Modernization of local public services in the Republic of Moldova

- Intervention area 2: Regional planning and programming -

Feasibility study

for the project „Optimisation of operation and maintenance costs for water supply and wastewater services in the town of Edinet and town of Cupcini”

Final report

December 2015

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Chisinau, December 2015

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Acronyms and abbreviations

ADA	Austrian Development Agency
AMAC	Association “Moldova Apa-Canal”
ANRE	National Agency for Energy Regulation
ASAD	Active Sludge Aeration Tanks
ATU	Autonomous Territorial Unit
BAU	Business as Usual
BOD	Biochemical Oxygen Demand
CBA	Cost-Benefit Analysis
CCTV	Closed-circuit television
CNAS	National Social Insurance House (Casa Națională de Asigurări Sociale)
COD	Chemical Oxygen Demand
CzDA	Czech Development Agency
DMA	District Metering Area (zone for active leakage control)
DR	Development Region
DRC	Development Region Centre
DRN	Development Region North
DRS	Development Region South
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
EIM	Environmental Impact Assessment
ENPV	Economic Net Present Value
ERR	Economic Rate of Return
ESA	Environmental and Social Assessment
EU	European Union
EUR	Euro- official currency of the European Union's member states
FFE	Foreign Funded Enterprises
FIDIC	Fédération Internationale des Ingénieurs Conseils (frz.) - International Federation of Consulting Engineers (engl.)
FNPV(C)	Financial Net Present Value of the Investment
FNPV(K)	Financial Net Present Value of the Capital
FOPIP	Financial and Operational Performance Improvement Programme
FRR(C)	Financial Rate of Return of the Investment
FRR(K)	Financial Rate of Return of the Capital
FS	Feasibility Study
GD	Government Decision
GDP	Gross Domestic Product
GIZ	German Development Cooperation through Deutsche Gesellschaft für Internationale Zusammenarbeit
GPS	Global Positioning System
HDPE	High-density polyethylene
IFA	International Financing Agency
IFI	International Financial Institution
IFO	Institute of Financial Operations
IIC	International Insurance Company
IMF	International Monetary Fund
IPE	Individual Private Enterprise
IRR	Internal rate of return
IWA	International Water Association
JSC	Joint Stock Company
KfW	Kreditanstalt für Wiederaufbau (KfW German Bank for Development)

LGA	Local Government Association
LIP	Long-Term Investment Programme
LPA	Local Public Administration
LT	Long term
Ltd.	Limited Liability Company
MBBR	Moving Bed Biofilm Reactor
MDL	Moldovan Lei
ME	Municipal Enterprise
MLPS	Modernization of Local Public Services
MoE	Ministry of Environment
MRDC	Ministry of Regional Development and Construction
MT	Medium term
MWWPS	Main Waste Water Pumping Station
n/a	Not available
n/f	Not functional
NBS	National Bureau of Statistics
NDS	National Development Strategy
NEF	National Ecological Fund
NFRD	National Fund for Regional Development
NHIC	National Health Insurance Company
NIF	Neighbourhood Investment Fund
NIS	Network Information System
NP	Nominal Pressure
NPV	Net present value
NRW	Non-Revenue Water
OD	Outside Diameter (of pipe)
PAAS	Water Supply and Sanitation Plan
PAI	Project Area of Influence
PE	Population Equivalent
PE60	Population Equivalent based on 60 g BOD/capita/day
PH	Phase
PIP	Priority Investment Programme/Plan
PIU	Project Implementation Unit
PP	Poly-propylene
PPC	Possible Project Concept
PPP	Public-Private Partnerships
PS/WPS/WSPS	Water (Supply) Pumping Station
PVC	Polyvinyl chloride
PWG	Project Working Group
Qdmax	Maximum daily dry weather flow
QDWF	Maximum hourly dry weather flow
QSWF	Maximum hourly storm water flow
RDA	Regional Development Agency
RDS	Regional Development Strategy
RM	Republic of Moldova
ROA	Return on Assets
ROC	Regional Operating Company
ROE	Return on Equity
RPP	Regional Planning and Programming
RSP	Regional Sector Programme
RtG	”Ready-to-go” Project

SCADA	Supervisory Control and Data Acquisition
SDI	State Design Institute
SEE	State Ecological Expertise
SEI	State Ecological Inspectorate
SGAP	Social and Gender Action Plan
SN	Sewerage network
SNiP	Norms and Rules in Construction
SoE	State-owned Enterprise
ST	Short term
TA	Technical Assistance
TC	Trading company
TP/WTP	Water Treatment Plant
USAID	United States Agency for International Development
VAT	Value-Added Tax
VPC	Viable Project Concept
WB	Word Bank
WDS	Water distribution networks
WSS	Water Supply and Sanitation
WT	Water Tower
WWPS	Waste Water Pumping Station
WWTP	Waste Water Treatment Plant

Glossary

The main definitions used in this document are following:

Aquifer – underground layer of rock or other types of geological layers with a porosity and permeability able to allow a significant flow of underground water or to capture significant quantities of underground water.

Water transmission main – a part of water supply system, comprising pipelines included between water intake and public transportation or distribution networks.

Agglomeration – an area where the population and/or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to an urban waste water treatment plant or to a final discharge point *(definition according to Directive 91/271/EEC)*.

Water supply – overall activities and works carried out with the aim to capture treat, transport, store and distribute drinking water to the final consumers.

Raw water – Intake water before any treatment or use.

Water sold – authorised water consumption which is billed and generate revenue (also known as revenue water). It is equal to billed and metered water consumption plus the billed unmetered water consumption.

Non-revenue water (NRW) – is the difference between the total system input volumes of water and the billed authorized water consumption.

Drinking water –water intended for human consumption, to be used directly or indirectly, for a long period of time without affecting negatively the health, which is as follows:

- All water either in its original state or after treatment, intended for drinking, cooking, food preparation or other domestic purposes, regardless of its origin and whether it is supplied from a distribution network, from a tanker, or in bottles or containers;
- All water used in any food-production undertaking for the manufacture, processing, preservation or marketing of products or substances intended for human consumption, unless the Ministry of Health and Ministry of Agriculture and Food Industry approved the use of water for technological purposes, showing that water used do not affect the quality and wholesomeness of the food stuff in their ready to use condition/state;
- Water from local sources, such as wells, springs, etc., used for drinking, cooking meals or other domestic purposes.

Treated water – water that is intended for human consumption and use, considered to be free of toxic substances and pathogenic bacteria, cysts and viruses; good drinking water that has been or will be further treated in order to improve the aesthetic quality and/ or reducing the content of undesirable minerals and other substances known or unknown, by one or more water treatment processes on the site where it is used.

Surface water – still water and flow water having contact with the soil surface.

Storm water – is pure rainwater plus anything the rain carries along with it and snow melting.

Groundwater – waters below the soil surface, in the zone of saturation and in contact with the soil or the subsoil.

Industrial wastewater – any waste water which is discharged from premises used for carrying on any trade or industry, other than domestic wastewater and run-off rain water.

Domestic wastewater – waste water from residential settlements and services which originates predominantly from the human metabolism and from household activities (definition according to EU Directive 91/271/EEC).

Urban wastewater – means domestic waste water or the mixture of domestic waste water with industrial waste water and/or run-off rain water.

Wastewater –waters that come from domestic, social and economic activities, containing pollutants or residues, this water being adversely affected in quality by anthropogenic influence, the physical, chemical and bacteriological baseline being changed.

Water service connection – a segment of the public water supply network, which provides the link between the water distribution network and internal piping of the buildings.

Service connection – the realisation by the operator of public water supply and sewerage networks of a permanent connection of the consumer's water and / or sewage facility to public water supply and / or sewerage networks.

Water tower – an elevated structure supporting a water tank constructed at a height sufficient to pressurize a water supply system for the distribution of drinking water, and to provide emergency storage for fire protection. The water tower is composed of a metal, reinforced concrete or varied shape bricks reservoir (usual spherical one) and pillar for support.

Manhole – underground construction designed for the protection and access to the flow control valve for water, drain, ventilation, etc.

Concentration – mass-volume ratio of the total volume of wastewater discharged within a certain timeframe.

Pipeline – assembly of pipes, by means of which the water is transported.

Pressure pipe – rising pipe for transportation under pressure of water or wastewater.

P.E. (population equivalent) - means the organic biodegradable load having a five-day biochemical oxygen demand (BOD5) of 60 g of oxygen per day.

Consumer – person or organisation that uses water supply and wastewater services or commodities according to a contract with the operator.

Biochemical oxygen demand (BOD) – is the amount of dissolved oxygen needed (i. e., demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period or the concentration of dissolved oxygen, in the given conditions (t days at 20 degrees Celsius with or without nitrification inhibition) by biological oxidation of organic material and / or inorganic water.

Chemical oxygen demand (COD) – the concentration of the oxygen required to oxidise soluble and particulate organic matter in water.

Water quality indicators –pollutants values, based on scientific researches, developed and updated by competent national authority. The concentration criteria and rec-

ommended values, or narrative descriptions that should not be exceeded for a water body to protect aquatic life or human health.

Volume of water/water flow rate – is the volume of fluid which passes through cross-section pipe within a unit time.

Biological treatment – the biological treatment of wastewater using a biological process with a secondary settlement or another process, which complies with actual national standards.

Mechanical treatment – treatment of waste water by means of a physical process and/or chemical process, involving settlement of suspended solids or other processes in which the BOD_5 of the influent wastewater is reduced by at least 20%, and suspended solids at least 50%.

Tertiary treatment (advanced) – treatment process which results in a more advanced treatment than that obtained by mechanical and biological wastewater treatment or it is the additional process designed to improve the quality of purified water so that it can be discharged into the natural environment or re-used.

Septic tank – is an underground reservoir designed for wastewater obtained from a household. Bacteria from wastewater decompose organic waste and sludge deposits on the bottom of the tank. The effluent flows into the soil through the drainage channels.

Drinking water supplier – business entity, which supply drinking water to consumer on a centralised basis.

Spring – the place where the underground water, meeting the hydrogeological favourable conditions, is brought to the ground surface (if the water carrying permeable water bed which ends top-down at the ground level on an impermeable bed, the water bed can only reach the surface to form springs).

Underground dam – a watercourse (lake) embanked by a dam, levee, dam or other barrier. It is used for collecting and storing water to a future use.

Suspended solids (SS) – the concentration of solids in a liquid, usually determined by filtering or centrifuging and then drying under specified conditions.

Groundwater level – level under which the soil is saturated with water.

Real water consumption (specific water flow rate) – the volume of water consumed by one customer during 24 hours to meet the physiological and domestic needs under normal and exceptional operation conditions of the water supply system (l/c/d).

Sanitary and hygienic (quality) standards for drinking water – physical-chemical, microbiological and organoleptic indicators which drinking water must meet in order to endanger the health consumption; indicators are established in sanitations rules and standards approved by the Government.

Operator – a legal person operating and maintaining a public water supply and/or sanitation system providing the consumers with public water supply and/or sanitation services based on a direct contract.

Sludge - means residual sludge, whether treated or untreated, from urban waste water treatment plants.

Sludge dewatering - drying and sludge dewatering structure by removing water and evaporating it.

Apparent (water) losses/commercial losses - including all types of errors associated with consumer metering and data processing errors (meter reading and billing), plus unauthorized consumption (theft or illegal use).

Water loss - is a quantity of water, which leaks from installations or network because of poor tightness of pipe joints, emergencies and etc. Determinative factors are: pressure, deteriorated conduits, low quality of pipes materials and execution, soil characteristics, traffic loads, corrosion of pipelines (due to vagabond electric current), grade and type of measurement.

Real (water) losses/physical losses - involving leaks and spills from tanks/reservoirs, losses related to pipe connections up to counter and water transport and distribution pipes leaking up to the consumer's meter.

Water supply and sanitation program (WSSP) - is a document planning investments for the long term development of the water supply and sanitation infrastructure, worked out for a specific region, rayon or locality (municipality, city, village, commune), so as to perfectly fit the existing systems as well as the funds and constraints related to the local water sources and the provisions of the law in force.

Water intake structure - all construction structures and facilities which serve for the introduction of the necessary volume of water in the water transmission main (abstracted from a river, lake, reservoir, etc.) with the purpose of water supply or irrigation.

Sewer connections – sewer collector provides the connection between the indoor consumer sewer facility and public sewer collector.

Water resources - sources of water that are useful or potentially useful including surface waters, ground water and atmospheric precipitations/rainfall which fell on the territory of the Republic of Moldova.

Sewerage network - a system of underground pipelines and additional structures collecting and transporting urban and/or industrial wastewater.

Water distribution network - created from pipelines, armature and other structures which supplies water to consumers. It is the most expensive facility/object, because of lengths, service works and water losses.

Underground water reservoir - storage of water volume needed to: compensate the consumption per hour, emergency reserves and reserves required for firefighting.

Water supply system – a set of constructions and sites, operating installations/facilities, and specific endowments, by which the water captured from a natural source is treated, transported, stored and distributed to the consumers based on a stable pressure, according to the quantity and quality norms in force.

Wastewater system – a number of structures and facilities, networks, pumping stations, wastewater treatment plants etc. by which the evacuation, transportation, treatment and disinfection of wastewater and sludge management is carried out. Treated and disinfected wastewater is discharged into a water stream or other natural water body.

Drilled or shallow well - underground water intake construction/structure, which main dimension is developed by vertical line, aiming to reach the ground water resources; structure or installation/facility used with the purpose to obtain groundwater from an aquifer for an advantageous use.

Water quality standard - concentrations/ maximum admissible values recommended or mandatory for chemicals and microorganisms in drinking water. These amounts are

established for the water used by municipalities (provided by public water supply systems), industrial and agricultural enterprises, and entertainment areas.

Wastewater treatment plant - consisting of all wastewater treatment installations; their size and form varies according to the adopted methods of treatment; mechanical treatment consists in removing of suspended solids by physical processes from wastewater; the biological treatment uses the activities of microorganisms to oxidize and mineralize the organic substances in wastewater, which previously was subjected to a mechanical treatment.

Water pumping station - to ensure on demand the required pressure in the distribution network.

Wastewater pumping stations –the pumping stations to be provided and designed in cases when configuration of the relief does not give possibility to collect and transport wastewater gravitationally. In such cases wastewater is pumped by pressure pipelines.

Water treatment plant - used for enhancing the quality of raw water from the river to the water quality criteria necessary for human consumption.

Water supply source - water natural resource (surface water, groundwater, etc.) to be used (or could be used) with the purpose to abstract water in the water supply system.

Sludge Treatment - all stages of transformation of sludge with the purpose to be used or disposed which could include thickening, stabilizing, conditioning, thermal hydrolysis, dewatering, drying, disinfection, sludge incineration.

Pipe – unit/piece in the cylindrical form, hollow in interior, made of metal, plastic, etc. and used for the distribution and transport of water and wastewater.

Sanitary protection area – unique territory, which includes water sources, constructions and water supply installations/facilities, for water protection.

Executive summary

Since 2010, the Modernization of Local Public Services Project (MLPS), acting on mutual agreement between Moldovan and German governments, has supported Moldovan Local Public Administrations (LPAs) in extending and modernising service provision in water supply and sanitation, solid waste management, regional and local roads, and energy efficiency of public buildings sectors.

The MLPS Project has the objective to improve the local public service delivery by local planning and programming, improving local public services infrastructure, capacity development of local public administration and local public service providers. As part of a major planning and programming programme, MLPS committed to facilitate the development of pipeline of feasible, cost-effective investment projects in the aforementioned sectors.

This Feasibility Study (FS) Report proposes a structured phasing of the **Priority Investment Programme (PIP)** and creating necessary conditions for further implementation of the PIP in **Edinet Rayon**. The FS particularly focuses on implementation of the first phase of the PIP, covering period of 2015-2018 and further named **the Project**.

The PIP includes both Edinet and Cupcini towns. The Project includes Edinet town only.

Main beneficiaries of this study are the inhabitants from the above-mentioned localities, which will have access to improved Water Supply and Sanitation (WSS) services.

Problem statement and Objective

The following major problems to be addressed in the feasibility study were identified during the preliminary project phases:

- Insufficient area coverage of the WSS services. While most of the town of Edinet benefit from water supply, the wastewater services are provided only to a limited urban area;
- Unsatisfactory levels of service, including:
  - Continuity of water and wastewater services. Urban consumers have often interruptions supply due to bursts, leakages and insufficient network pressure. The average supply time is 16 hours per day. Certain parts of the town continuously suffer of sewer blockages.

As for the operational efficiency, the main problems encountered by the company are, as follows:

- High non-revenue water (NRW) ratio. Increased level of NRW results (around 71% in 2014) results in higher energy consumption for water pumping and consequently increased water tariffs;
- High staff efficiency ratio, as a result of inefficient operation of facilities and overstaffing of the utility;
- Poor asset management and lack of preventive maintenance, resulting in obsolete pipelines and facilities.

The **objective** of the present feasibility study is the development of an affordable, least-cost and cost-effective phased investment programme for water and wastewater

infrastructure to be rehabilitated and extended, as well as facilitation of regionalisation of the WSS services.

The aim of the PIP is to extend the coverage and connection rates of the population connected to the regionalised water supply services by 21% from 79% to 100% of coverage rate and by 15% from 77% to 92% of connection rate, as well as increase of coverage and connection rates to wastewater services by 27% from 62% to 89% of coverage rate and by 17% from 46% to 63% of connection rate.

The aim of the first phase (the Project, 2015-2018) for the town of Edinet is to extend the access of the population to the water supply services by 4% from 79% to 83% of coverage rate and by 3% from 77% to 80% of connection rate.

Legal aspects

In the process of regulating and developing the water supply and wastewater services sector the competences belong to the central public authorities; the establishment, organisation and management of these services is the responsibility of local administration and operators of public water supply and wastewater services.

The main sector policy document, Strategy for Water Supply and Sanitation (2014-2028) includes new approaches on structuring, financial planning and project identification, on which should be based sector development and institutional reforms in the sector in order to overcome excessive fragmentation through regionalisation.

"*Regionalisation*" is the main aspect of the development policy of the water supply and wastewater services sector. This policy aims to improve sector performance through better management and professionalism, and benefiting from economies of scale as well.

Currently, the public water supply and wastewater services are organised and operated in the town of Edinet and town of Cupcini by ME ‘Apa–Canal’ Edinet.

Taking into consideration the national WSS policy, and the positive aspects of regionalisation of WSS public services learnt from international experience, it is recommended to promote the joint operation and development of the services and infrastructure projects. This policy was supported unanimously by the local authorities in the administrative units of Edinet and Cupcini.

The institutional model of regionalisation of water supply and wastewater public services in Edinet Rayon, developed under the current legislation, comprises two key elements:

- Regional Operator;
- Delegated management contract which regulates the relationship between regional operator and local authorities.

Regionalisation of water supply and wastewater services will involve the extension of service area in all localities included in the Feasibility Study, initially in the urban areas, and afterwards in the rural areas. The existing organisational structure of the ME ‘Apa – Canal’ Edinet will require significant changes in order to cover the increasing demands of expanding service area.

Technical aspects and investment programme

The Investment Programme includes:

- Short-term;

- Medium-term;
- Long-term measures.

The short-term measures are referred to as *Priority Investment Measures* and are again sub-divided into two sub-phases as follows:

- Phase 1 – priority measures to be implemented until 2018;
- Phase 2 – priority measures to implemented between 2018 and 2021 (depending on the availability of funds and the capacity of the implementing and operating agency this period might be extended).

Priority investment measures retained in Phase 1 are referred to as “The Project” for which further assessments have been carried out (Option Analysis, Financial Analysis, Environmental Assessment, etc.) in this study.

Investment framework:

Water Supply:

In Edinet there are 14,507 people (80%) and in Cupcini 6,439 people (72%) currently connected to the water supply system. The LPA plans to extend the water supply networks in both localities. There is no supply shortage for the service area of the ME ‘Apa-Canal’ Edinet as the current production capacity of 9,000 m³/d is more than sufficient to cover the current as well as the long-term water demand of the serviced area. However, the water treatment plant is already quite outdated and NRW is high (71% of the production).

The water quality provided in the service area does not reliably comply with the national standards for drinking water quality, depending on the respective raw water (surface water) quality. In order to provide a reliable water quality to the consumer, it is proposed to replace the water treatment plant, starting with 2021. Due to the poor building structure and the outdated electro- mechanical equipment of the existing plant, rehabilitation is not considered.

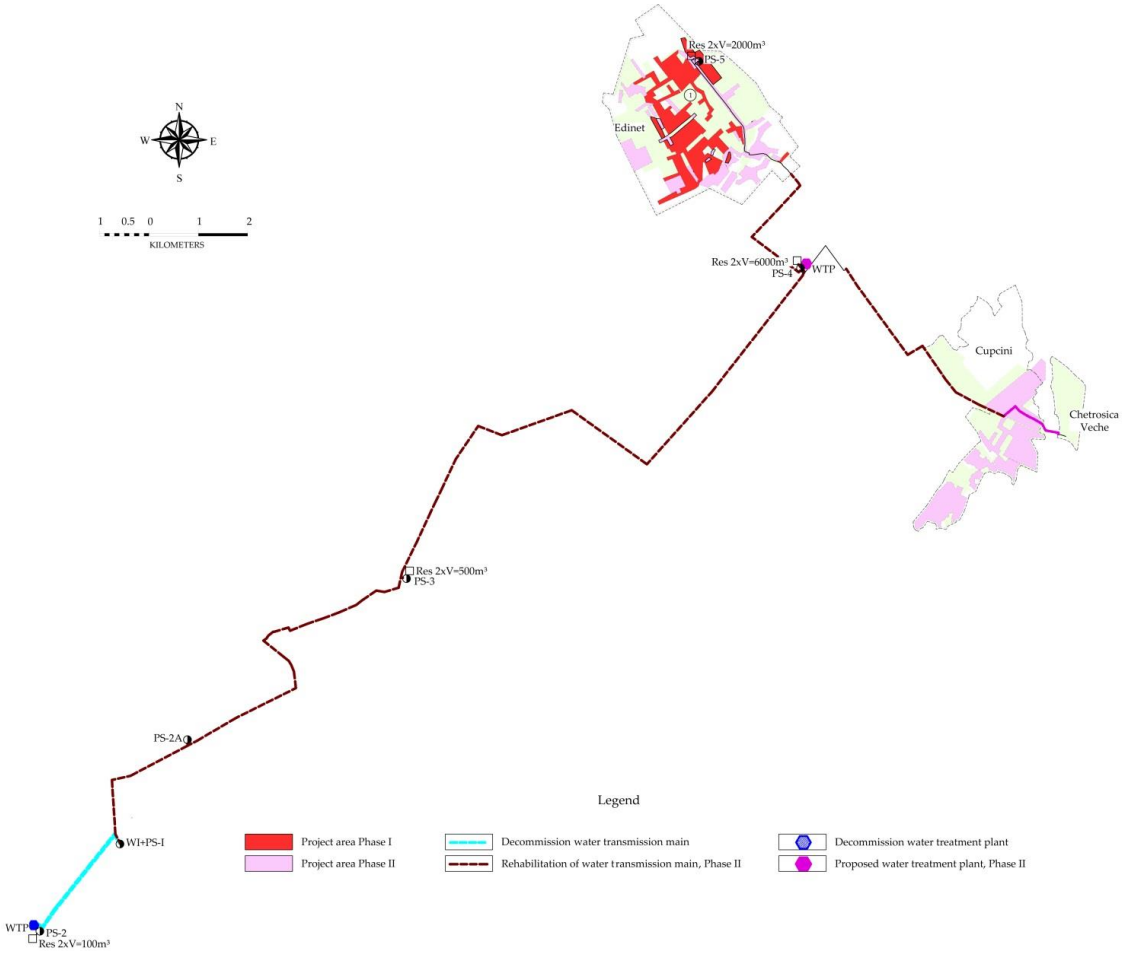
In order to increase the efficiency of the water supply system it is recommended to put the focus in Phase 1 on the reduction of NRW and on operational improvements. Therefore, the rehabilitation of the existing water distribution network in Edinet and Cupcini, and the rehabilitation of the transmission main from the water extraction to Edinet and Cupcini with a length of about 32 km is proposed. All these facilities are in large parts older than 30 years.

Further it is proposed to enlarge the service coverage area within Edinet and Cupcini in order to make use of economies of scale and to improve service quality and living conditions for the population.

Most of the pumping stations and water storage facilities have been rehabilitated in 2004 and are in satisfying condition and do not need any rehabilitation in a short-term.

For the medium-term, it is recommended to further optimise the network operation in Edinet and Cupcini, based on the results of the detailed investment plan to be prepared in the frame of the Water Supply Network Analysis and Water Loss Reduction Programme included in the technical assistance measures in Phase 1.

