are considered, allowing for example, tariff charges progressively increasing with consumption, increasing subscription part of the tariff, applying higher tariff for big consumers (industry), etc.

The CBA will have to duly describe the recommended tariff system.

17.1.7 3.5 Funding Gap Calculation

For the period 2007-2013, art. 55.2 of the Regulation 1083/2006 stipulates that the determination of the level of EU co-financing is based on the concept of funding gap, intended as the portion of the proposed (eligible) investment that cannot be covered by the net revenues accruing for the investment itself, both expressed in term of their current (present) value.

The difference between the two values is considered as *Eligible Expenditure* when applying the co-financing rates specified in the relevant SOPs.

Using cash flows calculated as in the previous section, the Applicant should calculate the maximum EU grant rate. WD4 gives clear instructions, which are replicated in the box below.

STEPS TO DETERMINING THE EU GRANT 2007-2013 PROGRAMMING PERIOD

Step 1. Find the funding-gap rate (R):

$$R = \text{Max EE/DIC}$$

where

Max EE is the *maximum eligible expenditure* = DIC-DNR (Art. 55.2)

DIC is the *discounted investment cost*

DNR is the *discounted net revenue* = discounted revenues – discounted operating costs + discounted residual value

Step 2. Find the “decision amount” (DA), i.e. “the amount to which the co-financing rate for the priority axis applies” (Art. 41.2):

$$DA = EC \cdot R$$

where

EC is the eligible cost.

Step 3. Find the (maximum) EU grant:

$$\text{EU grant} = DA \cdot \text{Max CRpa}$$

where

Max CRpa is the maximum co-funding rate fixed for the priority axis in the Commission’s decision adopting the operational programme (Art. 52.7).

17.1.8 The resulting funding gap and subsequent grant rate will then feed-back to the financial projections in an iterative process.

While the tariff increases based on the approach recommended in the previous section are the basis for forecasting project’s incremental revenues, the discounted cash flow analysis performed to calculate the Funding Gap (see following section), however, **should not include non-cash accounting items** such as depreciation and contingency reserves, as clearly stated in Working Document 4.

On the other side, replacement costs that are due to be incurred during the period of analysis (e.g., for electro-mechanical equipment with a shorter economic life, see Annex 2 for details) are included in the Funding Gap calculation as (discounted) operating and maintenance costs.

17.1.9

17.1.10 3.6 Profitability Analysis

The same incremental cash flows used for establishing the funding gap are also used to calculate the project financial performance indicators (i.e. the financial net present values FNPV/C and the corresponding financial return on the investment or FRR/C) in absence of co-financing from the Funds⁴⁵.

Since co-financing is required only if the proposed project or action is not financially profitable, a project will be eligible for co-financing only if, before EU interventions its FNPV/C is lower than 0, and its FRR/C is lower than the chosen discount rate⁴⁶.

In case of grant funded projects the profitability analysis is used to assure that the grant was properly calibrated and does not transfer too much funding to the operator promoter of the project. To that extent, the project promoter is also expected to calculate the following financial indicators to show that the EU grant rate identified above is not too generous:

- FRR/C and FNPV/C
- FRR/K and FNPV/K

FRR/C measures the capacity of the project to provide an adequate return on the investment, regardless the way it is funded. As discussed above, FRR/C is calculated from a cash flow projection that covers the project's economic life and includes initial investment, replacement costs for the project short-life equipments, operation and maintenance costs as outflows, and receipts from project revenues and project residual value at the end of its economic life as inflows. These estimates are made gross of taxes.

After the EU grant, FRR/C value shall be higher but most likely still below the financial discount rate.

FRR/K measures the capacity of the project to provide an adequate return to the capital invested by the project promoter. The FRR/K is calculated from the same cash flow projection used for calculating FRR/C, but detracting from the project investment costs both loans drawdown and the EU contribution⁴⁷.

FRR/K should never exceed the required return on equity for companies in the sector, since this would show an excessive return of the promoter at the expense of the EU tax payer.

If relevant, it may be useful to determine a separate FRR/K for the operator when this is different from the owner of the infrastructure/investor. Beside conducting a consolidated financial analysis (and a consolidated calculation of the indicators), this can be addressed by calculating two FRR/K taking into account the capital outlays to be covered respectively by the operator and by the investor.

It has to be noted that investments in water supply and wastewater treatment are expected to have a low to medium financial profitability, as duly noted in WD4. This is expected to be even truer where a significant part of the investments are mainly aimed at improving service and environmental standards, which have a low impact on revenues.

3.5 Economic Analysis

17.1.11 3.5.1 Objectives and scope of the analysis

The purpose of the economic analysis is to prove that the project has a positive net contribution to society and is therefore, worth being co-financed by EU funds. For the selected alternative, the project's benefits

⁴⁵ FNPV/C is calculated by calculating the Present Value of the stream of cash-flows in the net cash-flow statement. FRR/C is the corresponding Internal Rate of Return, at the chosen discount rate.