Figure 0-1: Scheme of the existing and proposed extensions of the water supply system in the towns of Edinet and Cupcini



Wastewater:

Currently the towns of Edinet and Cupcini are partly endowed with an existing wastewater system. In Edinet 8,293 people (46%) and in Cupcini 4,208 people (47%) are currently connected to the sewerage network. The LPA plans to extend the wastewater system in both localities.

The wastewater treatment plant is in operation however, already quite outdated and can serve for the short-term only. Further the current capacity of the wastewater treatment plant is not sufficient for an extended wastewater system.

In order to develop the wastewater infrastructure in the rayon, agglomerations (as per EU-definition “an area where the population and/or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to an urban waste water treatment plant or to a final discharge point”) have to be defined for the entire rayon. Further, an assessment (option analysis) will be necessary to decide which of these agglomerations should be grouped to be connected to a Wastewater Treatment Plant (WWTP). It is recommended to include this analysis in a technical assistance component to be implemented in Phase 1.

In order to improve the collection and treatment of wastewater in Edinet (current population of 18,211) and Cupcini (current population of 8,916) it is proposed to extend the

sewerage networks including five WWPS and pressure lines to pump the wastewater to the WWTP.

Further the existing sewer as well as pressure lines will be rehabilitated in order to increase the efficiency in the wastewater collection.

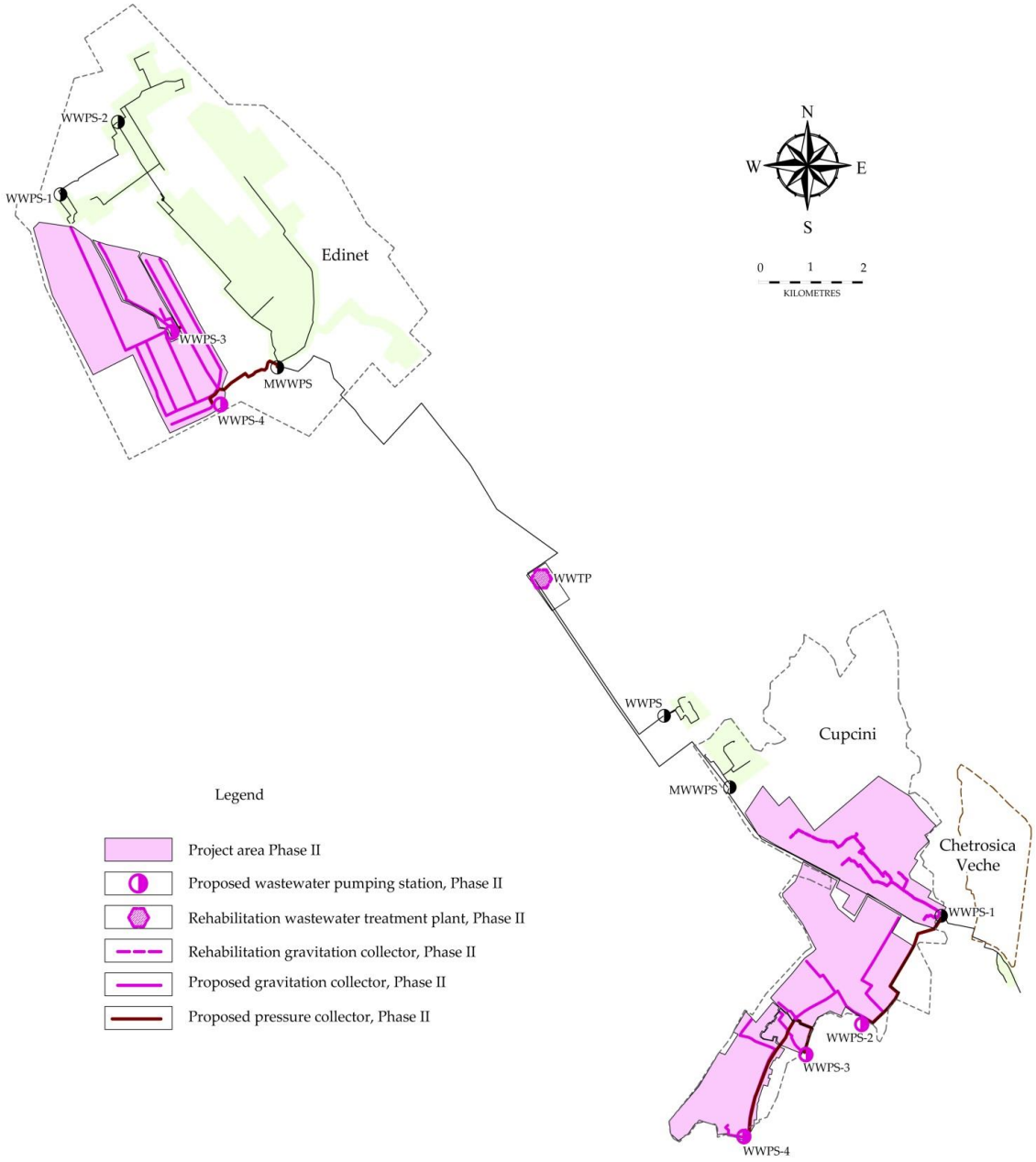
In the short term (until 2020), it is recommended to continue using the existing WWTP Edinet for treating the wastewater from the drainage areas of the existing network. The Consultant's assessment reveals that due to the condition of the WWTP and its limited capacities a new wastewater treatment plant shall be operated from 2021 onwards.

The connection rate in the town of Edinet will reach about 57% after Phase 2 and will linearly increase to 95% in 2045.

Wastewater generated in Edinet and Cupcini will increase from currently 14,507 P.E. to 20,298 P.E. in 2021 and is projected then to increase to 32,052 P.E. in 2045.

The design capacity of the future WWTP will depend on the above mentioned agglomeration analysis, depending on the number of possible localities to be connected in future to the WWTP in Edinet. Further planning shall be based on the results of the technical assistance-study to be carried out in Phase 1. For the investment costs estimations in this study a WWTP of a capacity of about 30,000 PE for Edinet and Cupcini is calculated. This should not be understood as presumption of the result of the proposed analysis. The WWTP shall in any case be designed in a way which allows a phased extension.

Figure 0-2: Scheme of the existing and proposed extensions of the wastewater system in the towns of Edinet and Cupcini



Priority Investment Plan

The proposed Priority Investment Plan for Phase 1 and Phase 2 including capital investments, equipment and technical assistance as well as the benefit of the proposed measures is presented in the table below. The total cost for the measures in Phase 1 amount to about 2.9 MEUR and 15,717 people will benefit from the proposed measures. The total costs for measures proposed in Phase 2 amount to about 35.6 MEUR and 18,165 people will benefit from the measures. The total project costs for Phase 1 and Phase 2 amount to 38.5 MEUR.

Table 0-1: Proposed investment measures Phase 1 ("The Project")

N°	Measure	Costs [€]	Benefit
1	Capital Investment		
1.1	Rehabilitation of the water distribution network in the town of Edinet (22,435 m)	1,506,615	Level of service and efficiency improvement for all people covered with water supply (15,717 in 2018)
1.2	Extension of the water distribution network in the town of Edinet (4,520 m)	381,120	Water supply coverage rate is increase from 80% to 86% (additional 1,071 people served)
1.3	Equipment and Tools for operational performance improvement	200,000	Level of service and efficiency improvement for all people covered by the water supply and wastewater system (15,717 in 2018)
ST-1	Sub-Total Capital Investment	1,520,716	
2	Technical Assistance	550,528	Level of service and efficiency improvement for all people covered by the water supply and wastewater system (15,717 in 2018)
3	Contingencies (10% of 1+2)	263,826	
GT-1	Total Costs for Phase 1	2,902,090	Additional 1,071 people will be served with water supply. In total 15,717 people will benefit from the water supply measures.

Source: GIZ/MLPS

Table 0-2: Proposed investment measures Phase 2

N°	Measure	Costs [€]	Benefit
1	Capital Investment Edinet		
1.1	Rehabilitation of the water transmission mains, from PS1 to PS2A, from PS2A to PS4, from PS4 to water distribution network Edinet town (48,450)	5,156,050	Level of service and efficiency improvement for all people covered with water supply in Edinet and Cupcini (27,081 in 2021)
1.2	Construction of water treatment plant in Edinet (serving for Cupcini as well)	2,000,000	Level of service, health situation and efficiency improvement for all people covered with water supply in Edinet and Cupcini (27,081 in 2021)
1.3	Extension of the water distribution network in the town of Edinet (15,705 m)	1,169,795	Water supply coverage rate is increase from 86% to 100% in Edinet (additional 2,448 people served)
1.4	Rehabilitation of the water distribution network in the town of Edinet (3,245 m)	441,080	Level of service and efficiency improvement for all people covered with water supply in Edinet (18,165 in 2021)
1.5	Extension of the sewerage network (18,620 m) and pressure mains (975 m), construction of two wastewater pumping stations in the town of Edinet	3,559,778	Wastewater coverage rate is increased from 67% to 87% in Edinet (additional 3,473 people served). Level of service and efficiency improvement for all people covered with sanitation in Edinet (15,763 in 2021); Improved environmental performance;
1.6	Rehabilitation of the sewerage network (7,492 m) in the town of Edinet	1,236,163	Level of service and efficiency improvement for all people covered with sanitation in Edinet (15,763 in 2021)
1.7	Construction of wastewater treatment plant in Edinet 30,000 P.E. (serving for Cupcini as well)	7,416,750	Level of service, health situation and efficiency improvement for all people covered with sanitation in Edinet and Cupcini (24,204 in 2021) Improved environmental performance; compliance with effluent standards.
2	Capital Investment Cupcini		
2.1	Rehabilitation of the water transmission mains, from PS4 to water distribution network	315,000	Level of service and efficiency improvement for all people covered with water supply in Edinet and Cupcini (27,081 in 2021)

N°	Measure	Costs [€]	Benefit
	Cupcini town (3,500 m)		
2.2	Rehabilitation of the water distribution network in the town of Cupcini (12,205 m)	800,210	Level of service and efficiency improvement for all people covered with water supply in Cupcini (8,916 in 2021)
2.3	Extension of the water distribution network in the town of Cupcini (14,195 m)	1,059,240	Water supply coverage rate is increase from 77% to 100% (additional 2,070 people served)
2.4	Rehabilitation of the sewerage network (7,370 m) in the town of Cupcini	1,131,050	Level of service and efficiency improvement for all people covered with sanitation in Cupcini (8,441 in 2021)
2.5	Extension of the sewerage network (21,165 m) and pressure mains (3,095 m), construction of three wastewater pumping stations in the town of Cupcini	4,609,989	Wastewater coverage rate is increase from 50% to 95% in Cupcini (additional 3,956 people served). Level of service and efficiency improvement for all people covered with sanitation in Cupcini (8,441 in 2021); Improved environmental performance;
ST-1+2	Sub-Total Capital Investment	28,895,106	
3	Technical assistance	3,467,413	Level of service and efficiency improvement for all people covered with the water supply and wastewater system in Edinet and Cupcini (27,081 in 2021)
4	Contingencies (10% of 1+2)	3,236,252	
GT-1+2	Total Costs for Phase 2	35,598,770	Additional 7,429 people will be served with sanitation and 4,518 with water supply. In total 27,801 people will benefit from the water supply and wastewater measures.

Source: GIZ/MLPS

Table 0-3: Summary of investment costs Phase 1 and 2

N°	Component	Costs Phase 1	Costs Phase 2	Costs Phase 1 & 2
		EUR	EUR	EUR
1	Water supply and wastewater, capital investments			
1,1	Water supply	1,887,735	10,941,375	12,829,110
1,2	Wastewater		17,953,731	17,953,731
1,3	Equipment and tools for operational performance improvement (water supply and wastewater)	200,000		
ST-1	Sub-total capital investments water supply and wastewater	2,087,735	28,895,106	30,982,841
2	Technical assistance	550,528	3,467,413	4,017,941
3	Contingencies	263,826	3,236,252	3,500,078
Total	**Total Costs Phase 1 & 2**	**2,902,090**	**35,598,770**	**38,500,859**

Source: GIZ/MLPS

Financial aspects

The financial and economic analysis was developed using the incremental analysis, which considers the differences in the costs and benefits between two alternatives. It compares the project scenario with the baseline scenario without the project or Business as Usual (BAU) scenario, which means ‘do-nothing’.

The financial and economic analysis is developed based on the macroeconomic assumptions which include the forecast of the principal macroeconomic figures such as: GDP per capita, the Real Wages increase, evolution of Electricity Prices etc.

In two the last three years the Operator generated losses from operating activities of about MDL 151.2 thousand in 2013 and MDL 1.4 million in 2014. This reveals that the company encountered cash liquidity difficulties. In present the operator used the cash generated from depreciation to pay current liabilities, and no cash flow remains for investment purposes to rehabilitate and replace the fixed assets. As well, this means that the operator has no creditworthiness capacity at the moment.

The investment costs of the project are estimated to amount of MDL 60.31 million or EUR 2.90 million. It is planned that the project will be implemented during a period of 3 years. In the first year it is planned that the project will be implemented in proportion of 10%, in the second year it is foreseen 50% to be covered and in third year - 40%. The Summary of the investment costs are presented in the table below.

Table 0-4: Summary of the investment cost (MDL mil.)

Project investment outlays	2015 (MDL mil.)	2016 (MDL mil.)	2017 (MDL mil.)	Total (MDL mil.)
	10%	50%	40%	
Rehabilitation of water network	3.13	15.66	12.52	31.31
Extension of water network	0.79	3.96	3.17	7.92
Equipment and Tools	0.42	2.08	1.66	4.16
Detailed design and procurement	0.52	2.61	2.08	5.21
Technical assistance, supervision and capacity development	0.62	3.12	2.49	6.23
Contingency	0.55	2.74	2.19	5.48
Total	**6.03**	**30.16**	**24.13**	**60.31**

Source: GIZ/MLPS

The total investment outlays will be financed by: domestic and international donors; national sources (national development funds, local and central budgets, water operator sources) and citizens contribution.

The donor contribution was estimated to be approximately 76.3% of the total investment costs that constitutes about EUR 2.21 million, while the local sources' contribution is 23.7%, which is about EUR 0.69 million.

In the development of the financial forecast of the project was used the weighted average tariff for providing services. The proposed tariffs take into account the cost coverage principle and the tariff affordability level. The cost coverage principle means that the tariff should cover the operational costs and capital costs.

The weighted average tariff for delivering water services will decrease slowly from 23.0 MDL/m^3 in 2015 to approximately 19.70 MDL/m^3 in 2021. After that, the tariff will increase slowly to 24.65 MDL/m^3 in the period 2022-2045. During the implementation period of the investment project, when capital costs increase significantly and water sale is limited, it is proposed that the depreciation cost do not to be included in the tariff, because of high depreciation cost of new assets realized due to the implementation of investment project. The total costs (the operational costs and depreciation cost) will be covered by the mentioned tariff beginning with the year 2033.

The weighted tariff for sanitation services is estimated to be higher in the first 6 years of the project and will constitute about 12.00 MDL/m^3. After that, the tariff will decrease

and will constitute on average approximately 7.00 MDL/m^3 in the period 2021-2045. As well, the tariff for wastewater services will not include the full depreciation cost in the period 2015-2017. The total costs (the operational costs and depreciation cost) will be covered by the tariff beginning with the year 2018.

The tariff affordability rate in the whole projected period will be about 1.8%, which indicates that it is within the limits of accepted affordability threshold of 4%.

The cash flow projections for the entire reference period (30 years) reveal that the cumulative cash flow at the end of each year is positive. This is the basic financial figure that indicates that the project is **financially sustainable**. During the period of 30 years the operator will be able to generate cumulative cash flow amounted to MDL 61.28 million, which could be used for investments purposes.

The net present value (NPV) of the investment project calculated at a 5% discount rate for a 30-years operating period is negative (MDL – 41.12 million), which emphasize that the project does not generate a return and is financially unprofitable. The economic net present value (ENPV) of the investment project calculated at a 5% discount rate is MDL 86.46 million. Such as, the value of ENPV is higher than zero this indicates that from a public perspective the investment project should be implemented.

Procurement plan

In line with Moldova's policies and rules, the required public sector services and works contracts shall be awarded on the basis of open competitive tendering, which should assure a maximum of competition and transparency. The proposed procurement plan is presented in the table below.

Table 0-5: Procurement plan

N°	Description	Estimated contract value[1], EUR	Contract type	Procurement method
1	Design, engineering, and supervision for Phase 1 investments	275,581	Consulting services	Competitive
2	Construction works: Rehabilitation and extension of the water supply system in the town of Edinet.	2,076,508	Works	Open
3	Supply of equipment for operational performance improvement	220,000	Supply of goods	shopping
4	Technical assistance for: Corporate Development Programme, Stakeholder Participation Programme Water Supply Network analysis and Water Loss Reduction Programme, Medium to Long-term Sanitation Study	330,000	Consulting services	Competitive
GT	**Total amount**	**2,902,090**		

Project implementation plan

The implementation steps are based on having the funding arrangement concluded by end of 2015. The table below gives the project implementation plan for the proposed measures.

[1] Including Contingencies

Table 0-6: Project implementation plan – milestones

N°	Item	Date
1	Contract award for consulting services	30.05.2016
2	Completion of consulting services	09.06.2019
3	Contract award for works contracts	31.03.2017
4	Completion of works contract	31.12.2017
5	End of defects liability period	31.12.2018

Source: GIZ/MLPS

Environmental and social aspects

An Environmental Assessment (EA) was prepared in order to facilitate the implementation of the Project and to ensure that the envisaged Project objectives will comply with Moldova's environmental and social legislation, procedures and policies and international and EU conventions. In addition the EA Report addresses the environmental and social impacts, mitigation measures and management issues associated with the proposed objectives of the project.

According to the new law on environmental assessment (Law No. 86/29.05.2014 on Environmental Impact Assessment which is in force from beginning January 4, 2015) **none of the WSS objectives of the Project is subject to full scale EIA** on the national level.

For acquiring the environmental and construction permission it is required to prepare the documents for the State Ecological Expertise (SEE). This needs to be done in the design stage of the Project.

An assessment of the social and gender aspects was undertaken for Straseni feasibility study in May 2015 and its findings were integrated in the respective report. Given the scope of the proposed study ("no regret" measures to improve service provision) and taking into account that social and gender needs and characteristics do not differ much from a town/study to another, the conclusions reached during the field visit in Straseni are also applied to Edinet project. The tools applied in the field visit to Straseni were interviews with key stakeholders and focus groups disaggregated by gender with potential beneficiaries. Based on its findings a social and gender action plan was developed. The assessment of beneficiaries' needs and priorities by gender shows that the men and women have different needs and patterns in using the water and sanitation facilities. Therefore, these discrepancies and gaps need to be taken into consideration in the development and implementation of the Project.

1 Introduction

1.1 Preliminary and background

Since 2010, the Modernization of Local Public Services (MLPS) Project, acting on mutual agreement between Moldovan and German governments, has supported Moldovan Local Public Administrations (LPAs) in extending and modernising service provision in water supply and sanitation, solid waste management, regional and local roads, and energy efficiency of public buildings sectors.

The MLPS Project has the objective to improve the local public service delivery through local sector planning and programming, improving local public services infrastructure, and capacity development of local public administration and public service providers. As part of a major planning and programming effort, MLPS has assisted Moldovan partners to develop a pipeline of feasible, cost-effective investment projects in the aforementioned sectors.

Currently, the Water Supply and Sanitation (WSS) sector is characterised by an inadequate mid-term financial planning and a lack of a coordinated systemic approach to the development of a pipeline of priority projects. In typical practice in Moldova, investment projects are often developed based on insufficient grounds, which leads to an increased risk to project sustainability. In order to address this situation, a Water Supply and Sanitation Regional Sector Programme (WSS RSP) was developed considering all relevant international, national and sector policy documents, with the intention of contributing to the implementation of the national Water Supply and Sanitation Strategy (2014-2028). The WSS RSP includes an analysis of the current situation in the sector in the development region, a set of sectorial targets to be achieved over the medium to long-term, an action plan that identifies barriers that must be addressed in the sector in order for the investments to have their full impact and for conditions to improve in the sector, and the process, methods and criteria for identification of priority investment projects that contribute to change in the sector and the achievement of sectorial targets.

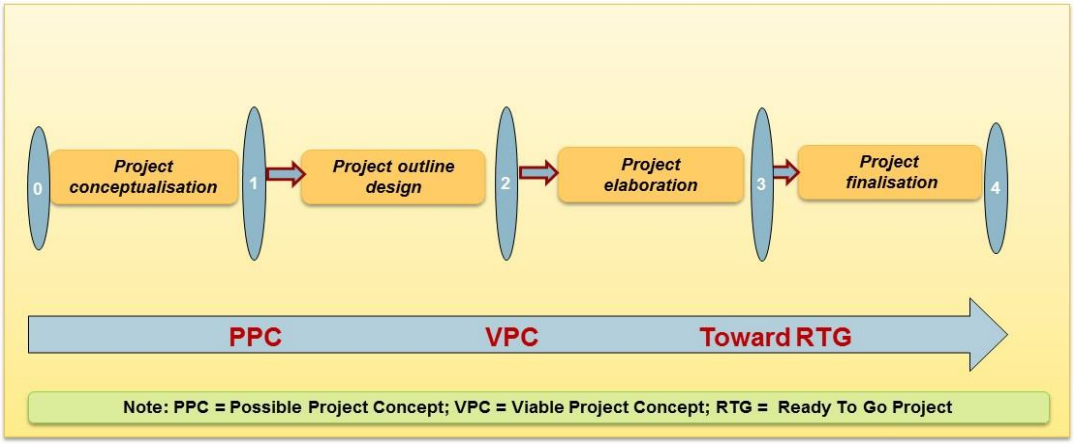
Based on the WSS sector development directions and criteria defined in the WSS RSP, a list of possible project concepts was defined for further project development.

1.2 Project Development Pathway

This feasibility study is an integral part of a comprehensive and systematic project identification and development process, defined and promoted by the Ministry of Regional Development and Construction (MRDC) as the Project Development Pathway (PDP). The Pathway Approach is the framework for implementation of the project pipeline, which, in turn, is the instrument used to carry out the investment component of the WSS Regional Sector Programmes.

The **project pipeline is developed over five stages**. If and when financing is identified, the project can be finalised and become ready for implementation (“Ready-to-Go”).

Figure 1-1: Project pipeline process in overview



Source: GIZ/MLPS

More specifically, the five stages of project development in MLPS are as follows:

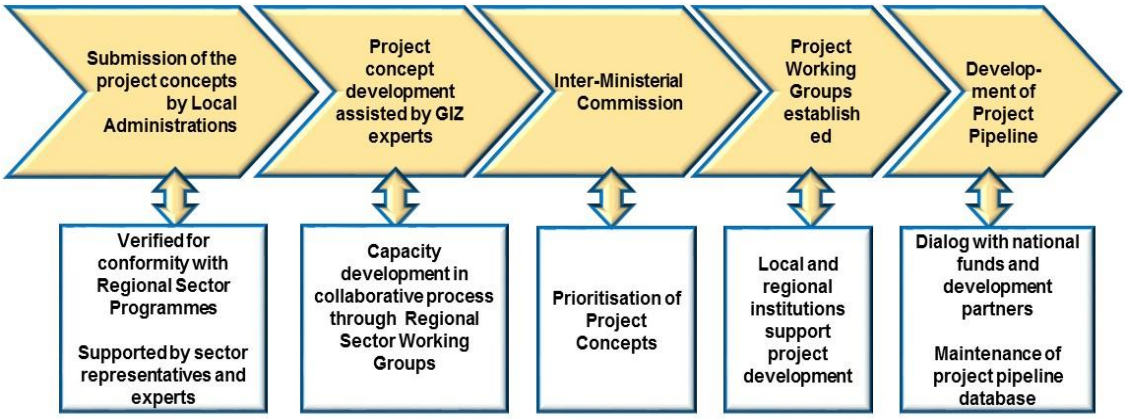
- **Stage 0 – Development of Regional Sector Programmes – Identification of Project Idea**
  In each RSP, specific process, methods, and criteria by which possible projects are identified for their contribution to the targets set out in the RSP for the sector;
- **Stage 1 – Conceptualisation (Possible Project Concept – PPC)**
  Possible project concepts are collected and screened for their compliance with and contribution to the targets of the RSP. Projects in this stage are termed "**Possible Project Concepts**";
- **Stage 2 – Project Outline Design (PPC to Viable Project Concept – VPC)**
  Project ideas that respond to a specific problem or set of problems are developed into possible project concepts and presented in brief reports outlining the objectives to be achieved by each project. Initial estimates for investment and operating costs are provided. Any potential barriers and risks to the development of the project are identified and assessed.
  Projects at the end of this stage are considered "Viable Project Concepts" and can be submitted to national and/or international agencies for further development and possible financing;
- **Stage 3 – Project Elaboration**
  Subject to availability of financial resources for further development, projects that contribute to the achievement of sectoral targets are further developed with a feasibility study, conceptual design, and EIA, as appropriate.
  Projects at the end of this stage are termed "Viable Project Concepts at Pre-final Stage" and can be submitted to national and/or international agencies for finalisation and possible financing;
- **Stage 4 – Project Finalisation**
  For the projects that have some financing commitment in place, the remaining tasks related to preparation of tender dossier, including final technical design, can be completed. All issues related to permitting, land ownership/access must be concluded during this stage. The future organisational and institutional set-ups must be clear and agreed so that they are ready for implementation during the investment period.

Projects at the end of this stage are ready for implementation.

These stages are somewhat fluid and vary from sector to sector. During the first PDP stages, RDAs along with the WSS sector working group identified 45 ideas for possible project concepts, out of which 31 PPCs have been identified as responsive to the WSS Sector policy documents. Further on, due diligence studies were conducted for the identified PPCs, and Inter-ministerial Commission identified 12 projects as most compliant to commonly agreed WSS sector development criteria, as project economic efficiency, contribution to achievement of sector goals, scale of regionalisation etc. A preliminary **Priority Investment Programme** (*further PIP, Programme*), covering period of 2015-2021, for each PPC was approved by the Inter-Ministerial Committee and was further developed in the feasibility study phase (Stage 3).

This collaborative process through which projects are developed is conceptualised in the following figure.

Figure 1-2: Project development and implementation



Source: GIZ/MLPS

This Feasibility Study (FS) Report constitutes the main output of Stage 3 of the PDP, proposing a structured phasing of the **Priority Investment Programme (PIP)** and creating necessary conditions for further implementation of the PIP in **Edinet Rayon**. The FS particularly focuses on implementation of the first phase of the PIP, covering period of 2015-2018 and further named *the Project*.

A Project Working Group (PWG), established by decision of the Rayonal Council and comprising members from the Regional Development Agency North (RDA North), the Edinet Local Public Administration (LPA) and GIZ/MLPS experts, was instituted to facilitate and coordinate the process of preparation and agreeing this feasibility study, in particular the scope of the proposed project. The same PWG will endorse the study for approval by the Edinet Rayon council.

1.3 PIP Service Area

The programme area was defined using, but not limited to, the following key sector development criteria set in the WSS RSP:

- **Regionalisation and scale of the project** – Only rayon capitals with associated localities, as well as urban/rural agglomerations over 10,000 people were considered. The integrated approach to WSS services development requires development of both water and wastewater services. As part of the EU-Moldova Association Agreement, the Government of Moldova is committed to harmonize National legislation and implement the provisions of the EU Directives, including the

Council Directive 91/271/EEC concerning urban wastewater treatment, requiring implementation of wastewater collection and treatment in the first place in localities over 15,000 people (10,000 in sensitive areas). Applying the logic of the integrated service, this condition for wastewater systems is extended over the water supply service as well;

- **Presence of source of treatable drinking water, including abstraction and treatment facilities**. Water quality is essential to consumers. Supply with a treated surface water is a prioritised strategic approach;
- **Presence of functioning wastewater collection systems with wastewater treatment facilities**. As stated, the requirement of the UWWT Directive shall be considered and the proposed PIP shall tend to contribution to (at least) partial achievement of the requirements;
- **Agreement between beneficiaries and a sustainable WSS operator**. The inter-municipal cooperation between the potential project beneficiaries is a key to successful regionalisation of services. The current legal framework enforces the local public administrations to adopt the most appropriate way of provision of WSS service in their respective localities, and therefore a strong willingness of the LPAs is required to organise a regionalised WSS service.

Also, one of the major WSS services development constraints identified in the WSS RSP is poor and inadequate operational capacity of the existing WSS companies. Taking into consideration current institutional and operational arrangements, the RSP recommended that strengthening of the operator's capacities within the existing service area shall be supported in the first place, and in the in short- term followed by extension of services, not exceeding double the size of the operator's existing service area. This was considered to prevent water operating companies from financial/operational/institutional collapse and set reasonable geographic boundaries for short-term regionalisation of the WSS services.

In Edinet Rayon, an agglomeration satisfying the WSS development criteria was identified in the area of the Rayon centre, **the Town of Edinet**.

The Towns of Edinet and Cupcini form the PIP service area for development of the regionalised WSS services in the Rayon of Edinet, which is expected to be gradually implemented in accordance with the proposed phasing of infrastructure investments during 2015-2021.

The first phase of the PIP (**the Project**) includes improvement of WSS **services in the Town of Edinet**.

This FS Report covers the entire PIP area, having particular attention on the first phase investment Project area. In the longer term, the project service area is to be extended, with flexibility to include additional localities from the Edinet Rayon and other neighbouring areas, where deemed technically and economically feasible.

1.4 Identified problems

The following major problems to be addressed in this feasibility study were identified during the preliminary project stages:

- Insufficient area coverage of the WSS services. While most of the town of Edinet benefit from water supply, the wastewater services are provided only to a limited urban area;
- Unsatisfactory levels of service, including:

- Continuity of water and wastewater services. Urban consumers have often interruptions supply due to bursts, leakages and insufficient network pressure. The average supply time is 16 hours per day. Certain parts of the town continuously suffer of sewer blockages.

As for the operational efficiency, the main problems encountered by the company are, as follows:

- High non-revenue water (NRW) ratio. Increased level of NRW results (around 71% in 2014) results in higher energy consumption for water pumping and consequently increased water tariffs;
- High staff efficiency ratio, as a result of inefficient operation of facilities and overstaffing of the utility;
- Poor asset management and lack of preventive maintenance, resulting in obsolete pipelines and facilities.

Further sections of the feasibility study address the major problems identified in the preliminary stages and provide appropriate measures split into implementation phases.

1.5 Study objective

The objective of the present Feasibility Study is the development of an affordable, least-cost and cost-effective phased investment programme for water and wastewater infrastructure to be rehabilitated and extended, as well as facilitation of regionalisation of the WSS services and inter-municipal cooperation with strong social and environmental benefits, as part of the implementation of the provisions of the WSS Regional Sector Programme and Water Supply and Sanitation Strategy (2014-2028).

The proposed Priority Investment Programme (2015-2021) is expected to result in improved access to regional water supply and sanitation services for the Towns of Edinet and Cupcini, and to contribute to the achievement of the regional WSS sector development indicators on access to water supply and wastewater services. The aim of the PIP is to extend the coverage and connection rates of the population connected to the regionalised water supply services by 21% from 79% to 100% of coverage rate and by 15% from 77% to 92% of connection rate, as well as increase of coverage and connection rates to wastewater services by 27% from 62% to 89% of coverage rate and by 17% from 46% to 63% of connection rate. Also, other major effect of the PIP is the rehabilitation and improvement of existing water supply services for 62% of population connected and for 14% of population connected to wastewater services.

The aim of the first phase (the Project, 2015-2018) for the town of Edinet is to extend access of the population to water supply services by 4% from 79% to 83% of coverage rate and by 3% from 77% to 80% of connection rate. Also, other major effect of phase 1 rehabilitation and improvement of existing water supply services for 56% of population connected.

Table 1-1: Main service indicators

Indicator	Current connection rate	The first phase Project (2015-2018)		The second phase (2018-2021)		Priority Investment Programme (2015-2021)	
		Rehabilitation	Extension	Rehabilitation	Extension	Improve-provement	After PIP
Share of population directly benefitted from the rehabilitated and extended water supply services							
Urban	77%	56%	3%	6%	12%	77%	92%
Share of population directly benefitted from the rehabilitated and extended wastewater services							
Urban	46%	0%	0%	14%	17%	31%	63%
Non-Revenue Water Ratio, %	71%					26%	45%
Continuity of water service (hours/day)	24					24	24
Number of beneficiary localities covered by regional WSS services (urban)	2/2	2/2	2/2	2/2	2/2		
Number of sustainable regional WSS operators instituted	1	1	1	1	1		

Source: GIZ/MLPS

2 Socio-economic aspects

2.1 Service area

This Feasibility Study covers the area that includes the territory of Edinet town and Cupcini town, as shown in Figure 2-1.

Figure 2-1: Map of FS localities

Source: www.google.com/maps/place

2.1.1 Geographical Conditions of the coverage area

Edinet Rayon is situated in the northern part of the Republic of Moldova, bordering rayons of Briceni and Romania to the north - west, Ocnita to the north-east, Donduseni to the east, Riscani to the south. The rayon centre is the town of Edinet.

Covering area of Edinet Rayon is about 933 km^2.

Table 2-1: Population and area of the localities covered in this feasibility study

	Population	Area [km^2]
Edinet	20,086	14.5
Cupcini	8,916	12

Source: GIZ/MLPS

Edinet Rayon comprises 49 localities, including two towns (Edinet and Cupcini), 30 communes and 17 villages.

The town of Edinet is situated in the north-west of the Republic of Moldova at a distance of approx. 207 km from Chisinau and at a distance of approx. 8 km from the railway station Bratuseni, bordering with the localities Cupcini, Alexandreni, Gordinestii Noi, Parcova, Slobodca, Hlinaia and Rotunda.

The area of land fund covers 6,365.9 ha, of which:

- Arable land – 3,604.3 ha;
- Orchards and vineyards - 181.6 ha;
- Area for construction - 597.3 ha;
- Areas of forestry fund - 922.5 ha;
- Pastures - 527 ha;
- Basins - 306.3 ha.

Edinet has the following aquatic resources: Prut River (length - 46 km); 8 rivers, including small rivers and 196 artificial water reservoirs/resources.

The town of Cupcini is situated in the south-east of Edinet rayon, on the right bank of Ciuhur River at a distance of approx. 6 km from Edinet and at a distance of approx. 2 km from the railway station Bratuseni, bordering with the localities Edinet, Chetrusica Veche, Parcova, Bratușeni, Chiurt, Alexeevca and Onesti. The area of Cupcini town is 12 km^2.

2.2 Relief and climate conditions

Edinet Rayon is characterised by a hilly relief and crossed by the valleys of the Ciugur, the Racovat and the Draghiste Rivers. The most important river is the Prut River which is the border between the territory of Edinet Rayon and neighbouring Romania. The territory of the rayon is quite variable, crossed by slopes of various inclination degrees and plateaus, and is situated in the Northern Moldovan Plateau, which reaches a height of cca 192 meters above sea level.

The prevailing soils in the Edinet rayon are Chernozem and alfisols. In addition, typical gray soils are the second widespread soil and mineral deposits such as sand and clay can be found also on the territory of Edinet Rayon.

Groundwater is found at an average depth of 0.5-15m. Groundwater has a major importance in water supply of Edinet Rayon, but their reserves are low and their quality is compliant to the standards.

The climate of Edinet Rayon is temperate - continental. The summers are long and warm, with an average temperature of July of 20°C. Winters are mild, with average temperature in January of -5°C. Precipitations vary between 520 and 620 mm. The feature of the rayon is the high frequency of floods, excessive rainfall, landslides and increased vulnerability to climatic hazards and increasing variability of climate.

2.3 Socio-economic data

The total official number of inhabitants of Edinet Rayon is about 81.60 thousand; of which urban population about 27.12 thousand and rural population 54.47 thousand. Accordingly, the population density is 87.4 inhabitants per 1 km^2.

The ethnical structure of population of Edinet Rayon is the following: Moldovans – 59,195 people or 72.7%; Ukrainians – 16.084 persons or 19.76%; Russians – 5.083 persons or 6.24%; Gipsies – 499 persons or 0.61%, Gagauzians - 143 persons or 0.17% and others.

Vital statistics are provided in the following table:

Table 2-2: Vital Statistics of Edinet Rayon for 2014, pers.

	Born	Deceased	Natural Growth
Edinet Rayon	884	1.200	-316
Edinet Town	185	220	-35
Cupcini Town	78	78	0
Rural Localities	581	902	-321

Source: National Bureau of Statistics, 2015, www.statistica.md

Town of Edinet is an administrative centre of Edinet rayon, with a total population number of cca. 18,211, of which men – 8,766 people and women – cca. 9,445[2].

Currently, about 2,100 economic agents are active in Edinet town.

The educational system of town of Edinet includes six pre-schools, two gymnasiums, four theoretical lyceum and four NGOs which are working in education.

Town of Edinet includes following cultural institutions: two public libraries, three houses of culture, one museum, a musical school, one arts school, three international creativity camps. In the town functions a sports school.

Health care system includes the rayon hospital, an emergency station, and a Centre of Family Physicians. Eight pharmacies are operating in the town of Edinet as well.

Town of Cupcini has a total population number of cca. 8,916, of which men – 3,980 people and women – cca. 4,936[3].

There are 11 industrial enterprises in the town of Cupcini, including 'Cupcini-Cristal' JSC, the cannery 'Natur-Vit' JSC, tobacco factory 'Nord-Tutun' JSC, 'Cupcini mine' Ltd, grain elevator 'Cereale-Cupcini' JSC, a milling factory etc.

The educational system comprises two vocational schools, two lyceums, one gymnasium, one musical school, an arts centre, and four libraries.

2.4 Population

Immediately upon gaining its independence in 1991, the Republic of Moldova faced economic hardships that severely affected demographic indicators. The main factors affecting demography are outmigration for economic reasons and a decline in the birth rate. These trends began with the military conflict in Transnistria in 1992, which prompted a wave of emigration from Moldova toward Russia and Ukraine, followed by migration towards current European Union Member States (mainly Italy, Poland, and Romania). These trends were exacerbated during the Russian financial crisis in 1998. The total outflow of emigrants comprises 17.3% of the total population residing in Moldova in 1991, with some estimates reaching 25% (circa 1 million). For the purpose of

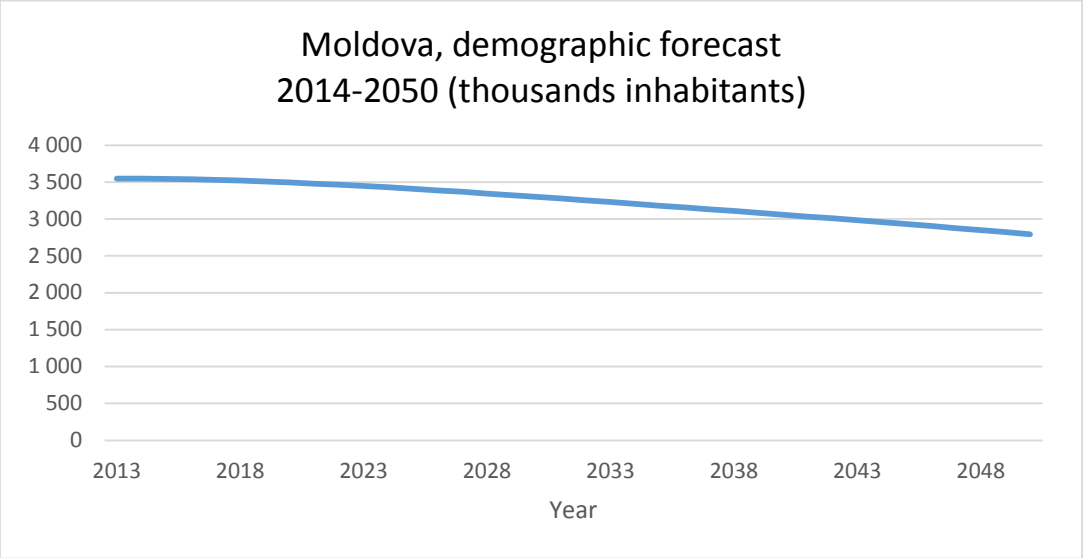
[2] Source: Edinet Municipal Services Utility, Edinet City Hall

[3] Source: Edinet Municipal Services Utility, Edinet City Hall

this feasibility study, the authors considered as a baseline the prognosis of United Nations, which indicates a negative population growth as depicted in the figure below.

The scenario for demographic evolution is derived from the UNDP prognosis for the country up to the year of 2050.

Figure 2-2: United Nations Development Programme population forecast for Moldova



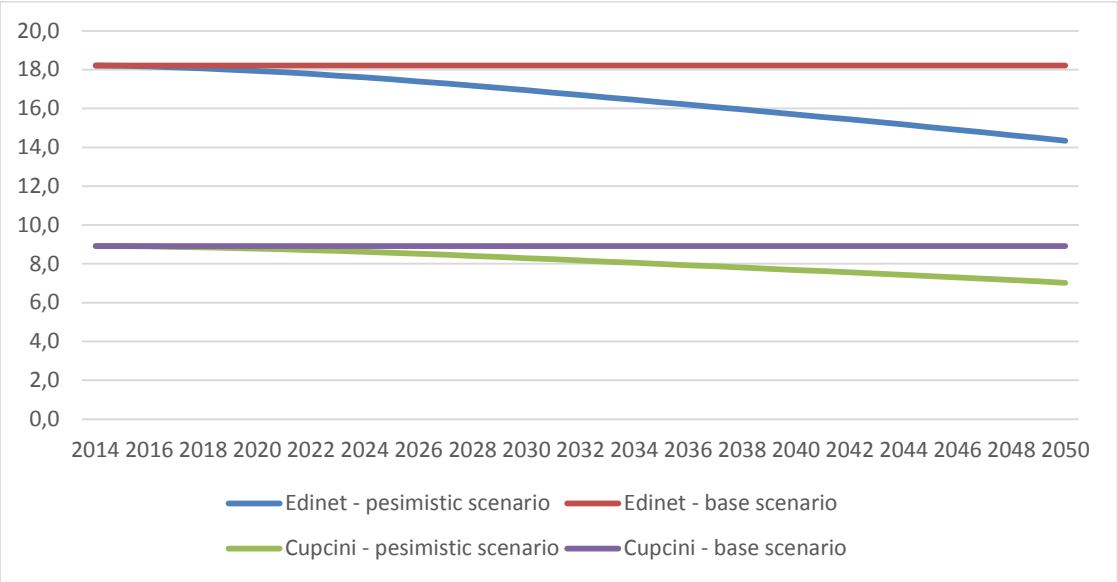
Source: UNDP, World Population prospects, 2013, internet: esa.un.org/wpp/

The Feasibility Study considers that the same national trend will apply uniformly to each rayon population.

Furthermore, the evolution of the demography for the rayons was compared to the evolution of the demography of the urban centres of the respective rayons for the last 10 years. Based on that, the internal migration rural-urban was calculated and three scenarios were derived:

- No internal migration: The rayon population and the rayon centre population follow the same national demographic trend (pessimistic scenario);
- The average migration of the last 10 years for each respective rayon for rural-urban migration (base scenario);
- The maximum migration rate from all the past 10 years for each respective rayon (optimistic scenario).

Figure 2-3: Population forecast for towns of Edinet and Cupcini, 2014-2050



Source: GIZ/MLPS

Further in this feasibility study (year 2015, with the expectancy that the detailed design year will be executed in 2016), the population forecast uses the base scenario, which in the particular case of Edinet and Cupcini is identical with the optimistic scenario. In conclusion, it is expected that the population of the towns of Edinet and Cupcini will stay constant (Edinet 18.2 thousand inhabitants, and Cupcini 8.9 thousand inhabitants) despite the descending trend of the population at national and rational level, the explanation being the rural-urban migration.

2.5 Employment

About 2,100 businesses operate in the town of Edinet, of which of which 75% are enterprises with the right of individuals (homesteads, individual businesses and patents), and 25% are legal persons (companies, state enterprises, municipal enterprises, associations farms, households). Most businesses are active in trade, hotels and restaurants (26%), but the highest turnover is recorded in industry (25%).

Concerning the types of activities of businesses, those who are working in the field of wholesale and retail trade, hotels and restaurants represent 26.11% of total businesses. In the construction and real estate sector operate 0.57% of businesses, and in transport and communication sectors operate 0.33% of businesses.

Industry is represented by five companies, with profiles food industry (bakery, mineral waters, soft drinks) and metal processing industry (wood processing machinery, metal construction units, fences, gates, etc.) with over 130 employees. The main enterprises in the industrial sector of Edinet are ‘Agroma’ JSC which manufactures woodworking tools and staffed 84 employees and ‘Modern’ JSC dealing with sewing of the clothing.

Until 1989, the economy of Edinet had had an industrial character, predominant branches being food processing industry, engineering industry, textile industry and food industry. Now the food industry are represented by such important for town enterprises as juice producer ‘Natur Bravo’ JSC, sugar factory ‘Moldova-Zahar’ JSC and milk factory ‘Inlac’.

In 2011 the Ministry of Economy decided to create in the town of Edinet an Industrial Park whose construction is almost completed. The Industrial Park 'Edinet' is created on the basis of 3 companies from different economic sectors, where there are already all necessary infrastructures for business development (access to highways of local and international importance, access to railroad, water distribution system, sewerage, telecommunications, and heating, gas and electricity). The most important enterprise in this Industrial Park is the Ukrainean company 'TB Fruit' Ltd that operate in the field of juices production and is going to hire cca 180 people, thus becoming one of the important employers in the town of Edinet.

In the last 20 years, the town of Edinet – just as the rest of the small and medium towns in Moldova – suffered a downturn due to the closing of several industrial enterprises. In the present, however, the town of Edinet is in the process of implementing a socio-economic strategy for 2015-2020, that is aimed at facilitating the creation of modern enterprises with application of the state of art technologies.

In general, the unemployment rate in the town of Edinet of 2.06% in 2014 is lower than average rate in Moldova (3.9% for 2014) and during 2011 – 2014, the unemployment rate has slightly increased.

Table 2-3: Unemployment rate in the town of Edinet (%)

Year	2011	2012	2013	2014
Town of Edinet	1.71	1.54	2.00	2.06

Source: Edinet rayon statistical department

Table 2-4 Number of economically active population in the town of Edinet

Year	2011	2012	2013	2014
Town of Edinet	12,810	12,341	12,245	12,138

Source: Edinet rayon statistical department

Table 2-4: Number of the unemployed persons in the town of Edinet

Year	2011	2012	2013	2014
Town of Edinet	220	190	245	250

Source: Edinet rayon statistical department

The largest employers are presented in the table below.

Table 2-5: The main employers in the town of Edinet

Company name	Company specialization
'Natur Bravo' JSC	Food industry
'Inlac ' JSC	Food industry
'Moldova-Zahar' JSC	Food industry
'TB Fruit' Ltd	Food industry
'Astra' Ltd	Food industry
'Maximos Pan' Ltd	Trade
'Modern' JSC	Clothing industry
ME 'Edinet Municipal Services Utility'	Water supply and sanitation services
'Vlados Com' Ltd	Trade

Company name	Company specialization
'Apromas' JSC	Machinery-tool industry
Edinet Rayon Hospital	Health services
'Gloria Qvark'' Ltd	Trade
'Constructorul' Ltd	Construction industry
'Cupcini mine' Ltd	Construction industry

Source: Edinet rayon statistical department

The location of the town of Edinet near Romania and Ukraine, along the international highway Brest-Odessa would appear to put Edinet at an advantage compared to its neighbouring towns. One of the objectives stated by local authorities and included in the Strategy mentioned above is creation of the modern enterprises with application of the state of art technologies, especially with the foreign investments. This is a good incentive for others to invest in the town economy in the future and speed up the economic development of the town of Edinet.

2.6 Affordability

The affordability means the population's capacity or possibility to cover the bills' costs for drinking water and wastewater disposal. Affordability rate indicates the percentage from family income which is directed to cover the cost of the water supply and sanitation services.

The key elements for affordability rate calculation represent the family income and bill cost. For the current analysis it was used disposable average income for the North region, based on the statistical data only (without taking into account the additional incomes from the "grey economy" or the incomes of the citizens working abroad). These incomes for 2015 were adjusted according to the incomes evolution forecasted by the Moldovan government.

The evolution of the disposable average income is shown in the table below.

Table 2-6: Evolution of the household average income per capita/month by region (MDL)

Disposable income (MDL), prognosis				
Region	**2012**	**2013**	**2014**	**2015**
North	1.412,60	1.572,60	1.653,56	1.738,69
Centre	1.317,20	1.437,90	1.511,93	1.589,76
South	1.247,20	1.419,10	1.492,16	1.568,98

Source: National Bureau of Statistics

According to the National Bureau of Statistics, the average households income in Moldova in 1st quarter was 1,768.23 MDL/person/month (Quarterly bulletin, I, 2015) while in the North region it was 1.738,69 MDL. MDL/person/month.

The average bill for water and sewage, taking into account the average consumption of 60 lcd, can be estimated as follows:

- 0,060 m^3/d x 30 days x 23 MDL / m^3 = 41.40 MDL.

Comparing it to the average disposable income of 1,738.69, the affordability ratio reaches 2.4% which means that population can support a further increase of the tariff, as a result of the new proposed infrastructure investments.