⁴⁶ The financing gap and financial profitability indicators (FRR/C, FNPV/C, FRR/K and FNPV/K, before and after Community assistance) are calculated using a financial discount rate of 5% in real terms, according to the regulations and more specifically according to the instructions in the Guide to Cost-Benefit Analysis of Investment Projects and Working Document 4: Guidance on the methodology for carrying out Cost-Benefit Analysis.

⁴⁷ An alternative is to consider as cash outflows in lieu of the investment cost, all national financing sources, including loans at the moment they are reimbursed.

should exceed the project's costs and, more specifically, the present value of the project's economic benefits should exceed the present value of the project's economic costs.

In practical terms, this is expressed as a positive ENPV, a Benefit/Cost (B/C) ratio higher than 1, or a project ERR exceeding the discount rate used for calculating the ENPV (i.e. 5.5%).

However, project economic (as opposed to financial) costs are measured in terms of their 'resource' or 'opportunity' costs; that is, the benefit which has to be foregone (the opportunity lost) by society in using scarce economic resources in the project rather than in some alternative use.

Similarly, project benefits can be measured in terms of the amounts that people benefiting from the project are ready to paid for (*willingness-to-pay terms*) or, alternatively, in *costs avoided* as a result of implementing the project, as well as in term of external benefits that are results of the implementation of the project and that are not captured by the analysis performed in financial terms.

17.1.12 3.5.2 Identification of project economic benefits

The estimation of the project economic benefits involves the identification of the project benefits, which can be classified into the following three main categories:

- a. Benefits from improved access to drinking water, which translates into more water of adequate quality sold to the customers, either through increase of the coverage of the water supply service or to the increase in individual consumption due to the improvement of the quality of the service (i.e.: increase of pressure and decrease of service interruptions).
- b. Benefits from improved quality of bathing and other surface waters, which translates into an improvement in the overall conditions of water bodies in the project area as a result of pollution prevention.
- c. Resource cost savings:
 - for the customers, which takes place (i) when the customer does no longer need to rely on private wells, private pumps, septic tanks, and does no longer have to buy bottled water
 - for the operator, through the optimization of the system which allows for a reduced resource depletion through water abstraction as well as a reduction in emissions related to energy savings.

Note that the increase of economic activity in the region as a direct result of the project is not a project benefit *per se* since this is inherent to all projects involving employment generation regardless of the objectives to be achieved. However, the economic impact of employment generation has indirectly been already considered when correcting the cost of un-skilled labour with the shadow wage⁴⁸ as explained with more detail below.

The methodology suggested for quantification and monetisation of potential project benefits, which due to the nature of those benefits in some cases is not straightforward and needs to be estimated, is detailed in Annex 4. A summary of the benefits to be used in the economic analysis is included in section 3.5.4.

As in the case of the financial analysis, also the economic analysis needs to be performed on an incremental basis.

17.1.13 3.5.3 Negative externalities

It is worth keeping in mind that the project could also have negative externalities that need to be taken into account in the economic analysis. Negative externalities could take the form of possible impacts on the environment (spoiling of scenery, naturalistic impact, loss of local land and real estate value due to disamenities, such as noise and odour), negative impact due to the opening of building sites (temporary effect) or increased emission due to increased activities triggered by the project.

⁴⁸ That is, the positive impact of the project in a region with high unemployment is considered through a lower shadow wage for un-skilled workers and therefore a lower project economic cost.

The CBA shall list all potential negative externalities that are expected as a result of the project implementation, specifying the methodology to be used for their quantification and monetisation, or assessing their impact only on a qualitative basis.

As a minimum, however, the following negative externalities shall be taken into account in the economic analysis (as an economic cost):

- a) CO₂ emissions from sludge digestors, based on a quantification of gas production and related CO₂ portion.
- b) CO₂ emissions from sludge transport to disposal sites, based on quantification of dehydrated sludge and other waste from the WWTPs (screenings, grid) to be transported to a sanitary landfill and to surrounding agricultural fields.

17.1.14 3.5.4 Summary for calculation of benefits and negative externalities

Table 5 summarises the assumptions to be used to quantify and monetise the impact of the project in term of economic benefits and negative externalities, the latter to be included in the analysis as economic costs.

Please note that this list is not meant to be exhaustive, since the extent of benefits stemming from the project as well as its potential negative impact is expected to be wider.

The CBA shall identify and list all potential benefits/negative impact that are expected as a result of the project, beside the ones listed in these Guidelines, and provide details of their impact on the economic analysis, even if their assessment could be done only on a qualitative basis.

Table 5: Project benefits and negative externalities

Project Benefits			
Type	Base for calculation	Monetary value	Comments
Access to drinking water	Nr. Of households in project service area	148 Euro/household/year (2008 value)	Values for following years of projection to be increased by real GDP growth (see Annex 2)
Improvement of water bodies (use value)	Nr. Of people living in the project service area	20.4 Euro/person/year (2008 value)	Values for following years of projection to be increased by real GDP growth (see Annex 2)
Improvement of water bodies (non use value)	Nr. Of households in project service area	0.004 – 0.011 Euro/household/year/KM river	See Annex 4 for further details
Cost savings to customers – private well	Nr. Of households newly connected	315 Euro/household/year	
Cost savings to customers – sewage disposal	Nr. Of households newly connected	348 Euro/household/year	
Cost savings to operator – water abstraction	Incremental water savings (in m ₃)	Water abstraction fee (Apele Romane)	To be detailed in technical studies
Cost savings to operator – energy consumption	CO ₂ emission savings (in tonnes)	From 25 Euro/tonne in 2010 to 45 Euro/tonne in 2030	To be detailed in technical studies. See annex 4 for details on prices.
Negative Externalities			
Type	Base for calculation	Monetary value	Comments
Increase in CO ₂ emission – sludge digestion	CO ₂ emission (in tonnes)	From 25 Euro/tonne in 2010 to 45 Euro/tonne in 2030	To be detailed in technical studies. See annex 4 for details on prices.
Increase in CO ₂ emission – sludge transportation	CO ₂ emission (in tonnes)	From 25 Euro/tonne in 2010 to 45 Euro/tonne in 2030	To be detailed in technical studies. See annex 4 for details on prices.

17.1.15 3.5.3 Conversion of project financial costs to economic costs

Fiscal corrections are needed for those elements of the financial prices that are not related to the underlying opportunity costs of the resources involved. To that extent, correction shall include deductions for indirect taxes (e.g. VAT), subsidies and pure transfer payments (e.g., social security payments). In particular, investment costs for beneficiaries that are not VAT registered (and for which VAT is therefore not recoverable) should include VAT in the *financial* analysis. This, however, should be excluded from the *economic* analysis.

However, economic prices should include direct taxes and specific indirect taxes/subsidies intended to correct externalities.

More specifically, converting project costs from market to economic prices implies breaking down the project cost into the different categories listed below, with the required treatment specified for each case:

- a. Traded items: This category comprises all goods and services included in the project cost that can be valued on the basis of world prices. For an open economy with international tenders for procuring the equipment, materials and services, this category will normally cover most of the project costs. No specific conversion is required since market prices are assumed to reflect economic prices.
- b. Non-traded items: This category comprises all goods and services that have to be procured domestically, like for example domestic transport and construction, some raw materials, and water and energy consumption. The conversion from financial to economic prices is usually done through a Standard Conversion Factor (SCF). The SCF is usually computed based on the average differences between domestic and international prices (i.e.: FOB and CIF border prices) due to trade tariffs and barriers. However, given that costs within this category are normally low with regards to total project costs and that roughly 70% of the Romanian trade is internal to the EU and therefore by definition not subject to trade tariffs, the SCF will be 1 unless otherwise justified.
- c. Skilled labour: This category comprises the labour component of the project cost that is considered scarce and therefore adequately priced in terms of opportunity cost. No specific conversion is required since market prices are assumed to reflect economic prices.
- d. Non-skilled labour: This category comprises the labour component of the project cost that is considered in surplus (i.e.: in a context of unemployment) and therefore not adequately priced from the economic point of view. The correction to reflect the opportunity cost of labour could be made by multiplying the financial cost of un-skilled workers by the so-called Shadow Wage Rate Factor (SWRF), which can be calculated as $(1-u)*(1-t)$, where u is the regional unemployment rate and t is the rate of social security payments and relevant taxes included in the labour costs⁴⁹.
- e. Land acquisition: This category comprises the land implicitly used in the project, even when no financial cost is included as part of the project cost. Correction of land costs intends to adjust for the net output that would have been produced on the land if it had not been used by the project. In those cases in which the land has been acquired at market value, the applicable conversion factor is 1 since it is assumed that the market value reflects the present value of the future output. Otherwise, the adjustment to reflect economic costs will have to be calculated on a case by case basis.
- f. Transfer payments: This category comprises indirect taxes (i.e.: VAT), subsidies, and pure transfers payments included in the market prices used to estimate the project costs. All these costs have to be eliminated for the purposes of the economic analysis.

Table 6 summarizes the corrections from market prices to economic prices here indicated. The financial costs are converted into the economic costs by multiplying by the corresponding conversion factor. Also, note that the relevant costs to be considered for the economic analysis are the project's incremental costs.