3 Legal and institutional framework

3.1 The legislative framework regulating water supply and wastewater services sector

3.1.1 European legislation on water supply and wastewater services

The water sector is one of the most regulated areas in the EU, in order to ensure the careful use of water resources and to minimise adverse impacts of water production and consumption on water quality.

Directive 2000/60/EC establishing a framework for Community action in the field of water is a keystone in the history of water policies in Europe. It establishes a common framework for sustainable and integrated management of all water bodies and requires that all impact factors and economic implications as well to be considered. Waters in the European Union are under increasing pressure, given the continued growth in demand for good quality water in sufficient quantities for a range of uses. The aim of this Directive is to protect and improve water quality by providing rules for stopping the deterioration of all water bodies in the European Union and achieve "good status" of rivers, lakes and groundwater in Europe.

Another regulation in the European Union, intended to protect human health by establishing strict standards for drinking water quality, is Directive 98/83/EC on the quality of water intended for human consumption, which amends Directive 80/778/EEC of 15 July 1980. The objectives of the Directive are to protect public health from the effects of any type of contamination of drinking water by ensuring quality. In order to ensure those the Directive requires the establishment of a program of measures to improve water quality. Member States have to monitor drinking water quality and take the necessary measures to ensure compliance with the standards.

In turn, the wastewater produced by the population and industry is an important source of pollution that can affect the quality of drinking and bathing waters, hampering the achievement of goals set out by Water Framework Directive.

Directive 91/271/EEC concerning urban wastewater treatment aims to protect surface waters, including those from the coastal territories, by regulating collection and treatment of urban wastewater and discharge of the biodegradable industrial wastewater (coming mainly from the agri-food industry). The Directive is often considered expensive, but proposes solutions to overcome these challenges that mean tremendous benefits for our health and the environment. Like other legislative acts of EU regarding water, the Directive provides clear and binding targets, while being very flexible in the means of achieving them. The Directive allows alternative solutions and encourages innovation, concerning both wastewater collection and treatment.

3.1.2 Transposition and implementation of the community environmental acquis

By signing the Association Agreement, the Republic of Moldova committed to implement the relevant environmental legislation of the European Union (including that regarding water quality and resources management) into its national legal system by adopting or changing national legislation, regulations and procedures.

The Republic of Moldova has to align national legislation with community environmental acquis in terms (3-8 years from the entry into force, starting September 1, 2014) and

conditions listed in Annex. XI Chapter 16 (Environment) of the Association Agreement Republic of Moldova - European Union[4].

Fulfilment of the assumed obligations started with the adoption of Government Decision no. 808 of 10.07.2014 regarding the approval of the National Action Plan for the implementation of the Association Agreement Moldova - European Union in 2014-2016.

These measures concern in particular the following tasks: completing the process of developing a mechanism to implement the Water Law; initiating assessment of the situation in the field of urban wastewater collection and treatment and identifying sensitive and less sensitive areas; drafting law on drinking water quality in accordance with Directive 98/83/EC on the quality of water intended for human consumption, as amended by Regulation (EC) no. 1882/2003; drafting Government Decision on the approval of sanitary regulations for small drinking water systems; and drafting Government Decision on the approval of sanitary regulations for drinking water quality monitoring.

Given these ambitious goals, Moldova has started to transpose and implement the Directives of the European Parliament and the European Council into Moldovan legislation by adopting the following legislation and regulations:

- Water Law no. 272 of 12.23.2011 is partially harmonised with Council Directive no. 91/271/ EEC of 21 May 1991 on urban wastewater treatment and no. 91/676 EEC of 12 December 1991 on waters protection against pollution caused by nitrates from agricultural sources, with European Parliament and Council Directives no. 2000/60/EC of 23 October 2000 on establishing a framework for the Community action in the field of water policy; no. 2006/7/EC of 15 February 2006 concerning the management of bathing water quality; no. 2007/60/EC of 23 October 2007 on the assessment and management of flood risks; no. 2008/105/EC of 16 December 2008 on environmental quality standards in the field of water, creates the legal framework, necessary for water management, protection and use;
- Regulations on requirements for wastewater collection, treatment and discharge into the sewage system and/or in water receiving bodies for urban and rural areas, approved by Government Decision no. 950 of 11.25.2013, partially transposes the provisions of Council Directive. 91/271/EEC of 21 May 1991 on urban wastewater treatment;
- Regulations on conditions for wastewater discharge into water receiving bodies, approved by Government Decision no. 802 of 10.09.2013, transposes art. 2 and 3 of Directive 2009/90/EC of Commission of 31 July 2009 on establishing, pursuant to Directive 2000/60/EC of the European Parliament and of the Council, technical specifications for chemical analysis and monitoring of water status; Annex III of Directive 91/271/EC of 21 May 1991 of Council regarding urban waste water treatment; Annex VIII of Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water.

3.1.3 National legislation for water supply and wastewater public services

The legal and normative framework in force which governs water supply and wastewater services sector, although harmonised only to a small extent with European

[4] www.parlament.md

legislation, represents the legal basis for the establishment, organisation, management, financing and monitoring of the functioning of these services.

The legal regulation of decentralised water supply and wastewater services is not a subject to a single legislative act, these being reflected in many laws and regulations, which are listed in Annex 3.

However, the framework act for this sector is the Law on water supply and wastewater public services no. 303 of December 13, 2013, which defines the legal framework for the establishment, organisation, management, regulation and monitoring of the functioning of the public service on raw and drinking water supply; public service on wastewater and industrial and domestic wastewater treatment in terms of accessibility, availability, reliability, continuity, competitiveness, transparency, compliance with quality, security and environmental protection.

The new law regulates public authorities (central and local public administrations) competences in water supply and wastewater services sector; the establishment of the National Agency for Energy Regulation as the regulator in water supply and wastewater services sector; service management, where local authorities can opt either for direct management or for delegated management; delegated management contract on water supply and wastewater services provision, as the only legal act that can establish rights and obligations of the parties; terms for delegating services provision based on public tender organised under the law; operator licensing under conditions of competition; endorsement and approval of tariffs for this service etc.

Adoption of Law 303 of 13 December 2013 started the process of amendment of the existing legislation, which is to be followed by putting into practice these regulations.

3.2 Administrative framework

3.2.1 At national level

The Ministry of Environment, Ministry of Regional Development and Construction, Ministry of Health and Ministry of Finance and State Chancellery with are competent authorities in the regulation and development of the water supply and wastewater services sector.

The Ministry of Environment is the main state institution, responsible for the development of national policies, legislative and regulatory framework and the subsequent implementation of the provisions of the policy documents, including the programming and implementation of investment needed in water supply and wastewater infrastructure. Additionally, the Ministry of Environment manages the National Ecological Fund.

The Ministry of Regional Development and Construction is responsible for the planning and development of water supply and sanitation at regional level and substantially involved in planning and infrastructure development through the three Regional Development Agencies. Additionally, the Ministry of Construction and Regional Development administers the National Fund for Regional Development. Together with the national Ecological Fund, these funds are the most important sources of national funding in the water supply and wastewater services sector.

The Ministry of Health oversees the population’s health and sets up priorities related to public health; promote provisions regarding health aspects into all public policies and supports their effective implementation in other sectors to maximise health gains. The Ministry of Health establishes and monitors all aspects of water quality in the field of water supply and wastewater services sector.

The Agency ‘Apele Moldovei’ under the Ministry of Environment is charged with implementing national policy in water management, hydro-reclamation and water supply and wastewater services sector.

The Agency for Geology and Mineral Resources under the Ministry of Environment is responsible for implementing state policy on geological research, and use and protection of soil and groundwater. Hydrogeological Expedition "EHGeoM" is under the Agency for Geology and Mineral Resources, providing services related to drilling artesian wells.

The National Agency for Energy Regulation is the regulator of water supply and wastewater services in terms of approving regulations and the tariffs for these services, giving licenses to the operators working in the field of energy supply and monitoring its activity.

At the national level, there are two main non-governmental associations, namely Water Operators Association of Republic of Moldova ‘Moldova Apa-Canal’ and the Congress of Local Authorities in Moldova.

Data on water supply and wastewater services sector are regularly collected and processed by the National Bureau of Statistics.

Moreover, it should be noted that besides the competent authorities indicated above, a series of other authorities play, directly or through their subsidiaries, more or less significant role in the monitoring and supervision of the water supply and wastewater services sector. These are, in particular:

3.2.2 At local level

In Republic of Moldova, the local government is organised on two levels: level 2 is the rayon public authorities, while the level1I is the public authorities in towns and localities. The water supply and wastewater public services are set up, organised and managed under the direction, coordination, supervision and responsibility of local public administrations of level 1, represented by local councils, as deliberative authorities, and mayors as executive authorities.

About 35 operators in Moldova provide water supply and wastewater services in urban areas, with the legal form of joint-stock companies or municipal enterprises. Of these, seven can be considered as regional operators, because they provide water supply and wastewater services in towns and neighboring administrative-territorial units. In rural areas, services are provided either by local authorities, under the direct management or by sole proprietorships, limited liability companies or water user associations, under delegated management.

3.3 National policies in water supply and wastewater services sector

Up to 2013, there was essentially no planning in the WSS sector at national, regional and local level. Since then, a new sectoral strategy and regional sector programmes have been completed. Thus, the development of water supply and wastewater services sector is based on its principal document which is Water Supply and Sanitation Strategy (2014-2028) and other development policies of the Republic of Moldova, including the National Regional Development Strategy (2013-2015). This framework aims to improve national policies and harmonise the legal framework with the community acquis and European standards. The National Regional Development Strategy sets out a number of directions of water supply and wastewater services sector development, including national targets for achieving the Millennium Development Goals.

The Water Supply and Sanitation Strategy has new approaches for structuring, financial planning and project identification, on which sector development should be based.

The strategy proposed institutional reforms of the sector, including a new authority as sector regulator - the National Agency for Energy Regulation which would be responsible to develop pricing and regulating policy for operators based on performance indicators.

The strategy also states the need to develop inter-municipal cooperation in the development and provision of water supply and wastewater services by regional operators. Services provision can be ensured by means of public services delegated management contract concluded between local authorities and regional operator, before the implementation of investment projects in infrastructure.

'Regionalisation' is a key aspect of development policy in water supply and wastewater services sector. This policy aims to improve sector performance through better management and economies of scale.

Regionalisation of water supply and wastewater services, which intends to overcome excessive fragmentation of the sector, is aimed at concentrating water supply and wastewater services around strong regional operators, set up and developed by merging local operators.

Thus, it is foreseen that municipal enterprises will be reorganised into commercial companies and will extend the water supply and wastewater services area to other administrative-territorial units, with the aim of becoming economically viable regional operators.

The Strategy also places emphasis on the need to prepare Water Supply and Sanitation Development Plans (equivalent to so-called Master Plans) and feasibility studies in order to attract investments in the sector. Actions indicated in the Strategy will require a major financial commitment that goes beyond the national sources that are available.

In 2014, the Regional Development Councils from North, Centre and South approved Regional Sector Programmes (RSP) in the WSS sector. The RSP is an operational tool that links local and regional priorities with the national strategy within the WSS sector. Based on an analysis of the current situation in the respective region and national sectoral targets, the RSP provides the process, methods and criteria by which priority projects are identified for further development and implementation.

3.4 Organisation of water supply and wastewater services in the administrative-territorial units covered in the feasibility study

3.4.1 Organisation and management of water supply and wastewater services

As stated, this feasibility study covers the town of Edinet with its localities Alexandreni and Gordinestii Noi and the town of Cupcini with its localities Chetrosica Veche and Chiurt.

To date, in the town of Edinet has organised water supply and wastewater services, organised and managed under the leadership, coordination, control and responsibility of the Edinet local public administrations, represented by the Edinet Local Council as deliberative authority, and Edinet mayor's office, as executive authority.

Municipal Enterprise 'Apa - Canal' Edinet, hereinafter ME 'Apa - Canal' Edinet, is the operator of water supply and wastewater public services within the town of Edinet and town of Cupcini. Within the locality Chetrosica Noua which is part of the town of Cupcini the enterprise provides water supply service only. Currently, the company carries out

the following types of activities according to the charter: water abstraction/intake, filtering and distribution; wastewater collection and treatment; freight transportation services and construction works.

Within the locality Alexandreni, which is part of the Edinet administrative-territorial unit, the water supply service is managed by Gas Consumers Association (the water supply system was recently rehabilitated by Moldovan Social Investment Fund). Within the locality Gordinestii Noi there is no centralised water supply service.

Within the locality Chiurt, which is part of the Cupcini administrative-territorial unit, the centralised water supply service is provided on the one third of its territory, being managed by local business.

The tariffs for water supply and wastewater services are approved by the local council, in accordance with legislation in force.

3.4.2 Ownership

Public water and wastewater systems, including all technological and functional structures covering entire technologic cycle from raw water abstraction to discharge of treated wastewater into receiving body, are the property of Edinet administrative-territorial unit and Cupcini, respectively.

The reservoir Racovat and the pumping station no.1 are the property of the Agency 'Apele Moldovei', being held under lease by ME 'Apa - Canal' Edinet.

Under the right to provide the water supply and wastewater services within the town of Edinet and town of Cupcini, Edinet Local Council and Cupcini Local Council have delegated the management and operation rights of the water supply and wastewater systems to the ME 'Apa - Canal' Edinet.

3.5 Organisation and management of the ME 'Apa - Canal' Edinet

ME 'Apa - Canal' Edinet was established by decision of the Local Public Administration, and shall carry out activities for an unspecified period of time starting with the date of registration by State Registration Chamber.

The company has a general director, who is responsible for coordination of all company activities and conducting regular coordination with Edinet mayor's office, being personally responsible to the company's board for meeting the performance indicators.

Three key-specialists and three departments report directly to general director:

- Production director, responsible for complete and efficient organisation of the technological process aiming to provide high quality services;
- Financial director, in charge with analysis of financial and economic situation, calculation of tariffs and development of production program and for accounting records management and working out of the accounting reports as well;
- Chief engineer (with the technical department), responsible for working out the technical policies, defining the directions of enterprise development and for researching as well;
- Legal Department, responsible for contracts concluding and disputes settling;
- Safety and Labor Protection Department, in charge with ensuring safety of industrial processes and labour safety within enterprise;
- Human Resources Department, in charge with staff policy and staff tracks keeping.

Under production director, who is the manager for technical teams, are seven of following units:

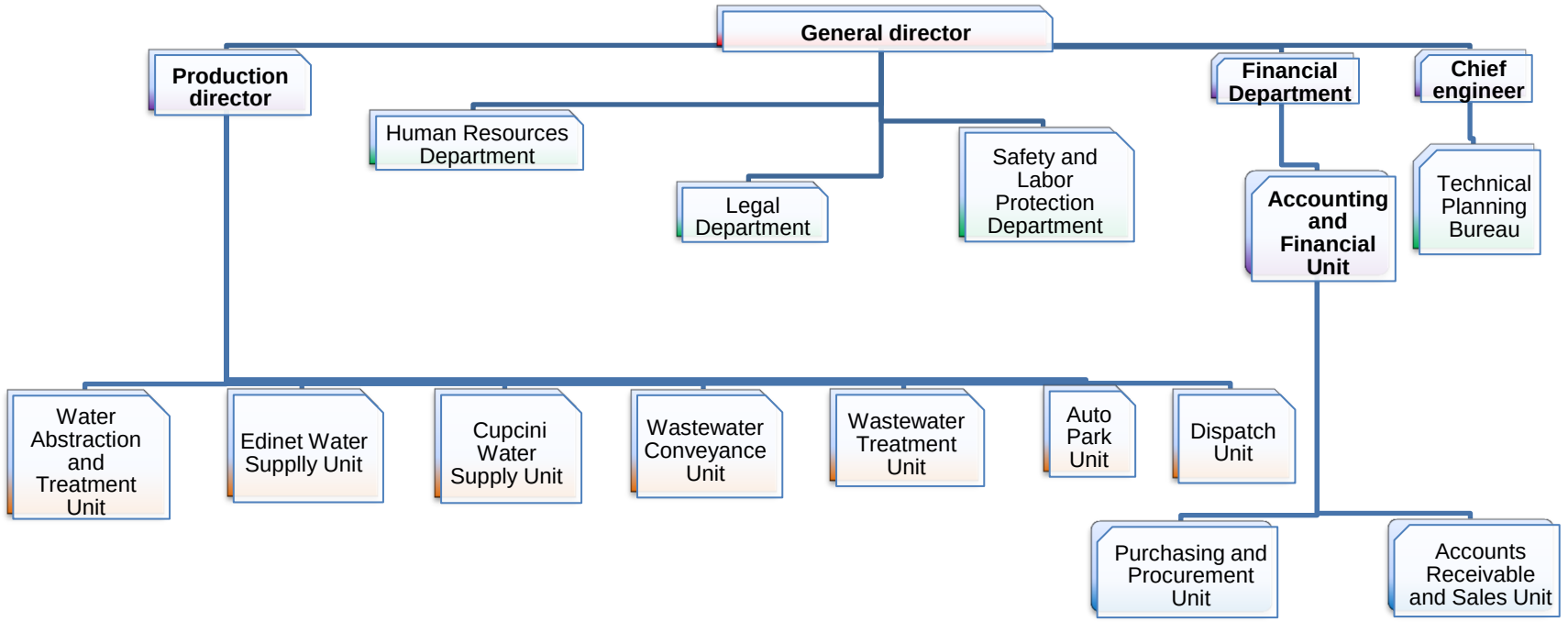
- Water Abstraction and Treatment Unit;
- Edinet Water Supply Unit;
- Cupcini Water Supply Unit;
- Wastewater Conveyance Unit;
- Wastewater Treatment Unit;
- Auto Park Unit;
- Dispatch Unit.

The Financial Director is responsible for the activity of the three units to whom they report directly:

- Accounting and Financial Unit;
- Purchasing and Procurement Unit;
- Accounts Receivable and Sales Unit.

The organisational structure of the ME ‘Apa - Canal’ Edinet is showed below:

Figure 3-1: ME 'Apa - Canal' Edinet (organisational chart)



Source: LPA Edinet, LPA Cupcini, ME 'Apa-Canal' Edinet

3.6 Company staff and training needs

The organisational structure of the company includes 114 positions (according to the staff list) and actual 112 employees. The actual number of employees within the company enables compliance with the actual schedule and workload. Thus, the occupancy rate within the company is high at 98%, while the staff turnover rate decreased from 9.8% to about 2.6% over the past three years.

The years of service at the company of the technical and financial staff shows a stable situation. One third of staff members (34 or 30% of the total) have more than 10 years of employment in the position, with an average of cca 21 years. One key person in the company superior technical staff has higher educations in water supply and wastewater systems operation. In general, 16% of the staff has a higher education, 42% - specialised secondary education; the rest have graduated from vocational schools.

Company management reports that it experiences difficulties in finding specialists and workers with the proper skills for the specificities of the WSS sector. This is due to the lack of skilled local labour in the town and neighbouring localities. ME 'Apa - Canal' Edinet has a Development and Improvement Activities Plan that includes a set of measures designed to increase staff capacities.

The table below lists the main topics that should be addressed in a human resources training programme, as identified during field visits to the utility and discussions with its management and those from the Plan mentioned above.

Table 3-1: ME 'Apa - Canal' Edinet staff training needs

Training topic	Beneficiary
Strategic planning	General director; production director; chief engineer; financial director
Investment planning and analysis of investment projects	General director; chief engineer; heads of departments; financial director
Human resources planning and development	General director; human resources officer; financial director
Performance indicators and staff motivation	General director; chief engineer; heads of departments; head of human resources department
Customer service management, public relations	Accounts Receivable and Sales Unit employees
Tariffs and costs calculation	Financial director; head of Accounts Receivable and Sales Unit
Financial planning	Accounting and financial unit employees
Management and maintenance of equipment	Chief engineer; heads of the related departments
Wastewater treatment and sludge management	Production director; heads of the related departments
Water supply and sewerage networks management	Chief engineer; heads of the related departments
Energy management in water supply and wastewater systems operation	Chief engineer; heads of relevant departments
Quality management in water supply and wastewater systems operation	Chief engineer; heads of relevant departments
Meter checking and reading	Head of marketing department; controllers
Job retraining on 'Operation of water supply and wastewater systems', specialty 'Intervention and reconstruction works'	Plumbers/operators
Project management	General director; production director
Legislative aspects and standards in water supply and sanitation	General director; production director; lawyer
Economic analysis in the field of water supply and sanitation	Financial director; Accounts Receivable and Sales Unit employees
Integrated accounting software use	Accounting and Financial Unit employees

4 Technical aspects – existing situation

4.1 General information

The assessment of the existing water supply and wastewater situation in the town of Edinet and the town of Cupcini has been conducted by the GIZ/MLPS experts in collaboration with members of Project Working Group (PWG, described in Chapter 1).

For assessment of existing situation, the necessary information was obtained from the following sources:

- Water supply and wastewater questionnaire prepared and distributed by GIZ/MLPS experts, and completed by local public administrations (LPAs) and the water utilities;
- Project Working Group (PWG) meetings;
- Site visits conducted by GIZ/MLPS experts to verify the collected information and to inspect the existing water supply and sewerage facilities;
- Available pre-feasibility and feasibility studies, existing and implemented technical designs, topographic surveys (site plans) related to water supply and sewerage infrastructure indicating existing WSS facilities, as provided by the PWG.

4.2 Water supply and wastewater service area

Both water supply and wastewater services in the town of Edinet and the town of Cupcini are provided by a single operator - ME 'Apa-Canal' Edinet.

General information about service area of localities included in the feasibility study is provided in Table 4-1.

Table 4-1: General information about feasibility study localities

N°	Locality	Population	Current situation and on-going activities - water supply	Population served by centralised water supply service		Current situation and ongoing activities - wastewater	Population served by centralised wastewater service	
				Covered	Connected		Covered	Connected
1.	Edinet	18,211	The coverage area of water supply system is about 80%. The connection rate is 79%.	14,646	14,507	The coverage area of wastewater system is about 67%. The connection rate is about 32%.	12,290	8,293
2.	Cupcini	8,916	The coverage area of water supply system is about 76%. The connection rate is 72%.	6,846	6,439	The coverage area of wastewater system is about 50%. The connection rate is about 47%.	4,485	4,208

Source: LPA Edinet, LPA Cupcini, ME 'Apa-Canal' Edinet

General information about public institutions in the feasibility study localities is provided in Table 4-2. Detailed information about public institutions in the towns of Edinet and Cupcini is provided in Annex 4.

Table 4-2: Public institutions in the feasibility study localities

N°	Locality/Public institution name	No. of institutions	Pupils/ children/ places/ beds	No. of employees	Connected to water supply system	Connected to centralised wastewater system
1.	Edinet					
	Kindergarten	4	780	191	yes	yes
	Schools	5	2,080	287	yes	yes
	Healthcare institutions	5	370	540	yes	yes
2.	Cupcini				yes	yes
	Kindergarten	4	348	82	yes	yes
	Schools	4	1,204	216	yes	yes
	Healthcare institutions	1			yes	yes

Source: LPA Edinet, LPA Cupcini, ME 'Apa-Canal' Edinet

The business entities in the feasibility study localities are listed in table below (Table 4-3). More detailed information about business entities from towns of Edinet and Cupcini is provided in Annex 4.

Table 4-3: Business entities in the feasibility study localities

No.	Locality/Type of business entity	No. of business entities	No. of employees	Connected to water supply system	Connected to centralised wastewater system
1.	Edinet				
	Commerce	28	696	yes	yes
2.	Cupcini				
	Commerce	10	787	yes	yes

Source: LPA Edinet, LPA Cupcini, ME 'Apa-Canal' Edinet

4.3 Water supply system

4.3.1 Water supply system in the town of Edinet

Water is supplied 24 hours/day in the town of Edinet. Water supply services are provided to about 14,507 consumers out of 18,211 inhabitants (79% water supply connection rate).