Table 6: Applicable conversion factor per cost item

Cost item	Conversion factor	Comment
Traded goods	1	
Non-traded goods	1	Unless otherwise justified
Skilled labour	1	
Non-skilled labour	SWRF	Calculated as $(1-u) \times (1-t)$

⁴⁹ This corresponds to a Shadow Wage of $SW=FW*(1-u)*(1-t)$, with FW being the financial (or market) wage, and a Shadow Wage Rate Factor of $SWRF=SW/FW$. It has to be stressed that this approach is more correct where condition of high involuntary unemployment exists.

Cost item	Conversion factor	Comment
Land acquisition	1	Unless otherwise justified
Transfer payments	0	

3.6 Sensitivity and risk analysis (Risk assessment)

As provided for by Art. 40 (e) of the Regulation 1083/2006, a “risk assessment” shall be included in the CBA. The goal is to deal with the uncertainty related to the implementation of investment projects.

The purpose of the sensitivity and risk analysis is to assess the robustness of the project financial and economic performance. For this purpose, the first part of the analysis (sensitivity analysis) aims at identifying the key variables and their potential impact in terms of changes in the financial and economic indicators, and the second part (risk analysis) aims at estimating the probability of these changes actually taking place, with the results expressed as a estimated mean and standard deviation for those indicators.

The relevant indicators to be considered for the sensitivity and risk analysis are:

- FRR/C and corresponding FNPV/C
- FRR/K and corresponding FNPV/K,
- ERR and corresponding ENPV.
- Cumulative cash flows (both at project and operator’s level).

In addition, the beneficiaries are strongly encouraged to check the sensitivity of end-of-the year cash flows (both at project and operator’s level), in order to be able to assess potential liquidity shortages during the period of analysis and identify measures to tackle them.

The sensitivity and risk analysis consists of three steps, with the result of each one of them having to be reflected in the application for funding:

1. **Identification of key variables:** This basically implies the calculation of the values of the indicators after variations of +/- 1% in the following variables: (i) project outturn cost; (ii) revenues; (iii) operation and maintenance costs; and (iv) economic benefits (possibly by disaggregate benefit categories). The +/- 1% variations will be applied across the board to the annual costs for the base case scenario, and the results will be duly presented in the CBA.

Given the results of the analysis above, any variable for which a variation of 1% results in a variation of more than 1 percentage point in the base case of FRR/C, FRR/K and ERR or more than 5% in the value of the base case of other indicators, will be considered a key variable.

2. **Calculation of switching values for the key variables:** The key variables require the calculation of the so-called *switching value*, which is the maximum variation (in percentage) in the key variable that is permitted before the relevant indicator for that specific key variable turns negative (or positive in case of FNPV/C).
3. **Estimation of probability distribution for the profitability indicators:** First of all, this implies a qualitative assessment of the relevant factors that may affect the values of the key variables as well as the mitigating measures already included in the project to reduce the impact of those factors⁵⁰. Then, there are two options to quantify the level of certainty of the calculated values for the profitability indicators:
 - a. If there is reasonable information (based on data collected on similar projects or reliable expert judgement) to define a probability distribution for the key variables⁵¹, then it is possible to use statistical methods as Monte Carlo or similar, which assigns random values to all the key variables simultaneously (within their expected distributions) for a number of repetitions

⁵⁰ For example, project outturn cost could be a key variable, poor definition of the different investments included in the project and their cost could pose a relevant risk in terms of project outturn cost, and the preparation of detailed designs and tender documents with realistic cost estimates as part of the feasibility studies could be a mitigating measure to control this risk.

⁵¹ Or at least a reasonable range of variation, assuming a normal distribution between the maximum and minimum value.

sufficiently high in order to come up with a probability distribution for each one of the profitability indicators. Then each profitability indicator will be expressed as the mean and standard deviation of the values obtained after all the repetitions.

- b. If there is no reasonable information to define a probability distribution for the key variables, then the risk assessment will be carried out by defining optimistic and pessimistic scenarios that include all the key variables, and then calculating the two extreme values for the profitability indicators based on these two scenarios⁵².

⁵² If low and high expected values could be identified, together with a most-likely value, one possibility is to assume a triangular distribution. Triangular distributions are used when there is only a limited sample data, or when the relation between the variables is known but data are scarce. Please see the 2008 version of the EC Guide for further details.

18 4. Presentation of results

The conclusions of the CBA need to be presented in a document covering the following sections:

1. Project area and beneficiaries, with detail of the service coverage, population concerned, demand projections, etc before and after the project.
2. Project objectives, with detail of the context within the relevant sector operational programme and the main indicators (in terms of standards) before and after the project.
3. Project description and cost, with the following sub-sections: (i) description of the alternatives considered and their corresponding cost; (ii) justification of the selection of the alternative considered as most suitable; and (iii) breakdown of project cost by component and type of expenditure.
4. Financial analysis, with details of the financial projections and conclusions of the analysis in terms of application of the polluter pays principle, affordability, financial sustainability and profitability indicators (FRR/C and corresponding FNPV, and FRR/K and corresponding FNPV).
5. Economic analysis, with identification and quantification in monetary terms of the project benefits, correction of project cost with economic prices and calculation of the ENPV, B/C ratio and ERR.
6. Sensitivity and risk analysis, with details of the key variables, the switching value on each case, the relevant factors and mitigated measures related to changes in these key variables, and the estimated probability distribution for the financial and the economic profitability indicators or, failing that, simply their values under an optimistic and pessimistic scenario.

Annex 1 – Itemised Unitary values for Investment and Operating Costs (to be confirmed)

<i>Item</i>	<i>Unitary value (€)</i>	<i>Comments</i>
INVESTMENT COSTS		
Water sector		
Construction of 1 wellfield composed of x wells in the agglomeration of X		
Rehabilitation of 1 wellfield composed of x wells in the agglomeration of X		
Construction of 1 reservoir of x m ³		
Rehabilitation of 1 reservoir of x m ³		
Construction of 1 intake of x m ³ /s		
Rehabilitation of 1 intake of x m ³ /s		
Construction of 1 pumping station with a capacity of x m ³ /h		
Rehabilitation of 1 pumping station with a capacity of x m ³ /h		
Construction of 1 booster station with a capacity of x m ³ /h		
Rehabilitation of 1 booster station with a capacity of x m ³ /h		
Setting up of a SCADA system for the municipality of X		
Construction of the DWTP (specify the treatment process and the capacity), in the agglomeration of X		
Rehabilitation of the DWTP (specify the treatment process and the capacity), in the agglomeration of X		
Construction of 1 chlorination plant, with a capacity of x m ³ /h		
Rehabilitation of 1 chlorination plant, with a capacity of x m ³ /h		

Replacement/ rehabilitation of 1 km of distribution pipe (Ø X mm)		<i>Important depth, particular geotechnical conditions</i>
Construction of 1 km of distribution pipe (Ø X mm)		<i>Important depth, particular geotechnical conditions</i>
Replacement of 1 km of transmission pipe (Ø X mm)		<i>Important depth, particular geotechnical conditions</i>
Construction of 1 km of transmission pipe (Ø X mm)		<i>Important depth, particular geotechnical conditions</i>
Construction of 1 connection to the distribution network		
<i>Other (specify)</i>		
Wastewater sector		
Replacement of 1 km of sewer (Ø X mm) – open trenches		<i>Important depth, particular geotechnical conditions</i>
Rehabilitation of 1 km of sewer (Ø X mm) -relining		
Extension of 1 km of sewer (Ø X mm)		<i>Important depth, particular geotechnical conditions</i>
Construction of 1 retention basin of x m ³		
Rehabilitation of 1 retention basin of x m ³		
Construction of 1 wastewater pumping station of x m ³ /h		
Rehabilitation of 1 wastewater pumping station of x m ³ /h		
Construction of 1 connection to the sewage network		
Construction of 1 flow metering point on the sewage network		
Removal of 1 connexion with the rainwater network		
Construction of a WWTP of x p.e., (specify the treatment process), in the agglomeration of X		<i>Additional treatment requirements, specific geotechnical conditions or other constrains (landscape integration, flooding area,..)</i>
Rehabilitation of a WWTP of x p.e. , (specify the treatment process), in the agglomeration of X		<i>Additional treatment requirements, specific geotechnical conditions or other constrains (landscape integration, flooding area,..)</i>
<i>Other (specify)</i>		

OPERATING COSTS (ON ANNUAL BASIS)		
Water sector		
Maintenance of the wellfield X– specify the identification number, of x m ³ (annual capacity), for the agglomeration of X	EUR	
Maintenance of the water intake of x m ³ (the annual capacity), for the agglomeration of X	EUR	
Maintenance of the transmission pipes, in the agglomeration of X	EUR/km	
Maintenance of the chlorination of x m ³ (the annual capacity), for the municipality of X	EUR	
Maintenance of 1 DWTP of x m ³ (specify the treatment process and the annual capacity), in agglomeration X <i>including management of sludge (specify destination)</i>	EUR	
Maintenance of water reservoirs, of x m ³ (annual capacity), for the agglomeration of X	EUR	
Maintenance of the pumping system (boosters and pumping stations), of x m ³ (annual capacity), for the municipality of X	EUR	
Maintenance of the distribution pipes, in the agglomeration of X	EUR/km	
Maintenance of the SCADA system, for the municipality of X	EUR	
<i>Other (specify)</i>		
Wastewater sector		
Maintenance of sewer, in the agglomeration of X	EUR/km	
Maintenance of the pumping system, of x m ³ (annual capacity), for the municipality of X	EUR	
Maintenance of the retention system, of x m ³ , for the municipality of X	EUR	
Maintenance of 1 WWTP of x p.e. in the agglomeration of X, <i>including sludge management (specify destination)</i>	EUR	<i>Based on average destination to the fields (agricultural reuse) or landfill</i>