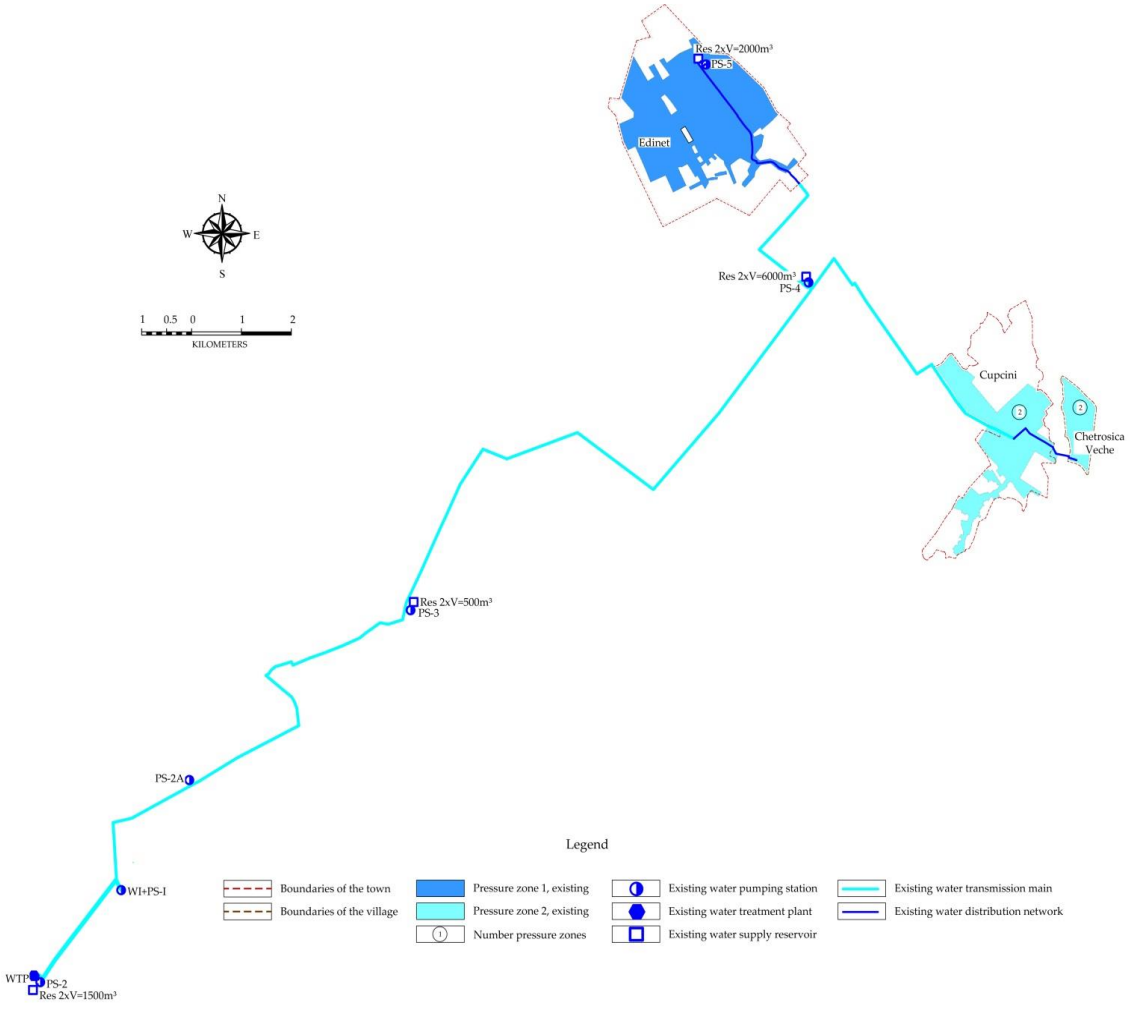
The water supply system in the town of Edinet represents a hydro-technical system and comprises the following key components:

- Water source (surface water – the water reservoir located in the locality of Racovat);
- Transportation of water, from water intake to the water treatment plant and further from the water treatment plant to the distribution network from the towns (raw and drinking water transmission main);

- First level pumping station (PS-1);
- Water treatment plant (WTP), to improve the water quality, so as to be acceptable for customers;
- Underground water reservoirs, designed for the storage of a volume of water necessary in such cases as following: water reserve in case of network failure, compensation of hourly consumption and water reserve necessary for firefighting purposes;
- Water pumping stations (PS-2, PS-2A, PS-3, PS-4, PS-5), to ensure the pressure in the water distribution network;
- Looped water distribution network, combined with branched one; and
- Underground service tanks.

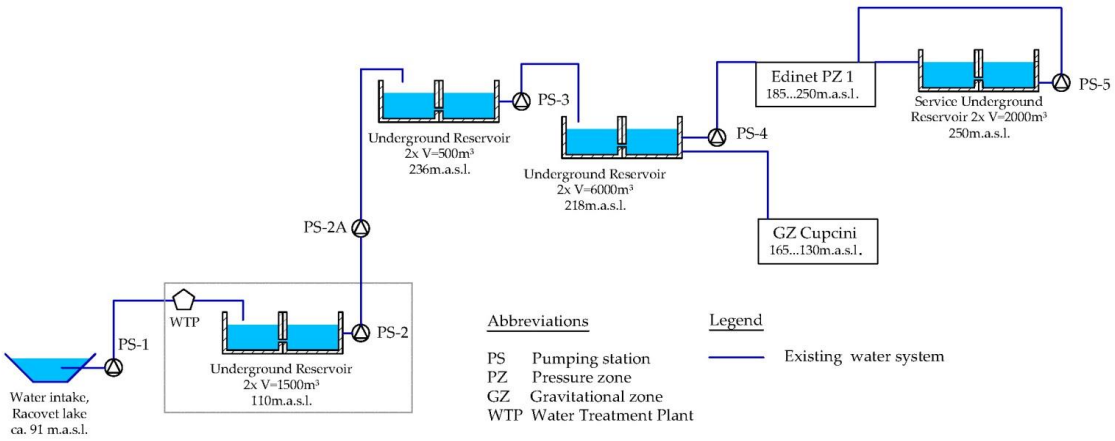
The existing water supply system in the towns of Edinet and Cupcini is represented in Figure 4-1. More detailed information about the water supply system in the towns of Edinet and Cupcini is provided in Annex 11.

Figure 4-1: Water supply scheme of the towns of Edinet and Cupcini



Source: GIZ/MLPS

Figure 4-2: Technological scheme of water supply system, towns of Edinet and Cupcini



Source: GIZ/MLPS

4.3.1.1 Water source. Water abstraction

By 2004, the towns of Edinet and Cupcini were supplied from surface water – the Prut River through water intake constructed in 1967. The raw water had been pumped to the existing water treatment plant (WTP) by the first level pumping station (PS-I) through six (6) pipelines with the diameter 500 mm each and with a length of about 55 m. The water intake has a high degree of wear and it is out of operation.

In the present, water in the towns of Edinet and Cupcini is supplied from surface water – the water reservoir located in the locality of Racovat.

The abstraction of raw water is carried out by gravity to the pumps installed at the first level pumping station (PS-1) through one (1) steel pipeline with diameters of 1,000 mm (as provided in Table 4-6), by the crib installed in the bed of Racovat water reservoir.

The quality indicators of raw water provided by the ME 'Apa-Canal' Edinet are presented in Table 4-4.

Table 4-4: Raw water quality indicators (01 December, 2015)

No.	Indicator	Unit	Max. concentration acc. to G.D. No 934	Raw water concentration
1.	Smell	Degree	acceptable for consumers	-
2.	Taste	Degree	acceptable for consumers	-
3.	Colour	Degree	acceptable for consumers	57.3
4.	Hydrogen Index pH		≥ 6.5 ≤9.5	6.0
5.	Turbidity	Degree	5	0.99
6.	Ammonia NH_4	mg/l	0.5	0.5

No.	Indicator	Unit	Max. concentration acc. to G.D. No 934	Raw water concentration
7.	Nitrites (NO_2)	mg/l	0.5	0.13
8.	Nitrates (NO_3)	mg/l	50	6.1
9.	Total hardness	Degree	5 German degree	4.4
10.	Total soluble dry sediment	mg/l	1,500	528.4
11.	Chlorine	mg/l	250	46
12.	Sulphates	mg/l	250	81.1
13.	Fluorine	mg/l	1.5	
14.	Iron	mg/l	0.3	0.1

Source: ME 'Apa-Canal' Edinet

4.3.1.2 Water pumping station, first level (PS-I)

The raw water is pumped by the first level pumping station (PS-I) to the water treatment plant (WTP) by a pipeline with a diameter of 400 mm.

The nominal parameters of the existing first level pumping station (PS-I) are provided in Table 4-5. The technical parameters of raw water transmission main are presented in Table 4-6.

Table 4-5: Main technical parameters of the first level pumping station (PS-I)

No.	PS name	Year of installation	Year of rehabilitation	Pump type	Pump flow rate (m^3/h)	Head (m)	Pump power (kW)	Pump energy specific consumption [kwh/m³]
1.	PS-1 Racovat locality	1973	2004	ABS VM-208/4A	400	35	55	0.2
2.				Д-200/36	200	36	37	0.24

Source: ME 'Apa-Canal' Edinet

Table 4-6: Main technical parameters of the raw water transmission main

No.	Type of water transmission main	Material	Diameter (mm)	Length (m)	Age (years)
1.	Raw water transmission main	Steel	1,000	120	10
2.		Concrete	400	3,378	> 30
3.		Steel	400	400	> 30
4.		HDPE	315	300	3

Source: ME 'Apa-Canal' Edinet

4.3.1.3 Water treatment facilities

The water treatment plant was built in 1973, with a design capacity of 32,000 m³/ day, current capacity of the water treatment plant is 9,000 m³/day.

The water treatment process includes: coagulation, sedimentation of solids, filtration and disinfection.

The water treatment plan technological scheme includes the following facilities:

- Vertical taper conical mixers (two (2) units);

- Longitudinal horizontal settlers (two (2) units);
- Fast filters (eight (8) units);
- Reagent building;
- Two (2) drinking water underground reservoirs with a volume of 1,500 m³ each;
- Second level pumping station (PS-2); and
- Administrative building; boiler room; warehouse and workshop; auxiliary buildings and structures.

The water from surface sources is generally turbid due to high concentration of suspension solids and colloids. These substances have specific weight very close to weight of water and basically they remain suspended for a long period of time. In order to be supplied, it is necessary to clarify the water. For this purpose, while the water is not in motion or is moving at a very low velocity, the natural settling mechanism of suspended solids in the water is used. The settling of suspended solids is caused by gravity and the velocity of their descent is constant due to the viscosity of water. This phenomenon is called settling or decanting process and it is carried out in special facilities called settlers.

In order to improve the settling process of surface water, aluminium sulphate Al2 (SO4) 3 is introduced as a coagulant that is a chemical substance which allows fine particles to accumulate into increasingly larger flakes, which then settle by freefall, together with non-coagulated particles. The coagulation process considerably reduces the turbidity, suspended solids and water colour. Also, in the flakes accumulation and sedimentation phases, a partial involvement of organic compound and bacteria contained in raw water.

The coagulant injection into the raw water is performed in the vertical truncated mixers (two (2) units), from which further the raw water mixed with reagent is transported by gravity to the suspension longitudinal horizontal settlers (two (2) units), which are concrete or reinforced concrete basins in which the water is moving horizontally with a small velocity and on the bottom of which the particles of suspended solids are settling as sludge.

In the settling process, a high clarification degree of water cannot be accomplished in order to meet required drinking water quality. To achieve a complete water clarification it is necessary to perform the water filtering through a filter layer, usually a sand layer. The removal of suspensions from water is carried out through filters, which are classified according to the filtration velocity: slow filters, fast filters and ultra-fast filters.

The water clarified in the above mentioned settlers, is transported through open fast filters (eight (8) units) based on gravel and quartz sand.

Figure 4-3: Water treatment plant. Open quick filter. The pipes of open quick filters

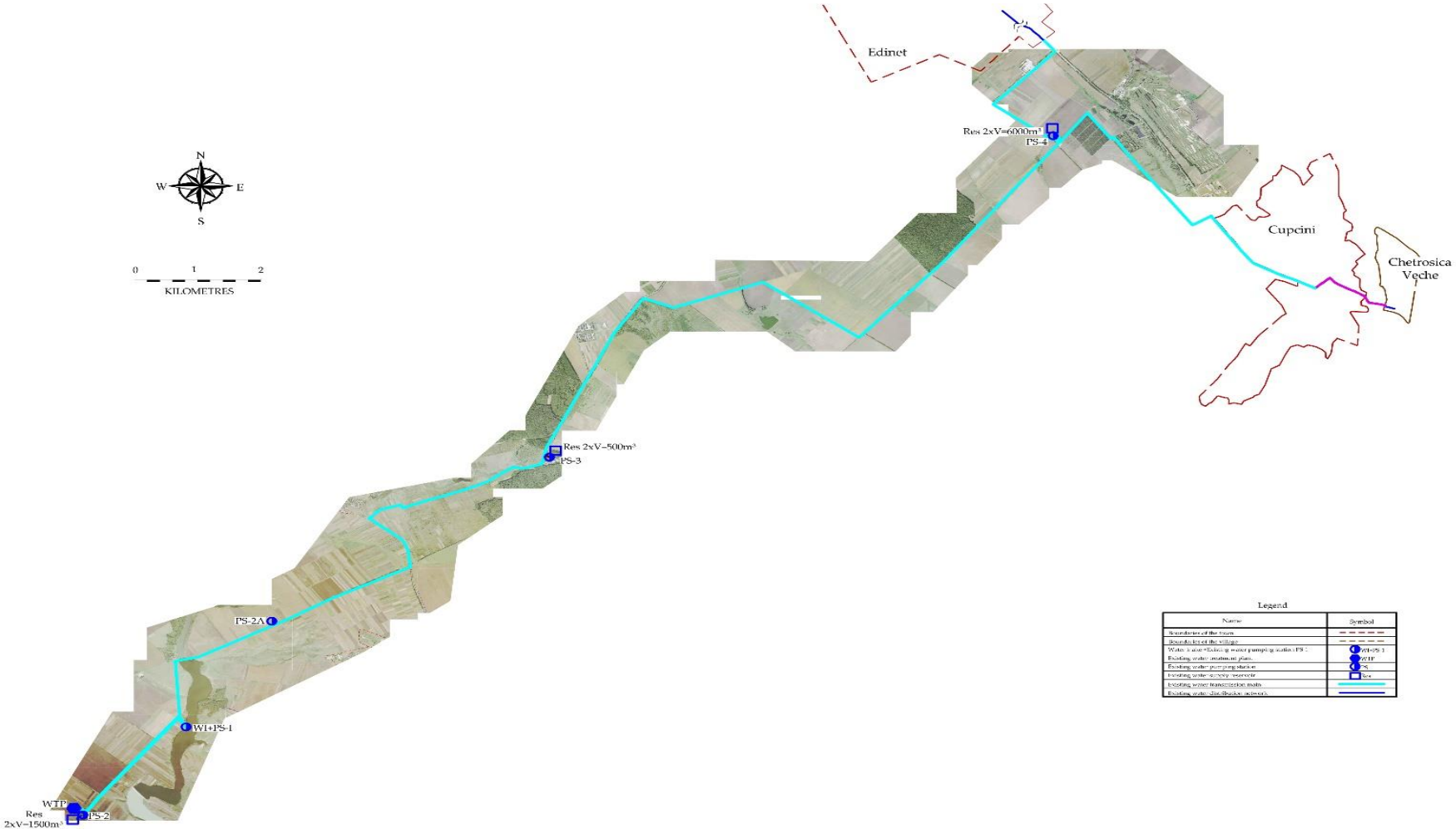
Source: GIZ/MLPS

The treated water is stored into two (2) drinking water underground reservoir with a volume of 1,500 m^3 each. The main technical parameters about existing underground drinking water reservoirs, are provided in Table 4-11.

4.3.1.4 Drinking water transmission main

The treated water, stored into drinking water underground reservoirs located at water treatment plant area, through a water transmission main, by three (3) water pumping stations (PS-2, PS-2A, PS-3) is stored into two (2) underground water reservoirs with a capacity of 6,000 m^3 each, installed at the fourth level pumping station PS-4 area and further delivered into water distribution network in the town of Edinet which operates, by use of two (2) underground service tanks, installed at the water pumping station (PS-5) area.

Figure 4-4: Drinking water transmission main from water treatment plant to water pumping station (PS-4)



Source: www.geoportal.md, GIZ/MLPS

The main technical parameters of drinking water transmission main are presented in Table 4-7.

Table 4-7: Technical parameters of drinking water transmission main

No.	Type of transmission main	Pipe material	Diameter (mm)	Length (m)	Pipe age (years)
1.	Drinking water transmission main (from PS-2 to PS-4)	Concrete	600	23.452	> 30
2.		Steel	600 500 400 300	610 30 1,500 1,600	> 30
3.	Drinking water transmission main (from PS-4 to town of Edinet)	HDPE	315	2,309	10
4.	Drinking water transmission main (from PS-4 to town of Cupcini)	Cast iron	400 300	1,400 1,180	> 30
	Total			**32,081**	

Source: ME 'Apa-Canal' Edinet

According to the obtained data, the quality of the drinking water do not comply with the standards of the Republic of Moldova (Government Decision no. 934 of 15.08.2007 on the establishment of Automated Information System "State register of natural mineral water, drinking water and bottled non-alcoholic beverages") and its treatment, for following indicators: colour and turbidity. The analysis of the drinking water quality provided by the ME 'Apa-Canal' Edinet, is presented in Tables 4-8 and 4-9 and 4-14.

Table 4-8: Water quality indicators (01 December, 2015)

No.	Indicator	Unit	Max. concentration acc. to G.D. No 934	Drinking water quality (after PS-4 to Edinet)	Drinking water quality (after PS-4 to the town of Cupcini)
1.	Smell	degree	acceptable for consumers	-	-
2.	Taste	degree	acceptable for consumers		
3.	Colour	degree	acceptable for consumers	46.9	46.9
4.	Hydrogen Index pH		≥ 6.5 ≤9.5		-
5.	Turbidity	degree	5	1.2	1.1
6.	Ammonia NH_4	mg/l	0.5	0.37	0.57
7.	Nitrites (NO_2)	mg/l	0.5	< 0.003	< 0.003
8.	Nitrates (NO_3)	mg/l	50	1.8	1.98
9.	Total hardness	degree	5 German degree	16.8	17.4
10.	Total dissolved solids	mg/l	1,500	523	527
11.	Chlorine	mg/l	250	48	50
12.	Sulphates	mg/l	250	73.4	69.9
13.	Fluorides	mg/l	1.5	0.50	0.56
14.	Iron	mg/l	0.3	0.1	0.1

Source: ME 'Apa-Canal' Edinet

Table 4-9: Drinking water quality indicators in the distribution network of town of Edinet (02 December, 2015)

N°	Indicator	Unit	Max. concentration acc. to G.D. No 934	Drinking water quality (hairdressers Dimineata)	Drinking water quality (café Gogoasa)	Drinking water quality (Lyceum Mihai Eminescu)
1.	Smell	Degree	acceptable for consumers	-	-	-
2.	Taste	Degree	acceptable for consumers	-	-	-
3.	Colour	Degree	acceptable for consumers	52	49.4	39
4.	Hydrogen Index pH		≥ 6.5 ≤9.5	-	-	-
5.	Turbidity	Grade	5	2.3	1.6	1.1
6.	Ammonia NH_4	mg/l	0.5	< 0.05	< 0.05	0.24
7.	Nitrites (NO_2)	mg/l	0.5	< 0.003	< 0.003	< 0.003
14.	Iron	mg/l	0.3	0.2	0.13	0.13

Source: ME 'Apa-Canal' Edinet

4.3.1.5 Water pumping stations

The main technical parameters of water pumping stations are presented in Table 4-10.

Table 4-10: Nominal parameters of water pumping stations

No	PS name	Year of installation	Year of rehabilitation	Type	Flow rate (m^3/h)	Head (m)	Power (kW)	Energy specific consumption [kwh/m³]
1.	PS-2 Badragii Vechi locality	1973	2004	GRUNDFOS HS-200/150/480	360	72	110	0.31
2.				GRUNDFOS HS-200/150/480	360	72	110	0.31
3.				Д320/70	320	70	90	n/f
4.	PS-2A Brinzeni locality	2004		GRUNDFOS HS-200/150/480	360	67	90	0.356
5.				GRUNDFOS HS-200/150/480	360	67	90	0.356
6.				Д-320/70	320	70	90	n/f
7.	PS-3 Zabriceni locality	1973	2004	WEIR SDD-200/250	325	47.5	90	0.3
8.				WEIR SDD-200/250	325	47.5	90	0.3
9.				8НДВ-60	400	45	75	n/f
10.				8НДВ-60	400	45	75	n/f
11.	PS-4 town of Edinet (outside area)	1973	2004	WEIR SDCD-150/200	300	38	55	0.18
12.				WEIR SDC-150/200	300	38	55	0.18
13.				Д-320/70	320	70	90	0.6
14.				8НДВ-60	400	45	75	n/f
15.	PS-5 the town of Edinet, Bucovinei road	1984	2004	HL-125/100/400	100	70	17	0.17
16.				HL-125/100/400	100	70	17	0.17
17.				HL-125/100/400	100	70	17	0.17

Source: ME 'Apa-Canal' Edinet

Figure 4-5: Water pumping station PS-1. Water pumping station PS-2

Source: GIZ/MLPS

Figure 4-6: Water pumping station PS-2A. Water pumping station PS-3

Source: GIZ/MLPS

Figure 4-7: Water pumping station PS-4. Existing water pumping station PS-5

Source: GIZ/MLPS

4.3.1.6 Water storage facilities

The main technical data on the existing underground water reservoirs are provided in Table 4-11.

Table 4-11: Main technical parameters of the existing underground water reservoirs

N°	Location	Year of construc-tion	Year of rehabili-tation	Type of reservoir	Capaci-ty (m^3)	Quantity/ No. of cham-bers	Condi-tion
1.	Badragii Vechi locality (PS-2)	1973	2004	rectangular	1,500	2	satisfac-tory
2.	Zabriceni local-ity (PS-3)	1973	2004	rectangular	500	2	satisfac-tory
3.	town of Edinet, outside area (PS-4)	1973	2004	rectangular	6,000	2	satisfac-tory
4.	PS-5 town of Edinet, Buco-vinei road	1984	2004	rectangular	2,000	2	satisfac-tory

Source: ME 'Apa-Canal' Edinet

Figure 4-8: The underground reservoir: 1,500 m^3 (water treatment plant area) and 500 m^3 each (PS-3 area)

Source: GIZ/MLPS

Figure 4-9: The underground water reservoir: 6,000 m^3 (PS-4 area) and 2,000 m^3 each (PS-5 area)

Source: GIZ/MLPS

4.3.1.7 Water disinfection

The clarification of water through the settling and filtration processes reduces the bacterial concentration in water, but not sufficiently for consumption. An additional disinfection process is needed to ensure the bacteriological quality of drinking water. A chlorine solution is used for water disinfection, which mainly aims to ensure antibacterial protection in the water distribution network of the towns of Edinet and Cupcini up to the end point of use as well as the oxidation of organic compound and minerals in the water.

The treated water is subjected to the chlorination injection into underground water reservoirs with a volume of 6,000 m^3 each installed at fourth level pumping station area PS-4.

4.3.1.8 Water distribution network

The water distribution network consists of cast iron, steel, asbestos-cement and high density polyethylene (HDPE) pipes with diameters of between 50 mm and 315 mm. The total length of water distribution network is about 45,375 m. Main technical parameters of water distribution network in the town of Edinet are provided in the Table 4-12. The length of water distribution network for different diameters expressed as a percentage is provided in Table 4-13.