<i>Other (specify)</i>		
<i>Savings (if applicable)</i>		

Annex 2 – Technical lifespans of equipment and works

Equipment and Works – Water

Equipments and works	Technical lifespan (years)
Boreholes (equipment)	15
Water intakes: civil engineering	50
Access ways	30
Treatment plants: civil engineering and pipes	50
Treatment plants: electromechanical equipment	15
Pumping stations (equipment)	12
Transport pipes	50
Supply pipes	50
Concrete water reservoirs	30
Metallic water reservoirs	30
Mechanical equipment (including piping)	10
Electromechanical equipment (including production for isolated sites)	12
Water Connections	50
Users' Meters ⁵³	10

Equipment and Works – Wastewater

Equipment and works	Technical life (years)
Access ways	30
Treatment plants: civil engineering and pipes	30
Treatment plants: electromechanical equipment	12
Pumping stations (equipment)	12
Collection pipes	30
Mechanical equipment (including piping)	12
Electromechanical equipment (including production for isolated sites)	12
Wastewater Connections	50

NOTE: Equipment with technical lifespan shorter than the reference period shall be considered as replaced at the end of its lifespan, and such costs built into the CBA analysis.

For items whose technical lifespan equals the reference period, and beyond, the values above shall only be considered, *prorata temporis*, for the calculation of the residual value (in case of technical life equal to the reference period the residual value is zero).

⁵³ Provided that regular check and calibration is performed

Annex 3 – Assumptions and sources of data for forecasts to be performed in the CBA

1. Rationale

This guidance is to be provided as part of the National CBA Guidelines to establish the framework for analysis to be performed by the Applicants (and their Consultants).

The data presented below are consistent with the macroeconomic assumptions used for the development of the National Strategic Reference Framework (NSFR), which is the guiding document for the preparation of Operational Programmes, and their related projects.

2. Macroeconomic and population growth assumptions

a) GDP Growth

Forecasts shall be based on the latest available prognosis of the Comisia Nationala de Prognoza (CNP). The current version of the Guidelines builds on the data published in May 2008 as part of the document *Prognoza de primavara pe termen lung 2008-2020*, available at www.cnp.ro.

For period after 2021, and for all remaining years of the analysis, the forecasts will take into account a stable **average 5% GDP growth rate** (in real terms) per annum.

The following table summarises the assumptions to be used.

Table 1 – GDP growth assumptions (% per annum)

2006*	2007	2008	2009	2010	2011	2012	2013	2014
7.7	6.0	6.5	6.1	5.8	5.8	5.7	5.7	5.5
2015	2016	2017	2018	2019	2020	2021 and beyond		
5.3	5.4	5.6	5.7	5.3	5.2	5		

* data from previous CNP publications

The table above refers to data at a National level, as published by CNP.

b) Inflation

Data on inflation are based on the development of the yearly Consumer Price Index (CPI), where inflation is calculated deducting 100 from the yearly CPI. The current version of the Guidelines builds on the data published in May 2008 as part of the document *Prognoza de primavara pe termen lung 2008-2020*, available at www.cnp.ro.

For period after 2021, and for all remaining years of the analysis, the forecasts will take into account a stable **average 2,0% inflation rate** per annum.

The following table summarises the assumptions to be used.

Table 2 – Inflation dynamics assumptions (growth rate per annum in %)

2006*	2007	2008	2009	2010	2011	2012	2013	2014
6.56	4.84	7.5	4.5	3.6	3.2	2.8	2.5	2.3
2015	2016	2017	2018	2019	2020	2021 and beyond		
2.0	2.0	2.0	2.0	2.0	2.0	2.0		

* data from previous CNP publications

c) Exchange rate

Forecasts will be based on the latest available prognosis of CNP. The current version of the Guidelines builds on the data published in May 2008 as part of the document *Prognoza de primavara pe termen lung 2008-2020*, available at www.cnp.ro.

For period after 2014, and for all remaining years of the analysis, the forecasts will take into account a **stable exchange rate of 3.1 RON/Euro**.

The following table summarises the assumptions to be used.

Table 3 – Exchange rate assumptions (RON/EUR)

2006*	2007	2008	2009	2010	2011	2012	2013	2014
3.53	3.34	3.55	3.45	3.38	3.33	3.30	3.25	3.25
2015	2016	2017	2018	2019	2020	2021 and beyond		
3.25	3.25	3.25	3.25	3.25	3.25	3.25		

* data from previous CNP publications

d) Population Growth

The latest available prognosis of CNP on population growth (PROIECȚIA PRINCIPALILOR INDICATORI MACROECONOMICI ÎN PERIOADA 2008 – 2013 – Prognosa de Primavara available at www.cnp.ro) indicates the following prognosis for population growth at a national level:

Table 4 – Population dynamics assumptions (% growth per annum)

2006	2007	2008	2009	2010	2011	2012	2013	2014+
-0.2	-0.3	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3

If more detailed official data are available for population growth at local level, then it is recommended to use those, clearly specifying the source of the data.