Table 4-12: Main technical parameters of water distribution network

N°	Material	Length (m) / diameter (mm)								Length (m)	Pipe age (years)	Total length (m)
		50	63	75	90	110/100	160/ 150	225/ 200	315/300			
1.	HDPE	10,984	1,492	1,348	3,803	3,011	1,595	800	1,060	24,093	9-10	45,375
2.	Cast iron					977	8,345	1,421	575	11,318	> 30	
3.	Steel	5,458				1,680			2,236	9,374	> 30	
4.	Asbestos-cement					306	284			590	> 30	

Source: ME 'Apa-Canal' Edinet

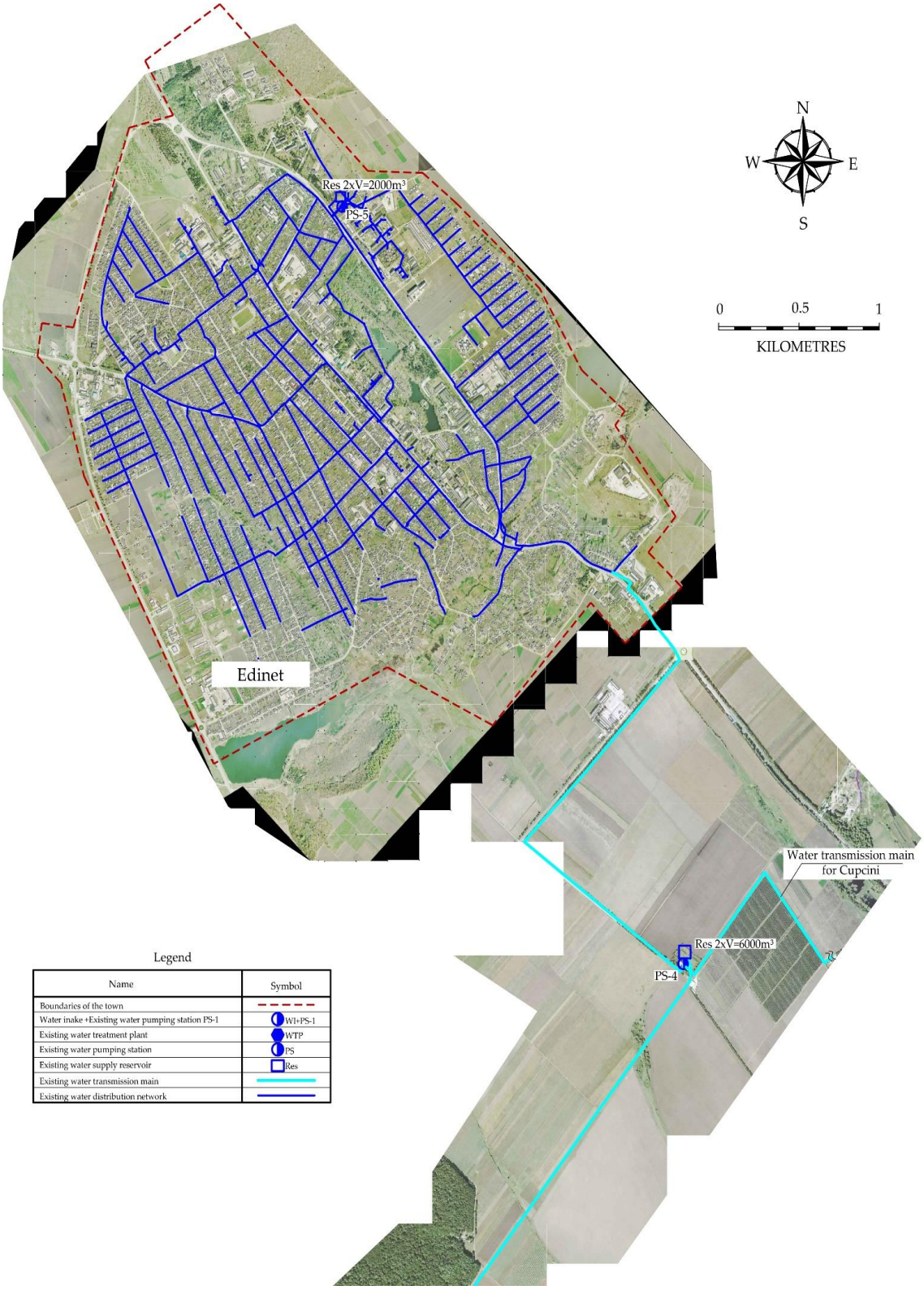
Table 4-13: Percentage of water distribution network by diameter size

No.	Material	Network length (m) by diameter size (mm)		Length (m)	Age (years)	Total (%)
		300 – 200 mm	160 – 50 mm			
1.	HDPE	1,860	22,233	24,093	9-10	53
2.	Cast iron	1,996	9,322	11,318	> 30	25
3.	Steel	2,236	7,138	9,374	> 30	21
4.	Asbestos-cement		590	590	> 30	1
	Total	**6,092**	**39,283**	**45,375**		**100**

Source: ME 'Apa-Canal' Edinet, GIZ/MLPS assessments

The water distribution network in the town of Edinet is provided in Figure 4-10. More detailed information about water distribution network in the town of Edinet is provided in Annex 11.

Figure 4-10: Water distribution network in the town of Edinet



Source: www.geoportal.md, GIZ/MLPS

Figure 4-11: Manhole with water meter node for the town of Edinet

Source: GIZ/MLPS

4.3.2 Water supply system in the town of Cupcini

Water is supplied 24 hours/day in the town of Cupcini. Water supply services are provided to about 6,439 consumers (72%) out of 8,916 inhabitants.

The drinking water in the town of Cupcini is supplied by gravity from underground water reservoirs with a capacity of 6,000 m^3 each installed at the fourth level pumping station PS-4 area.

Table 4-14: Drinking water quality indicators in the distribution network of town of Cupcini (02 December, 2015)

No.	Indicator	Unit	Max. concentration acc. to G.D. No 934	Drinking water quality (hairdresser Borta)	Drinking water quality (cannery)	Drinking water quality (Shop Mercurii)
1.	Smell	Degree	acceptable for consumers	-	-	-
2.	Taste	Degree	acceptable for consumers	-	-	-
3.	Colour	Degree	acceptable for consumers	**39**	**26**	**7.8**
4.	Hydrogen Index pH		≥ 6.5 ≤9.5	-	-	-
5.	Turbidity	Degree	5	0.99	0.74	0.24
6.	Ammonia NH_4	mg/l	0.5	0.24	0.24	< 0.05
7.	Nitrites (NO_2)	mg/l	0.5	< 0.003	< 0.003	< 0.003
14.	Iron	mg/l	0.3	0.2	0.15	0.2

Source: ME 'Apa-Canal' Edinet

The water distribution network consists of cast iron, steel and high density polyethylene (HDPE) pipes with diameters of between 50 mm and 315 mm. The total length of water distribution network is about 33,038 m. Main technical parameters of water distribution network in the town of Cupcini are provided in Table 4-15. The length of water distribution network for different diameters expressed as a percentage is provided in Table 4-16.

Table 4-15: Main technical parameters of water distribution network in the town of Cupcini

No	Mate-rial	Length (m) / diameter (mm)								Length (m)	Pipe age (years)	Total length (m)
		50	63	75	90/80	110/100	160/150	225/200	315/300			
1.	HDPE	6,300	973		846	3,178			2,064	13,361	9-10	33,038
2.	Cast iron					1,424				1,424	> 30	
3.	Steel	4,705			185	4,052	4,155	5,156		18,253	> 30	

Source: ME 'Apa-Canal' Edinet

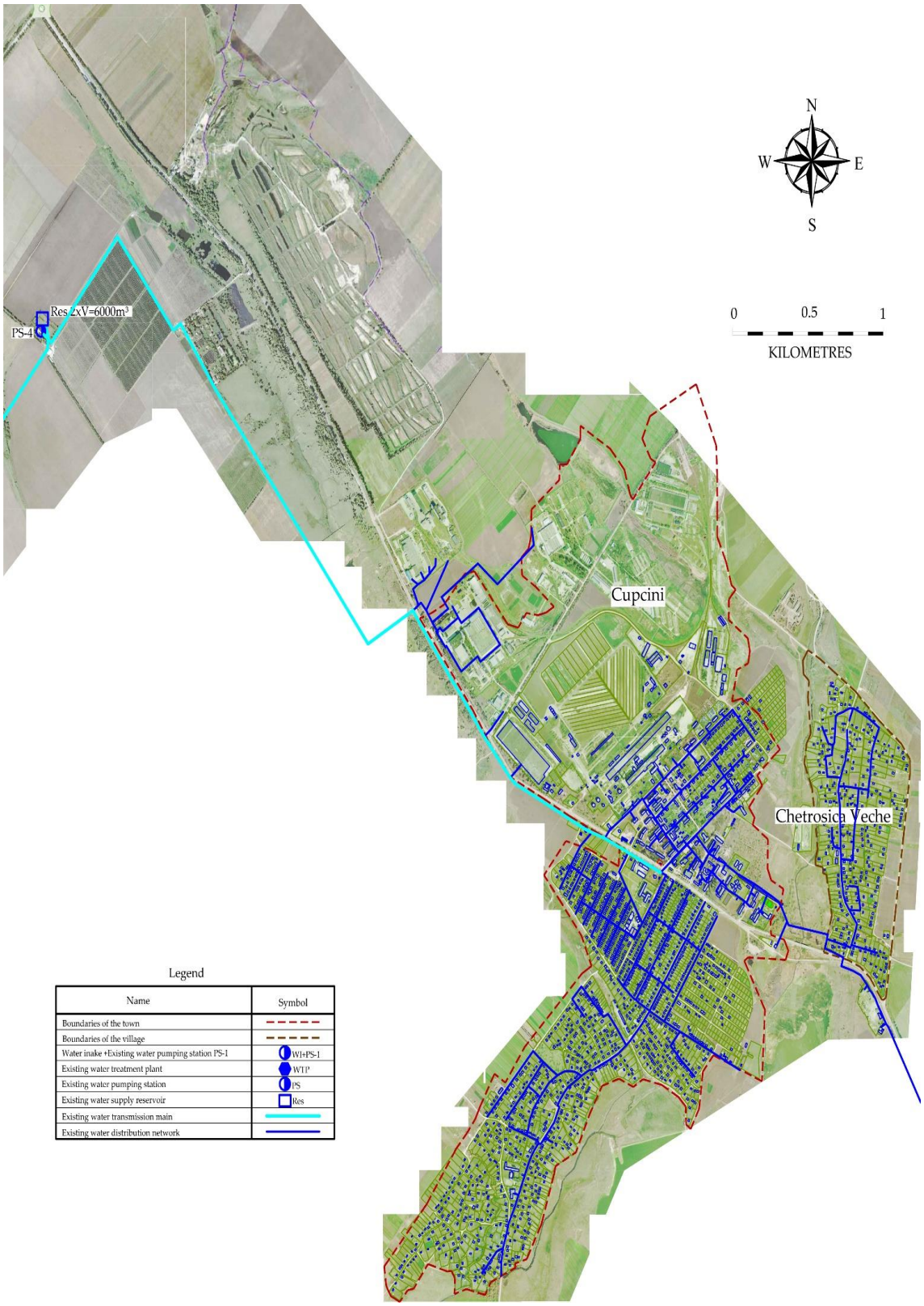
Table 4-16: Percentage of water distribution network by diameter size

No.	Material	Network length (m) by diameter size (mm)		Length (m)	Age (years)	Total (%)
		300 – 200 mm	160 – 50 mm			
1.	HDPE	11,297	2,064	13,361	9-10	40
2.	Cast iron		1,424	1,424	> 30	4
3.	Steel	5,156	13,097	18,253	> 30	55
	Total	**16,453**	**16,585**	**33,038**		**100**

Source: ME 'Apa-Canal' Edinet, GIZ/MLPS assessments

The water distribution network in the town of Cupcini is provided in figure 4-12. More detailed information about water distribution network in the town of Cupcini is provided in Annex 11.

Figure 4-12: Water distribution network in the town of Cupcini



Source: www.geoportal.md, GIZ/MLPS

4.4 Water balance

The data necessary for water balance calculation were provided by the ME 'Apa-Canal' Edinet and included the following details: monthly volumes of the abstracted raw water, monthly volumes of water sold to domestic customers, monthly volumes of water sold to public institutions and business entities.

Following the real water consumption, the non-revenue water rate for water supply system of towns of Edinet and Cupcini was determined.

4.4.1 The monthly volume of the abstracted raw water

According to the information provided by the ME 'Apa-Canal' Edinet, the monthly volume of the abstracted raw water is determined according to the pumping time of raw water, pumps capacity located at the first level pumping station (PS-1) and the season of the year.

4.4.2 Water consumption

The water demand per month is the monthly volume of water sold to domestic customers, public institutions and business entities in the towns of Edinet and Cupcini.

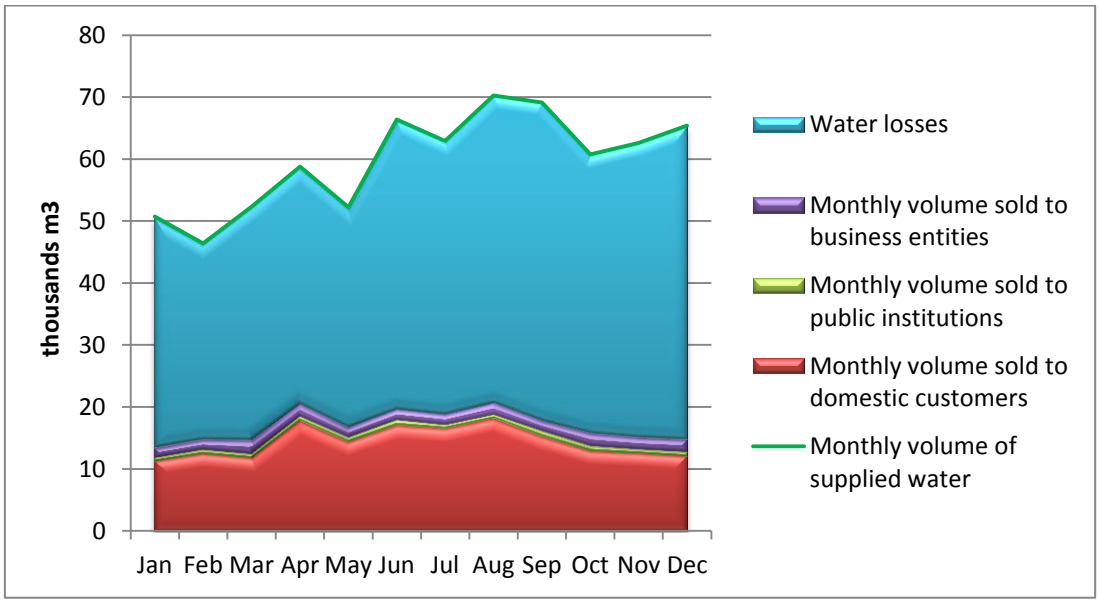
Operational indicators for 2014, presented by the ME 'Apa-Canal' Edinet, are provided in Table 4-17 for the town of Edinet and in Table 4-18 for the town of Cupcini.

Table 4-17: Operational indicators for 2014, town of Edinet

N°	Month	Monthly volume of the abstracted raw water (m^3)	Monthly volume of raw water at the inlet of treatment plant (m^3)	Monthly volume of treated water (m^3)	Monthly volume of supplied water (m^3)	Monthly volume of water sold, m^3		
						Domestic customers	Public institutions	Business entities
1.	January	111,027	109,386	106,229	50,760	11,329	684	1,542
2.	February	97,540	96,099	93,305	46,400	12,529	745	1,631
3.	March	100,050	98,571	95,800	52,350	11,816	805	2,166
4.	April	95,972	94,554	91,800	58,820	17,750	767	2,061
5.	May	111,968	110,313	107,075	52,220	14,381	821	1,616
6.	June	159,954	157,590	153,000	66,400	17,008	910	1,798
7.	July	130,681	128,750	124,950	62,920	16,498	689	1,670
8.	August	153,472	151,204	146,750	70,260	18,070	701	1,947
9.	September	168.004	165,521	127,716	69,150	15,195	967	1,681
10.	October	139,254	137,196	133,185	60,750	12,904	941	2,042
11.	November	124,513	122,673	119,082	62,600	12,563	790	1,868
12.	December	118,554	116,802	113,400	65,430	12,093	858	1,936
	Total	**1,510,989**	**1,488,659**	**1,445,304**	**718,060**	**172,135**	**9,678**	**21,958**

Source: ME 'Apa-Canal' Edinet

Figure 4-13: Operational indicators, town of Edinet



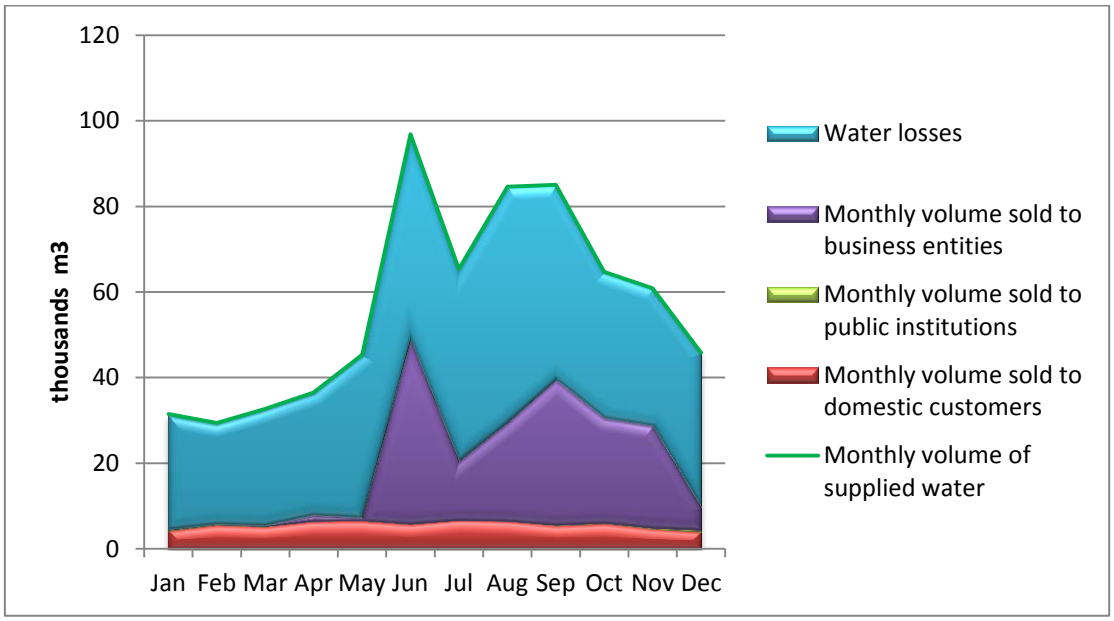
Source: ME 'Apa-Canal' Edinet, GIZ/MLPS

Table 4-18: Operational indicators for 2014, town of Cupcini

No.	Month	Monthly volume of supplied water (m^3)	Monthly volume of water sold, m^3		
			Domestic customers (m^3)	Public institutions (m^3)	Business entities (m^3)
1.	January	31,504	4,287	280	221
2.	February	29,413	5,533	244	277
3.	March	32,696	5,187	235	332
4.	April	36,502	6,428	195	1,461
5.	May	45,315	6,489	263	790
6.	June	96,884	5,741	197	43,072
7.	July	65,418	6,758	98	13,914
8.	August	84,597	6,499	80	23,163
9.	September	85,015	5,447	267	33,954
10.	October	64,680	5,882	289	24,541
11.	November	60,897	4,760	263	23,885
12.	December	45,822	4,098	595	5,245
	Total	**678,743**	**67,114**	**3,006**	**170,855**

Source: ME 'Apa-Canal' Edinet

Figure 4-14: Operational indicators, town of Cupcini



Source: ME 'Apa-Canal' Edinet, GIZ/MLPS

4.4.3 Real water consumption

The real water consumption is the volume of water consumed by one customer during 24 hours to meet the physiological and domestic needs under normal operation conditions of the water supply system (l/c/d). and is the ratio of daily water sold by the utility divided by the number of consumers (domestic, public institutions and business entities), as provided in Table 4-19 for town of Edinet and in Table 4-20 for the town of Cupcini.

Table 4-19: The real water consumption, town of Edinet

No.	Indicator	Unit of measurement	Year		
			2012	2013	2014
1.	Number of domestic customers	pers.	7,847	8,075	11,378
2.	The annual of abstracted raw water	m³	1,826,141	1,696,352	1,510,989
3.	Total volume of treated water	m³	1,747,500	1,623,300	1,445,300
4.	Total water sold by the utility, of which: • Domestic consumers • Public institutions and business entities	m³ m³ m³	199,897 173,561 26,336	199,654 171,071 28,583	203,771 172,135 31,636
5.	Real water consumption (based on daily sold water)	l/c/d	71	68	49
6.	Real water consumption (based on daily water sold to domestic consumers)	l/c/d	61	58	41

Source: ME 'Apa-Canal' Edinet, GIZ/MLPS assessments

Table 4-20: The real water consumption, town of Cupcini

No.	Indicator	Unit of measure-ment	Year		
			2012	2013	2014
1.	Number of domestic customers	pers.	3,380	3,420	5,203
2.	The annual of abstracted raw water	m³	1,826,141	1,696,352	1,510,989
3.	Annual volume of treated water	m³	1,747,500	1,623,300	1,445,300
4.	Total water sold by the utility, of which: • Domestic consumers • Public institutions and business entities	m³ m³ m³	308,810 61,341 247,469	272,692 62,914 210,048	240,975 67,114 173,861
5.	Real water consumption (based on daily sold water)	l/c/d	250	219	127
6.	Real water consumption (based on daily water sold to domestic consumers)	l/c/d	50	50	35

Source: ME 'Apa-Canal' Edinet, GIZ/MLPS assessments

4.4.4 Non-revenue water (NRW)

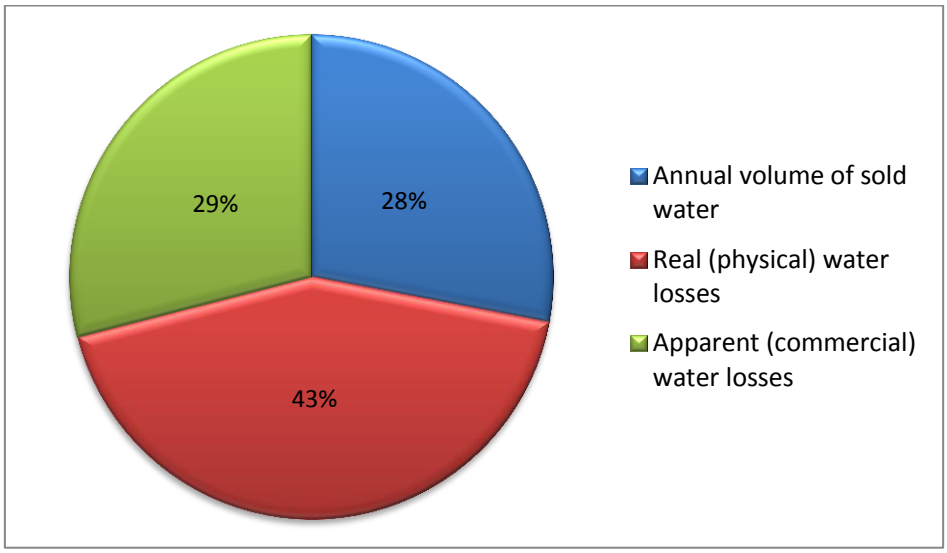
Annual non-revenue water is the difference between the annual volume of abstracted raw water and annual water sold by the utility. The water balance for water supply system in town of Edinet and for water supply system in the town of Cupcini is provided in Table 4-21.

Table 4-21: The water balance

N°	Indicator	Unit of measurement		2014	
1.	Annual volume of abstracted raw water	m³		1,510,989	
2.	Annual volume of treated water	m³		1,445,300	
3.	Water losses on water transmission main	m³		114,186	
4.	Domestic customers (town of Edinet)	pers.		11,227	
5.	Annual volume of supplied water (town of Edinet)	m³		718,060	
6.	Annual volume of sold water (town of Edinet)	m³		203,771	
7.	The annual volume of NRW, (town of Edinet) including: • Real (physical) water losses (60% of NRW) • Apparent (commercial) water losses (40% of NRW)	m³ m³ m³	% % %	514,289 308,573 205,715	72 43 29
8.	Domestic customers (town of Cupcini)	pers.		5,203	
9.	Annual volume of supplied water (town of Cupcini)	m³		678,743	
10.	Annual volume of sold water (town of Cupcini)	m³		240,975	
11.	The annual volume of NRW, (town of Cupcini) including: • Real (physical) water losses (60% of NRW) • Apparent (commercial) water losses (40% of NRW)	m³ m³ m³	% % %	437,768 262,661 175,107	65 39 26

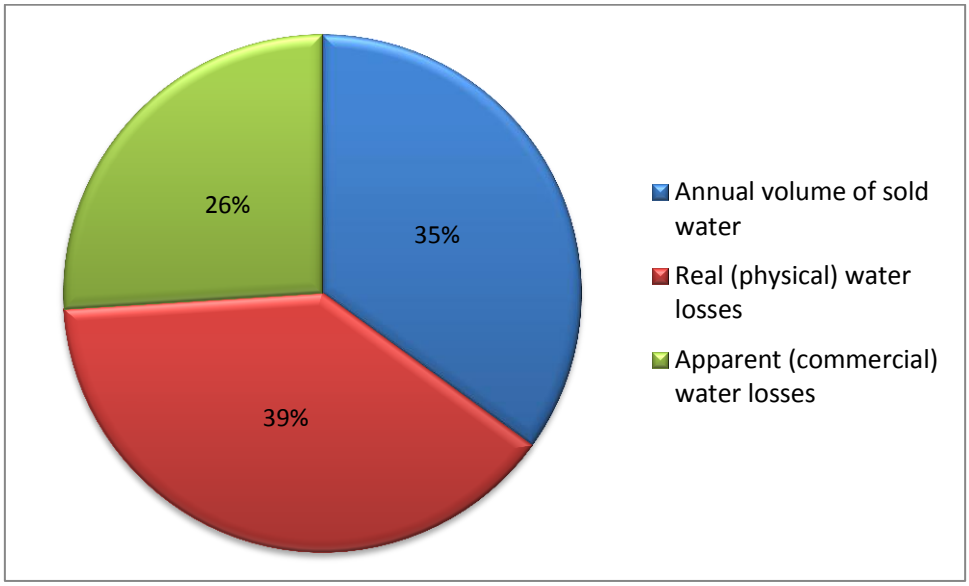
Source: ME 'Apa-Canal' Edinet, GIZ/MLPS assessments

Figure 4-15: Water balance, town of Edinet



Source: ME 'Apa-Canal' Edinet, GIZ/MLPS assessments

Figure 4-16: Water balance, town of Cupcini



Source: ME 'Apa-Canal' Edinet, GIZ/MLPS assessments

In order to reduce real (physical) losses of water it is recommended to:

- Identify the condition of pipes during operational or capital repairs (taking note of the material, interior and outer diameter, as well as interior and exterior condition);
- Identify the network sections with an advanced degree of wear or damage;
- Rapidly detect hidden water losses;
- Maintain records related to damages/ leaks and their quick remedy.

The measures related to apparent (commercial) water loss reduction can be identified by effective management of water supply system in towns of Edinet and Cupcini. With the purpose to reduce apparent water losses it is recommended to:

- Identify and replace defective water meters; and
- Identify unauthorised connections of the water distribution network.

4.4.5 Water metering

During the period 2008-2009, in the town of Edinet a water metering programme was implemented, resulting in a metering rate of about 91% of customers in single-family dwellings, about 96% of customers of multi-storey apartment buildings, 100% of public institutions and business entities. The water meters installed for customers are of class "A", class "B" and class "C".

At same time, in the town of Cupcini a water metering programme was implemented also, resulting in a metering rate of about 99% customers in single-family dwellings, about 99.9% of customers of multi-storey apartment buildings, 100% of public institutions and business entities in town of Cupcini. The water meters installed for customers are of class "A", class "B" and class "C".

4.4.6 Equipment and facilities

The ME ‘Apa-Canal’ Edinet owns and operates the following equipment and facilities:

- Portable ultrasonic flow meter (one (1) unit);
- Leak detection equipment, which includes also acoustical detection system and correlator (one (1) unit);
- Water transportation truck (one (1) unit);
- Laboratory equipment for monitoring of water quality analysis (one (1) unit);
- Laboratory equipment for indicator measurement (SS, BOD_5, COD, phosphorus etc.), (one (1) unit);
- Drainage truck (e.g. with combined functions of vacuum suction and pipe washing) and other equipment necessary for sewerage network maintenance (three (3) units);
- Tractor/vehicles for sewerage network maintenance (two(2) units);
- ZIL transportation truck (one (1) unit).

4.5 Technical and operational analysis of the water supply system

4.5.1 Non-revenue water (NRW)

Non-revenue water has a negative impact on operating costs (high level of electricity consumption for pumping, costs for current and capital repairs, etc.) and revenues (apparent /commercial losses). Both the operating costs and revenues are important factors for sustainable development in water supply sector.

At this time, the degree of wear of existing pipelines is very high, causing large leaks in the water supply system in the towns of Edinet and Cupcini. The statistics on damages and repairs in the period 1 January 2014 – 31 December 2014 are provided in Tables 4-22, 4-23, 4-24 and 4-25.

Table 4-22: Statistics on pipe damage, 1 Jan-31 Dec, 2014, town of Edinet

No.	Location	Pipeline breakdowns
1.	On water transmission main	9
2.	On distribution network	39

Source: ME 'Apa-Canal' Edinet

Table 4-23: Statistics on repairs made, 1 Jan-31 Dec 2014, town of Edinet

No.	Type of repair/location	Pipeline repairs
1.	Current repairs	74
2.	Capital repairs	1
3.	Water losses	411,397 m^3

Source: ME 'Apa-Canal' Edinet

Table 4-24: Statistics on pipe damage, 1 Jan-31 Dec, 2014, town of Cupcini

No.	Location	Pipeline breakdowns
1.	On water transmission main	9
2.	On distribution network	25

Source: ME 'Apa-Canal' Edinet

Table 4-25: Statistics on repairs made, 1 Jan-31 Dec 2014, town of Cupcini

No.	Type of repair/location	Pipeline repairs
1.	Current repairs	52
2.	Capital repairs	2
3.	Water losses	437,768 m^3

Source: ME 'Apa-Canal' Edinet

4.6 Wastewater system

4.6.1 Wastewater system in the town of Edinet

About 8,293 domestic consumers out of 18,211 inhabitants from the town of Edinet are connected to the centralised wastewater system, connection rate for wastewater services is about 45%.

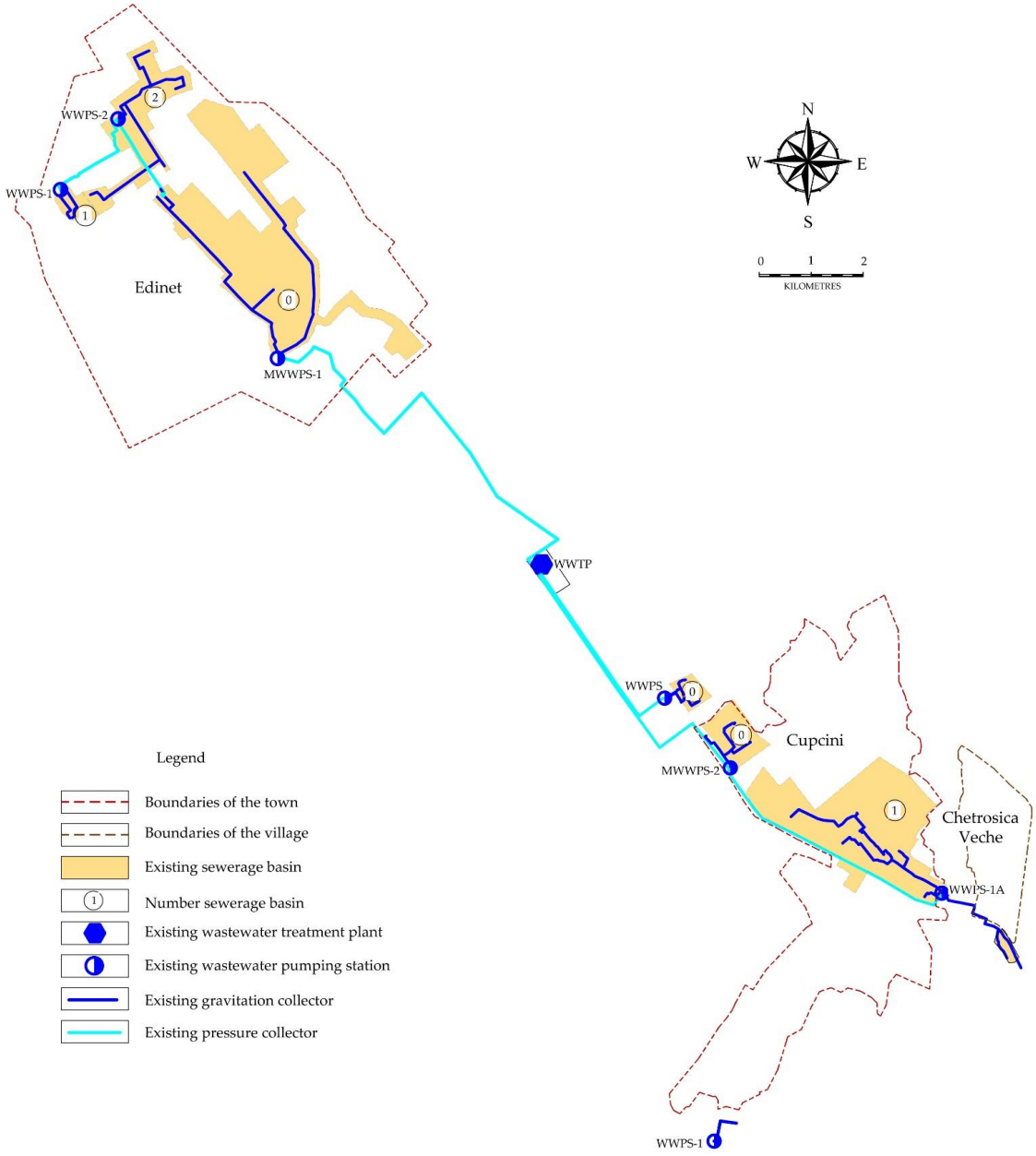
The wastewater system in the town of Edinet consists of separate sewerage networks, which is a system that collects and disposes through - two networks the domestic wastewater, industrial wastewater and storm water. The main facilities of the wastewater system in the town of Edinet are the following:

- Gravity and pressure sewerage network;
- Four (4) wastewater pumping stations of which one (1) is the main wastewater pumping station located in the Frunze street (MWWPS) and three (3) local wastewater pumping stations located in the Gagarin street (WWPS-1), in the Independentei street (WWPS-2), and in the Bercu River area (WWPS-4);
- Wastewater treatment plant (WWTP) in the towns of Edinet and Cupcini.

A scheme of wastewater system is presented in Figure 4-17. More detailed information about wastewater system in the town Edinet is provided in Annex 11.

The drainage areadrainage area represents a defined territory, from which the wastewater is collected to a sewerage network.

Figure 4-17: Wastewater system in the towns of Edinet and Cupcini



Source: GIZ/MLPS

4.6.1.1 Sewerage network

The total length of gravity sewerage network is about. 26,837 m. The main technical parameters of gravity sewerage network are provided in Table 4-26. The total length of pressure sewerage is about. 4,647 m. The main technical parameters of the pressure

sewerage network are provided in Table 4-27. The length of sewerage network for different diameters expressed as a percentage is provided in Table 4-28.

Table 4-26: Main parameters of gravity sewerage network

N°	Material	Length (m) / diameter (mm)							Length (m)	Pipe age (years)	Total length (m)
		100	160/150	225/200	300	350	400	500			
1.	PVC		1,476	1,340					2,816	9-10	26,837
2.	Steel						2,240		2,240	> 30	
3.	Cast iron	757	2,428	205	400	980	339	759	5,868	> 30	
4.	Ceramic		3,551	6,851	3,151				13,553	> 30	
5.	Asbes-tos-cement		1,744	616					2,360	> 30	

Source: ME 'Apa-Canal' Edinet

Table 4-27: Main parameters of pressure sewerage network

No.	Material	Length (m) / diameter (mm)					Length (m)	Pipe age (years)	Total length (m)
		500	225	315/300	400	500			
1.	HDPE	1,340	2,140	215			3,695	9-10	4,647
2.	Steel				656	296	952	30	

Source: ME 'Apa-Canal' Edinet

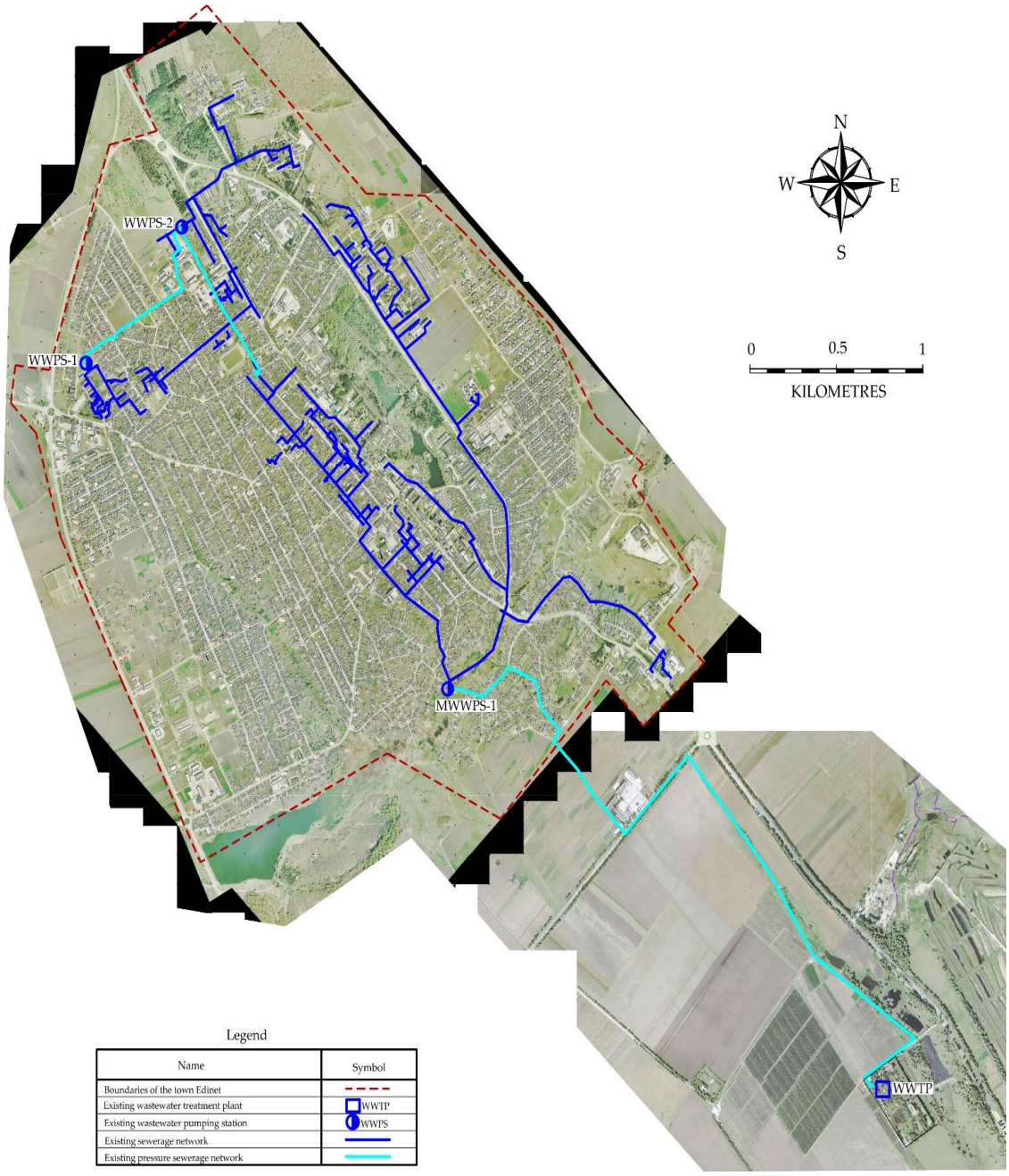
According to GD no.338 of 21.03.2003 on the approval of the Catalogue of fixed assets and intangible assets and presented data, the age of steel pipes with a total length of 3,192 m exceeds 20 years, the age of asbestos-cement pipes with a total length of 2,360 m exceeds 20 years of useful life, and thus, pipe rehabilitation is required.

Table 4-28: Percentage of water distribution network by diameter size

No.	Material	Network length (m) by diameter size (mm)		Length (m)	Age (years)	Total (%)
		500 – 200 mm	160 – 100 mm			
1.	PVC	1,340	1,476	2,816	9-10	9
2.	Steel	3,192		3,192	> 30	10
3.	Cast iron	2,683	3,185	5,868	> 30	19
4.	Ceramic	10,002	3,551	13,553	> 30	43
5.	Asbestos-cement	616	1,744	2,360	> 30	7
6.	HDPE	2,355	1,340	3,695	9-10	12
	Total	**20,188**	**11,296**	**31,484**		**100**

Source: ME 'Apa-Canal' Edinet, GIZ/MLPS assessments

Figure 4-18: Sewerage network in the town of Edinet



Source: www.geoportal.md, ME 'Apa-Canal' Edinet, GIZ/MLPS

4.6.1.2 Wastewater pumping stations

The wastewater pumping stations are located in the lower part of drainage area, where the gravity collection is impossible because of the topography in the area.

The technical parameters of the wastewater pumping stations and pumps are presented in Table 4-29.

Table 4-29: Technical parameters of pumping equipment

N°	PS name	Year of installation	Year of rehabilitation	Type	Flow rate (m^3/h)	Head (m)	Power (kW)	Energy specific consumption (kwh/m^3)
1.	MWWPS -1 Frunze str.	1978		CM-200/150/500	400	80	160	0.4
2.				CM-200/150/500	400	80	160	n/f
3.				GRUNDFOS S2-1604-H3	500	62	155	n/f
4.	WWPS-1 Gagarin str.	1989	2005	GRUNDFOS SV-072-BH3	40	20	9.5	0.24
5.				CM-125/80/315	80	32	22	0.28
6.	WWPS-2 Independenței str.	1978	2005	GRUNDFOS S1-134-H3	90	24	14	0.156
7.				CM-150/185/315	200	32	55	0.28
8.	WWPS-4 Bercut River	2007		GRUNDFOS	26	11	4.5	n/f
9.				GRUNDFOS	26	11	4.5	n/f

Source: ME 'Apa-Canal' Edinet

4.6.2 Wastewater system in the town of Cupcini

About 4,208 domestic consumers out of 8,916 inhabitants from the town of Cupcini are connected to the centralised wastewater system, connection rate for wastewater services is about 47%.

In the town of Cupcini is implemented the separate wastewater system, the main facilities of which are the following:

- Gravity and pressure sewerage network;
- Three (3) wastewater pumping stations (WWPS), of which one is the main wastewater pumping station located at the "Natur Bravo" JSC cannery area (MWWPS-2) and two (2) local wastewater pumping stations (WWPS): one located at the boarding school area (WWPS-1) and the second one located at the technical school area (WWPS-1a).

The sewerage network in the town of Cupcini is provided in Figure 4-17.

4.6.2.1 Sewerage network

The total length of gravity sewerage network in the town of Cupcini is about. 12,949 m. The main technical parameters of gravity sewerage network are provided in Table 4-30. The total length of pressure sewerage is about. 5,520 m. The main technical parameters of the pressure sewerage network, are provided in Table 4-31. The length of sewerage network for different diameters expressed as a percentage, is provided in Table 4-32.

Table 4-30: Main technical parameters of gravity sewerage network

N°	Material	Length (m) / diameter (mm)				Length (m)	Pipe age (years)	Total length (m)
		100	160/150	200	300			
1.	PVC		658			658	9-10	12,949
2.	Steel				647	647	> 30	
3.	Cast iron	2,544				2,544	> 30	
4.	Ceramic		5,369	2,799	813	8,981	> 30	
5.	Asbestos-cement	119				119	> 30	

Source: ME 'Apa-Canal' Edinet

Table 4-31: Main technical parameters of pressure sewerage network

N°	Material	Length (m) / diameter (mm)					Length (m)	Pipe age (years)	Total length (m)
		90	160/150	225	315	400			
1.	HDPE	500	1,200	1,300	1,370		4,370	9-10	5,520
2.	Steel		650			500	1,150	> 30	

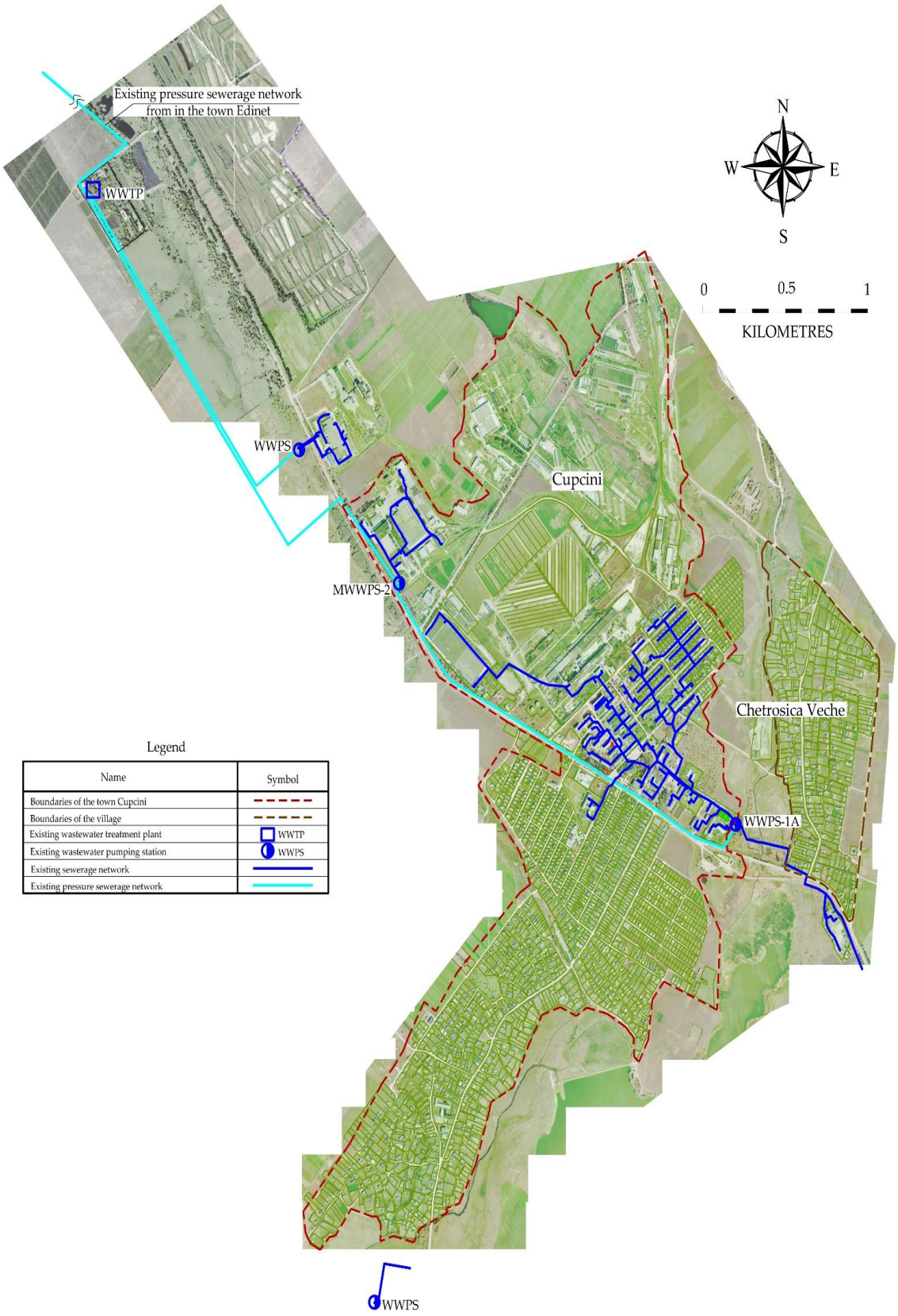
Source: ME 'Apa-Canal' Edinet

Table 4-32: Percentage of water distribution network by diameter size

No.	Material	Network length (m) by diameter size (mm)		Length (m)	Age (years)	Total (%)
		400 – 200 mm	160 – 90 mm			
1.	PVC		658	658	9-10	1.
2.	Steel	1,147	650	1,797	> 30	2.
3.	Cast iron		2,544	2,544	> 30	3.
4.	Ceramic	3,612	5,369	8,981	> 30	4.
5.	Asbestos-cement		119	119	> 30	5.
6.	HDPE	2,670	1,700	4,30	9-10	6.
	Total	**7,429**	**11,040**	**18,469**		

Source: ME 'Apa-Canal' Edinet, GIZ/MLPS assessments

Figure 4-19: Sewerage network in the town of Cupcini



Source: www.geoportal.md, ME 'Apa-Canal' Edinet, GIZ/MLPS

4.6.2.2 Wastewater pumping stations

The wastewater pumping stations are located in the lower part of drainage area, where the gravity collection is impossible because of the topography in the area.

The technical parameters of the wastewater pumping stations and pumps are presented in Table 4-33.

Table 4-33: Technical parameters of the wastewater pumping stations and pumps

N°	PS name	Year of installation	Year of rehabilitation	Pump type	Pump flow rate (m^3/h)	Head (m)	Pump power (kW)	Pump energy specific consumption (kwh/m³)
1.	MWWPS-2 (cannery)	1973		ФГ/6	216	24	40	0,2
2.				ФГ/6	216	24	40	0,2
3.				CM-150/185/315	200	32	40	0,2
4.	WWPS-1 (boarding school)	1973	2005	GRUNDFOS SV-072-BH3	40	20	9,5	0,24
5.				CM-125/80/315	80	32	22	0,28
6.	WWPS-1a (technical school)	2006		GRUNDFOS S1-264-H1	80	40	26	0,33
7.				GRUNDFOS S1-264-H1	80	40	26	n/f

Source: ME 'Apa-Canal' Edinet

Figure 4-20: Main wastewater pumping station MWWPS-2, the town of Cupcini: Contact chamber. Receiving tank

Source: GIZ/MLPS

Figure 4-21: Main wastewater pumping station MWWPS-2, town of Cupcini: Engine room.

Source: GIZ/MLPS

4.6.3 Wastewater treatment plant

The wastewater collected in the towns of Edinet and Cupcini is stored in receiving tanks installed at the main wastewater pumping stations MWWPS-1 and MWWPS-2, and further pumped to the wastewater treatment plant.