If not, reasonable assumptions shall be used (and duly presented in the CBA) to derive population growth at local level from National values.

3. Data on Household Income for affordability assessment

Current

Unless more detailed official data at the local level are available (sources needs to be clearly specified in any CBA to be presented), data from the Family Budget Surveys on INSSE (the Statistical office) shall be used for establishing disposable income at local level. The latest INSSE's Statistical Yearbook includes a chapter summarising statistics taken from Family Budget Surveys.

Forecasts

It is recommended considering household's disposable income growth as equal to GDP growth. As a result, current data collected, split by income decile, will be projected using a growth rate equal to the GDP growth.

Please note that the income of the lower three deciles are likely to evolve at a lower pace than the average income, which is indexed fully to GDP growth. To that extent, it is recommended to use historical averages during (at least) the last 5 years to determine the percentage of growth rate that can be attached to the income of the last three deciles.

Annex 4 – Methodology followed in estimating and monetising project's benefits and negative externalities in these Guidelines

18.1.1 A4.1 Introduction

For the economic analysis to be performed in line with these Guidelines, **a minimum set of project benefits** needs to be taken into account, according to the following main categories:

1. Benefits from improved access to drinking water, which translates into more water of adequate quality sold to the customers, either through increase of the coverage of the water supply service or to the increase in individual consumption due to the improvement of the quality of the service (i.e.: increase of pressure and decrease of service interruptions).
2. Benefits from improved quality of bathing and other surface waters, which translates into an improvement in the overall conditions of water bodies in the project area as a result of pollution prevention.
3. Resource cost savings:
 - for the customers, which takes place (i) when the customer does no longer need to rely on private wells, private pumps, septic tanks, and does no longer have to buy bottled water
 - for the operator, through the optimization of the system which allows for a reduced resource depletion through water abstraction as well as a reduction in emissions related to energy savings.

Turning to the negative impact of the implementation of the project, the following **negative externalities** are to be taken into account, as an economic cost:

4. CO₂ emissions from sludge digestors, based on a quantification of gas production and related CO₂ portion.
5. CO₂ emissions from sludge transport to disposal sites, based on quantification of dehydrated sludge and other waste from the WWTPs (screenings, grid) to be transported to a sanitary landfill and to surrounding agricultural fields.

For the project benefits under category 1 and 2 above, the approach is based on unitary values identified in a study performed by Ecotec for an assessment of the benefits to comply with environmental acquis.

The results of this assessment are included in the report "*The benefits of compliance with the environmental acquis for the Candidate Countries*"⁵⁴. These Guidelines relies particularly on the methodological approach and findings of part C of the above mentioned study, focused on the implementation of Water Directives.

The monetisation of benefits of category 3 above, as well as negative externalities are based on estimates provided by MESD. The price for CO₂ emission is based on the latest scenarios published by EIB.

18.1.2 A4.2 Improved access to drinking water services

The ECOTEC study uses the result of other studies to estimate the WTP for the benefits for three impacts categories related to the implementation of all water related directives:

1. Benefits to human health from cleaner drinking water;
2. Benefits to users of water bodies (lakes and rivers) for bathing; and
3. Non-use benefits due to better water quality in rivers.

This is only a subset of the total identified benefits in the ECOTEC study, which is limited by the difficulties encountered in providing a monetary value to all benefits. The first benefit is discussed in this section, while the other two in the following section.

⁵⁴ Available at http://ec.europa.eu/environment/enlarg/benefit_en.htm

As a result of the project, benefits of improved drinking water will accrue to households that have a new connection to water supply, and to households that already have water supply, but are guaranteed better quality water and more reliable supply. In practice, the benefits will relate to both new access to supply and to availability of improved drinking water.

These types of benefits are generally difficult to estimate, and their monetisation is normally done on the basis of willingness to pay surveys conducted with a representative sample of the potential customers. Since such surveys are currently not available for Romania, it is recommended to use a benefit transfer approach, where the willingness to pay is inferred from other studies, under appropriate assumptions.

Based on other studies, ECOTEC identify the WTP for cleaner drinking water as ranging between 6.58 and 114.17 Euro/household/year in 1999 values, which in 2008 values become respectively [10] and [175] Euro/household/year⁵⁵.

The ECOTEC study recognized that the upper limit shall be surely considered as more representative of the real WTP and justify the assumption that this WTP concerns both unconnected and already connected households.

To that extent, for the calculation of this benefit is recommended to use as a starting value for the analysis of **[148] Euro/household/year** (85% of the upper value).

This will have to be calculated for all households in the service area concerned by the project.

Since WTP measures generally depend on income levels, annual values will have to be projected by increasing them following real per capita GDP growth over the project reference period (in line with the assumptions presented in Annex 2).

18.1.3 A4.3 Benefit for improved quality of bathing and other surface waters

18.1.4 This second benefit refers to the use value of an improvement in the quality of water bodies in the region under consideration. This is linked to the benefits accruing to people undertaking water related recreational activities.

Based on survey performed for Hungary, ECOTEC calculate the WTP for such benefit for Romania in an average of 13.3 Euro/person/year in 1999 values, which in 2008 values equals **[20.4] Euro/person/year**.

Given the characteristics of the original study and due to the fact that the local communities are likely to be the first one ready to pay for improved water bodies condition in their surrounding, the values above are considered realistic.

This benefit has to be calculated for the whole population living in concerned area (the County).

The ECOTEC study provides also an estimate for the non use value of an improvement in the water bodies as a result of pollution prevention. In 2008 values, this will be ranging between 0.004 and 0.011 Euro/household/km of river/year.

However the choice of the value depends on the specific conditions of the water bodies in the areas under analysis. To that extent, an assessment of such conditions in the technical feasibility study is a needed to justify the monetization of this benefit according to these lines.

Since WTP measures generally depend on income levels, annual values will have to be projected by increasing them following real per capita GDP growth over the project reference period (in line with the assumptions presented in Annex 2).

⁵⁵ According to Eurostat data, in the period between 1999 and 2007, Romania have experienced an average real GDP growth rate of 4.88% per annum. The calculations in this document are based on the assumption that this is equally transferred on GDP/household.

18.1.5 A4.4 Resource cost savings to customers

Resource cost savings to the customers are avoided capital and O&M cost for drinking water wells and septic tanks. New users connected with the project to drinking water and sewage collection system would not need to use private wells and septic tanks, which involve annual capital and O&M expenditures.

The total cost savings (Opex+Capex) per person has been estimated by MESD in 315 Euro/household/year for the operation of a private well⁵⁶ and 348 Euro/household/year for the operation of a septic tank⁵⁷.

Connection to the water supply system would also substitute the consumption of 1,5 bottle of mineral water per person/day.

The saving applies to the customers that are going to be newly connected by the project.

A realistic assumption on cost savings related to the connection of non-residential users, per economic agent, shall be developed in the individual analysis.

18.1.6 A4.5 Resource cost savings to operator

18.1.7 Since avoided O&M costs are already taken into account when performing an incremental analysis, resource cost savings to the operator shall be considered in term of i) avoided opportunity cost of water and ii) avoided emissions due to energy savings.

Through loss reduction and other efficiency measures envisaged in the project, less raw water has to be abstracted, i.e. more water will be available for alternative purposes or left in the natural environment. The value to monetise the avoided opportunity cost of water could be set at the level of the fee for water abstraction paid to Apele Romane.

A reduction in overall energy consumption brought forward by the project both in term of energy saving and in-house energy production, if relevant, will result in a reduction in CO₂ emissions. The extent of such reduction shall be considered in the feasibility studies to assess its relevance.

The proposed values to monetise the reduction in CO₂ emission are in line with the latest EIB energy price scenario, going from 25 EUR per tonne of CO₂ until 2010, and then assuming a gradual increase to 45 EUR per tonne of CO₂ until 2030⁵⁸.

18.1.8 A4.6 Negative Externalities

When relevant to the technical solutions envisaged in the project, the economic analysis will have to take into account, as economic costs:

CO₂ emissions from sludge digestors, based on a quantification of gas production and related CO₂ portion, to be justified in the technical feasibility study.

CO₂ emissions from sludge transport to disposal sites, based on quantification of dehydrated sludge and other waste from the WWTPs (screenings, grid) to be transported to a sanitary landfill and to surrounding agricultural fields.

⁵⁶ Based on an annual cost per person of 110 Euro and an average household size of 2.87 persons.

⁵⁷ Based on an indicative estimate for Opex of 90 Euro/person/year, and Capex of 90 Euro/household/year, and an average household size of 2.87 persons. It is very important to note that for these calculations, and thus for a valid benchmarking, it has been considered the cost of a "correct individual treatment systems": composed of tanks acting as pretreatment (settler + digester) before drain systems. If the "correct individual treatment (tank + filtration / drain) is not always technically possible (for ex insufficient surface, slope, impermeable soil,...) then the "reservoir" option could be needed as fall back position.

⁵⁸ Clean Energy for Europe, a reinforced EIB contribution. Available at <http://www.eib.org/about/publications/clean-energy-for-europe.htm>

To ensure consistency, the corresponding increases in CO₂ emissions needs to be monetised according to the same price scenario used in the previous section.