The wastewater treatment plant (WWTP) is located in the southeast from Edinet town centre and was put into operation in 1973, with a design capacity of 5,300 m³/day. At present, the capacity of wastewater treatment plant is 904 m³/day.

Wastewater treatment process includes: mechanical treatment, biological treatment, tertiary treatment, and disinfection level.

The technological wastewater treatment plant scheme includes the following facilities:

- Energy dissipater;
- Screens (two (2) units);
- Grit chambers (two (2) units);
- Primary settlers (three (3) units);
- Biological filters (one (1) units);
- Secondary settlers (three (3) units);
- Sludge drying beds (area of 1,8 ha);
- Biological ponds (two (2) units);
- Laboratory building, garage, administrative building.

The energy dissipater (or contact chamber) is designed to reduce the flow rate of pumped wastewater and the transition in gravity flow through open channels to treatment facilities.

The **mechanical treatment** or primary treatment is designed to remove suspended solids from wastewater by physical processes.

Gross solids and other constituents removal is carried out through screens as a mandatory operation to be performed at the inlet of the wastewater treatment plant. Gross solids and other constituents removal at the wastewater treatment plant is carried out through screens installed in the grit chamber.

The grit chambers is designed for removal of mineral particles bigger than 0.2 mm from the wastewater, especially sand particles and particles considered non-decayed. The technological scheme includes two (2) grit chambers, of which only one is in operation.

The sand trapped sludge (dredged sludge) is non-decayed and it is subjected to dewatering on the sludge drying beds, which are not foreseen in the technological scheme.

The primary settlers are designed to gravity sedimentation of particles smaller than 0.2 mm, especially of organic suspended solids. The technological scheme includes three (3) primary settlers, of which one is in operation.

Biological treatment or secondary treatment uses the biological activity of microorganisms in order to oxidise and mineralise the organic matter from wastewater, which previously have been subjected to the primary treatment. The removal of organic matter dissolved in the wastewater is carried out by its absorption on the cell area, microorganisms, especially bacteria. As a result, the new bacteria cells and so-called metabolites (carbon dioxide, mineral salts) are formed. The technological scheme includes one (1) biological filter.

The secondary settlers are designed to remove the grown microorganisms from wastewater, (usually as a biological membrane) in the active sludge aeration tanks. Sedimented sludge is partially used for seeding aeration tanks with activated sludge, and the excess is stored on the sludge drying beds for dewatering, which aims to reduce humidity from 98% up to 70 – 80%. The technological scheme includes three (3) secondary settlers and sludge drying beds, of which one is in operation.

Figure 4-22: Wastewater treatment plant: biological filter. Secondary settlers

Source: GIZ/MLPS

Sludge dewatering or humidity reduction is carried out by natural processes of evaporation and draining. The sludge drying beds are designed for sludge dewatering and are composed of developed sites by damming with earth embankments or concrete/reinforced concrete fences. The sludge drying beds are open-air uncovered. The technological scheme includes sludge drying beds on area about 1.8 ha.

The **tertiary treatment** includes biological ponds, which represents open underground basins. The functioning of biological ponds is based on microbial cultures (usually aerobic). The necessary oxygen for aerobic treatment process which occurs in ponds, is taken from wastewater, organic compounds (sulphates; nitrates), and the atmosphere as a result of algae photosynthesis in the pond. The treatment in the biological ponds is ensured due to long period of wastewater retention, which is enough for development of natural self-treatment processes. The photosynthesis process is the main mecha-

nism on which natural ponds are based. Regarding the design of ponds, their size depends on the required treatment, wastewater quality, climatic conditions (particularly temperature and brightness) and the depth of the pond. In ponds with a depth of 1.0 m occurs also anaerobic processes, on the bottom sludge, producing offensive odours. The technological scheme includes two (2) biological ponds.

The artificial biological treatment does not always ensure the elimination of microbes, bacteria and pathogenic viruses. The **disinfection level** is foreseen to avoid the spread of infectious diseases at the wastewater discharge, and includes following units:

- Chlorination plant, where the chlorine solution is dosed and prepared.

The treated wastewater is discharged in the Ciugur River.

According to obtained data, the quality of effluent wastewater does not comply to the current standards of the Republic of Moldova (Law no.950 of 25.11.2013 on Approval of the Regulations on the conditions of collection, treatment and wastewater evacuation into sewage and /or water bodies for rural and urban localities), and corresponding treatment, for following indicators: suspended solids (SS) and biochemical oxygen demand (BOD5). Quality indicators of influent and effluent wastewater were presented by the ME 'Apa-Canal' Edinet, as provided in Table 4-34.

Table 4-34: Wastewater quality indicators

No.	Indicator	Unit	Maximum allowed concentration acc. to GD nr.950	Influent concentration	Effluent concentration
1.	Hydrogen ion concentration (pH)		6.5 – 8.5	7.4	7.6
2.	Suspended solids	mg/l	35.0	215.3	58.3
3.	Biochemical oxygen demand (BOD_5)	mgO_2/l	25.0	144.0	29.6
4.	Chemical oxygen demand (COD)	mgO_2/l	125.0	329.9	67.0
5.	Ammonia Nitrogen (NH_4+)	mg/l	2.0	39.27	7.49
6.	Total phosphorus (P)	mg/l	2.0	-	-
7.	Synthetic detergents biodegradable active anions	mg/l	0.5	-	-

Source: ME 'Apa-Canal' Edinet

The monthly volume of wastewater discharged to the wastewater treatment plant is provided in Table 4-35.

Table 4-35: Monthly volume of wastewater discharged to the WWTP, 2014

Month	Monthly volume of wastewater discharged to the WWTP in the town of Edinet (m^3)	Monthly volume of wastewater discharged to the WWTP in the town of Cupcini (m^3)
January	11,454	4,000
February	13,084	3,532
March	10,166	3,653
April	10,900	4,768
May	11,384	4,029
June	12,353	39,236
July	12,543	15,503
August	13,158	23,212

Month	Monthly volume of wastewater discharged to the WWTP in the town of Edinet (m^3)	Monthly volume of wastewater discharged to the WWTP in the town of Cupcini (m^3)
September	12,785	32,358
October	10,366	24,797
November	11,673	24,448
December	11,600	8,523
Annual volume of treated wastewater (m^3)		329,532

Source: ME 'Apa-Canal' Edinet

4.7 Available pre-feasibility studies and technical documentation

During the elaboration of this feasibility study; available studies, feasibility studies and existing technical designs have been consulted, as provided in Table 4-36.

Table 4-36: Available studies and technical documentation

No	Project Name	Type of document	Financing Agency
1.	Design of sewerage network in the east district of the town of Edinet, in the perimeter of M. Eminescu street, Bucovinei road, Al. Hijdeu street– (first district), RICOD CONSULTING Ltd. (2014)	Technical design	N/A
2.	Design of sewerage network in the west district of the town of Edinet, in the perimeter of bypass road –Gagarin str., Pescarilor str., Trifan Balta str.– (second district), RICOD CONSULTING S.R.L. (2014)	Technical design	N/A
3.	Energy audit of pumping stations of Edinet Municipal Services Utility, EXCO-VOLTAJ Ltd. (2013)	Energy audit	N/A
4.	Network extension of Prut-Badragi-Edinet water transmission main to supply with water the localities of the town of Edinet, Ltd. "Hidroproiect" (2011)	Feasibility Study	N/A
5.	Activity Development Plan of Edinet Municipal Services Utility, Ltd. "ProConsulting" USAID (2014)	Improvement Plan	N/A
6.	Feasibility Study for reduction of water losses in the distribution network, Ltd. "Cason Engineering Pic", (2011)	Feasibility Study	N/A

Source: LPA Edinet, ME 'Apa-Canal' Edinet

4.8 Conclusions

The identified issues of water supply and wastewater services in the feasibility study area are the following:

- In the town of Edinet, the water supply service area is about 80% and water supply connection rate is about 79%;
- In the town of Cupcini, the water supply service area is about 76% and water supply connection rate is about 72%;
- According to the obtained data, the quality of the drinking water do not comply with the standards of the Republic of Moldova (Government Decision no.934 of 15.08.2007 on the establishment of Automated Information System "State register of natural mineral water, drinking water and bottled non-alcoholic beverages") and its treatment, for following indicators: colour and turbidity;

- High real (physical) and apparent (commercial) water losses (annual volume of NRW is about 72%) in the town of Edinet;
- High real (physical) and apparent (commercial) water losses (annual volume of NRW is about 65%) in the town of Cupcini;
- High degree of wear of existing pipelines (the pipe age exceeds years of useful life) causes leakages in the water supply system in some sectors of the towns of Edinet and Cupcini;
- In the town of Edinet, the wastewater service area is about 67% and wastewater connection rate is about 46%;
- In the town of Cupcini, the wastewater service area is about 50% and wastewater connection rate is about 47%;
- High degree of wear of existing pipelines (the pipe age exceeds years of useful life) causes frequent sewerage blockages and emergency driven maintenance;
- According to information provided by the ME 'Apa-Canal' Edinet, the quality of effluent wastewater do not comply to the actual standards of the Republic of Moldova (Law no.950 of 25.11.2013 on Approval of the Regulations on the conditions of collection, treatment and wastewater evacuation into sewage and /or water bodies for rural and urban localities), and corresponding treatment, for following indicators: suspended solids (SS) and biochemical oxygen demand (BOD_5).

5 Investment programme

5.1 General

The objective of this chapter is to prepare an Investment Programme to set the general direction for sector development in the feasibility study area and to identify the investment needs that will lead to increased coverage of population with water supply and wastewater services, improved service quality and efficiency improvements.

The subject Investment Programme has been developed in partnership system between the MLPS experts as well as local and regional partners[5] based on the following. The subject Investment Programme has been prepared by the Consultant based on the following:

- Existing pre-feasibility, feasibility studies and detailed designs (see Chapter 4.7);
- WSS Regional Sector Programme (RSP) and Possible Project Concept (PPC) for Edinet developed in the framework of the programme "Modernization of local public services in the Republic of Moldova";
- Analysis of the existing situation (see Chapter 4);
- The comparison of results and assessment of initial conditions with Regional Sector Programme, Water Supply and Sanitation Strategy 2014-2028 (GD nr.199 of 20.03.2014);
- Strategies, goals and priorities defined by the Mayor's Office of the town of Edinet and the ME 'Apa-Canal' Edinet (see Chapter 5.2);
- Identified problems and objectives based thereon;
- Water demand and wastewater flow projection (see Chapter 5.4).

The Investment Programme includes:

- Short-term;
- Medium-term;
- Long-term measures.

The short-term measures are referred to as Priority Investment Measures and are again sub-divided into two sub-phases as follows:

- Phase 1 – priority measures to be implemented until 2018;
- Phase 2 – priority measures to be implemented between 2018 and 2021 (depending on the availability of funds and the capacity of the implementing and operating agency this period might be extended).

The main reason for the sub-division of the short-term measures into two phases is that the capacity of the implementing and operating agencies should not be overloaded. Further, the objective is to identify "no-regret" measures which can be implemented

[5] A Project Working Group (PWG), established by decision of the local council and comprising members from the Regional Development Agency Centre (RDA North), the Local Public Administration (LPA) and GIZ/MLPS experts, was instituted to facilitate and coordinate the process of preparation and agreeing this feasibility study, in particular the scope of the proposed project. The same PWG will endorse the study for approval by the Edinet local council.

immediately after completion of this feasibility study and which neither require further studies or investigations nor might it be in contradiction to other regional projects under development. Priority investment measures retained in Phase 1 are considered as “The Project” for which further assessments have been carried out (Option Analysis, Financial Analysis, Environmental Assessment, etc.) in this study.

The identified investment measures are presented in this chapter in the following sections:

- In Chapter 5.7 all identified measures are described (irrespective of their phasing);
- In Chapter 5.8 the identified measures will be prioritised and phased (grouping into the above-mentioned phases);
- In Chapter 5.9 an Option analysis for the priority investment measures retained for Phase 1 has been carried out;
- In Chapter 5.10 a Priority Investment Plan (PIP) including investment cost estimates for Phase 1 and Phase 2 measures has been presented.

5.2 Development strategy for the water supply and wastewater services

In general, the main drivers for developing the Investment Programme in the water supply and wastewater sector are:

- Strategic goal;
- Urban development;
- Service objectives;
- Water demand projection;
- Metering policy;
- Tariff policy.

Strategic goal

The general strategic goal of the Mayor Office and the ME ‘Apa-Canal’ Edinet is to achieve a viable and high quality management of the centralised water supply and wastewater systems. In order to further improve the efficiency of the services and to make use of economies of scale, neighboring localities should be integrated into the services area of the ME ‘Apa-Canal’ Edinet.

The local and regional strategies are therefore aligned to this national objective since the local strategy foresees the regionalisation of water supply and wastewater (WSS) services whilst the Regional Sector Programme (RSP) provides the framework for improving the conditions of local operators so that they can expand services and provide a viable partner for any future regional transmission main should it be found to be the most feasible solution.

Urban development

According to the analysis of demographic development in recent years, it is expected that the population of the towns of Edinet and Cupcini will stay constant, despite the overall decrease of the population at rayon level.

This trend is explained by the fact that the population will continue to migrate from rural to urban areas in search of better living conditions and employment opportunities. The towns benefit from the proximity to the border points (both with Romania and Ukraine).

Service objectives

The overall service objective is to provide the population with safe, reliable and continuous water supply and wastewater services. To achieve this, the Mayor Office and the ME 'Apa-Canal' Edinet should consider (see assumptions and targets presented in Chapter 5.3) the following specific objectives:

- Provide water compliant with the national drinking water standards to all parts of the service area;
- Maintain the current level of service by providing water 24 hours per day;
- Provide water of sufficient quantity to all customers;
- Extend the water supply and sewerage service area in the town of Edinet;
- Treat effluents from the wastewater system in compliance with the current national legislation and in the future in compliance with the respective EU legislation (Urban Wastewater Treatment Directive);
- Reduce non-revenue water to an acceptable level of a maximum 25% by 2045;
- Improve efficiency of service provision by enhancing operation and maintenance practices for the Mayor Office and the ME 'Apa-Canal' Edinet;
- Reduce operating costs and provide sufficient funds for adequate maintenance, repair and capital renovation of the system in order to ensure sustainability of service provision;
- Improve environmental protection;
- Ensure affordability of the tariffs for water supply and wastewater services.

Water demand projection

Following a period of decrease due to the decline of the old industries, the towns of Edinet and Cupcini are experiencing a reverse trend, with a slight recovery of industrial activities. Notable, is the creation of the industrial park in Edinet. Most of the industries present in Edinet and Cupcini deal with food processing. Despite these new employment opportunities (Edinet has lower unemployment rate than national average), for the immediate future it is not foreseen any significant development of new residential areas neither in Edinet nor Cupcini.

Metering policy

Customer metering:

In 2008-2009, in the town of Edinet 91% of the residential house connections and 96% of the apartment connections were metered. All public institutions and businesses were metered. The precision class of the meters used is A, B and C. In the same period, in the town of Cupcini, 99% of the residential house connections and 99.9% of the apartment connections were metered. All public institutions and businesses were metered. The precision class of the meters used is A, B and C.

Water Production metering:

In term of water production and other control meters, the water system in Edinet and Cupcini is endowed with meters at intake (1 pc), at the treatment station (2 pcs), pumping stations (5 pcs), discharge from reservoirs (5 pcs) and in the main intersection (11

pcs) of the distribution network, but most of them require replacement being obsolete or not functional.

Tariff policy

Water tariff policy and strategy (level of average tariff and tariff structure) has a significant impact on:

- Water consumption (demand elasticity results in reduction of consumption when tariffs increase);
- Revenue stream and consequently capacity of the operator to maintain the WSS system adequately (sustainability).

Capacity building measures should be foreseen to develop an appropriate tariff policy and to ensure sustainability of the proposed Priority Investment Plan. Reference is made to Chapter 6 – Financial and Economic analysis.

5.3 Design parameters and assumptions

The development of water demand is determined by the parameters and assumptions defined as follows:

5.3.1 Domestic water consumption and wastewater generation

- Population forecast and its assumptions as presented in Chapter 2.4.-Population;
- The development of the service connection rate (water and wastewater) for domestic customers considers the following:
  - Existing population connected;
  - Additional population connected due to on-going projects (completed before 2018);
  - Population connected due to network extension foreseen in Phase 1 by 2018;
  - Population connected due to network extension foreseen in Phase 2 by 2021;
  - Maximum target connection rate within the planning horizon is assumed to be reached in 2030 for urban localities and in 2045 for rural localities;
  - It is further assumed that the coverage rate (population which can potentially be connected to the network) is different from the connection rate (population which actually is connected to the network) and the following applies: Data for the existing situation regarding coverage and connection rate are applied if available (see chapter 4 Technical Aspects- Existing Situation); if data are not available it is assumed that the connection rate is 30% less than the coverage rate for water supply and 40% less than the coverage rate for wastewater. The difference between coverage rate and connection rate will then decrease linearly and will be zero in the year when the target connection rate is defined (e.g. water supply coverage rate for urban areas will reach 100% in 2030 and will be equal to the water supply connection rate in 2030). The respective targets are presented in Table 5-1 below.
- **Per capita domestic water consumption** (volume of water sold) is currently very low as presented in Chapter 4.4 - Water balance, mainly due to two reasons (i) absence of part of the registered customers and (ii) apparent water losses (water theft, metering inaccuracy). Due to measures proposed in this feasibility study (Chapter 5.7.6. Technical Assistance) aimed at drastically reducing apparent (commercial) losses it is assumed that per capita water sales are projected to in-

crease to the maximum of 110 l/c/d in urban areas and 80 l/c/d in rural areas due to economic development until the year 2045. It is noteworthy, that the demand projection model refers to "water sales" and not to "real water consumption[6]", which explains the difference to the suggested per capita consumption figures in the Regional Sector Programme (RSP);

- The **wastewater generation factor** (share of wastewater discharged to the wastewater system out of water consumed) for domestic customers is assumed to be 100% (factor of 1).

5.3.2 Non-domestic water consumption and wastewater flow

- **Industrial consumption**[7]: During the last decades, the economy in the study area has slowed down and many industries closed, which resulted in a decline in industrial water consumption. For the purpose of this study, it is assumed that industrial water consumption will slightly increase (from a very low level) linearly to 15 l/c/d until 2030, and will then remain constant until the end of the planning horizon. It is assumed that industrial consumption only applies to urban localities;
- **Institutional water consumption**: It is assumed that institutional water consumption will increase/decrease from current consumption level[8] linearly to 10 l/c/day until 2030 and will then remain constant until the end of the planning horizon. It is assumed that institutional consumption applies to urban and rural localities;
- **The wastewater generation factor** for non-domestic customers (share of wastewater discharged to the wastewater system out of water consumed) is assumed to be 100% for commercial and institutional customers (factor 1);
- **Industrial wastewater** flow from customers not connected to the water supply system (own wells) but discharging to the wastewater system is unknown and cannot be determined based on the provided data). For future development it is assumed that this volume is insignificant and will not be taken into consideration for wastewater flow projection.

5.3.3 Extension of water supply system to localities in neighbourhood of Edinet

The existing water supply system for Edinet and Cupcini was originally planned as regional water supply system. However, only the backbone of the system, which supplies today Edinet and Cupcini, was implemented. According the LPA and the ME 'Apa-Canal' Edinet, there are no plans for extending the system to the region.

It is proposed to discuss with the rayon administration a possible extension to the region during Phase 1. For the regionalisation relevant water facilities (transmission mains, water treatment plant etc.) are not included on Phase 1 but for Phase 2 and later.

[6] The difference between water sales and real water consumption are the „apparent or commercial losses" due to meter under registration, meter tampering, etc. and partly also due to consumption from private individual wells.

[7] Including all commercial entities

[8] According to data from the ME 'Apa-Canal' Edinet sales department

5.3.4 Water losses

Currently non-revenue water (NRW) in the water supply system of the town of Edinet is comparatively high. Reduction of NRW is therefore one of the main goals in order to increase efficiency of the WSS system. The following assumptions have been made with regard to reduction of NRW for the network:

- *Apparent Losses*[9] *(commercial losses)* are assumed to decrease linearly to 5% (unavoidable apparent losses) until the year 2045 due to technical assistance measures for reduction of commercial losses included in Phase 1;
- *Real losses (physical losses)* are assumed to decrease linearly to 20% until the end of the planning horizon in 2045. This target is assumed to be achieved by implementing (i) investment measures for renovation of the existing water supply system and (ii) Technical assistance measures and equipment aiming to reduce water losses (including training in water loss reduction e.g. leakage detection and pressure management; improvement of revenue collection[10]) proposed in Phase 1. Further, in the long-term it is assumed that continuous renovation of the network[11] will further reduce real water losses;
- Overall, NRW is therefore assumed to decrease to 25% until the year 2045.

5.3.5 Sewerage infiltration rate

The sewerage infiltration rate (as % of total water discharged to the wastewater system) is assumed to decrease if measures for rehabilitation of the sewerage network are foreseen. The development of this parameter is based on expert assessment, separate for each sewerage network, depending on:

- The condition of the sewerage network;
- The share of new and old sewerage network;
- The type of sewer (separate or combined system);
- Information about groundwater table if available;
- Data of wastewater concentration at the outflow of the wastewater system if available.

There is no information on the current infiltration rate available for Edinet sewerage network (see Chapter 4 Technical Aspects- Existing Situation) and therefore a typical[12] infiltration rate for sewerage networks in the region has been applied in the model (see table below). It is assumed that the infiltration rate will decrease after implementation of measures for rehabilitation of sewerage network or extension of the sewerage network in accordance with the ratio of “new sewerage network[13]” and “old sewerage network[14]” (see table below). Thereafter, it is assumed that the sewer infiltration rate will linearly decrease due to measures for sewerage network rehabilitation (financed by additional

[9] Including unbilled authorised consumption

[10] Commercial improvements will result in availability of funds for regular renovation of the water network

[11] Financed from additional revenues generated by the ME ‘Apa-Canal’ Edinet as a result of technical assistance measures included in Phase 1.

[12] Outworn and obsolete wastewater system

[13] Infiltration rate of 10% is assumed for new sewerage networks

[14] An infiltration rate of 50% is assumed for old sewerage networks (e.g. above 30 years)

funds generated by the ME 'Apa-Canal' Edinet as a result of the technical assistance measures included in Phase 1) until the end of the planning horizon[15].

5.3.6 Wastewater flow and load

The following assumptions have been made regarding wastewater flow and load development.

- Specific domestic wastewater load: 60 gBOD_5/capita/day for design of WWTP;
- Specific non-domestic wastewater load: Wastewater flow at a max. admissible BOD_5 concentration of 225 mg/l to discharge into the sewerage network;
- Peak Storm Water Factor: 1.3 for allowance for storm water entering into the sewerage network from "unacceptable[16]" rainwater connections or rainwater entering into manholes during storm water run-off (applicable for separate systems).

All design parameters are in line with the national regulation and with international standards. The main design parameters are presented in the table below (reference is made to explanations in the previous chapter).

Table 5-1: Design parameter

N°	Design Parameter	Unit	2014[17]	2018[18]	2021[19]	2030	2045
0	Service coverage rate for domestic customers, disaggregated for total, urban and rural localities						
0.1	Water - total	%	79	83	100	100	100
0.2	Wastewater - total	%	62	62	89	100	100
0.3	Water supply – urban	%	79	83	100	100	100
0.4	Water supply – rural	%	-	-	-	-	-
0.5	Wastewater - urban	%	62	62	89	100	100
0.6	Wastewater - rural	%	-	-	-	-	-
1	Service connection rate for domestic customers, disaggregated for urban and rural localities						
1.1	Water - total	%	77	80	92	100	100
1.2	Wastewater - total	%	46	46	63	90	95
1.3	Water supply – urban	%	77	80	92	100	100
1.4	Water supply – rural	%	-	-	-	-	-
1.5	Wastewater - urban	%	46	46	63	90	95
1.6	Wastewater - rural	%	-	-	-	-	-
2	Volume of water sold for domestic consumers						
2.1	In urban localities	l/c/d	31	41	49	72	110
2.2	In rural localities	l/c/d	-	-	-	-	-
3	Volume of water sold for non-domestic consumer (industry, commercial…), disaggregated for urban and rural localities						
3.1	Ind. and commercial - urban	l/c/d	25.2	27.7	29.5	35.0	35.0
3.2	Ind. and commercial - rural	l/c/d	-	-	-	-	-
3.3	Institutional entities - urban	l/c/d	1.7	3.7	5.3	10.0	10.0

[15] It is assumed that without major investments after Phase 2 the infiltration rate cannot be further reduced. However, regular replacement of sewerage network by the Municipal Services Utility will maintain the infiltration rate at constant level (increasing of the infiltration rate can be avoided by regular repairs and rehabilitation).

[16] It is best practice to avoid any connection from rainwater drains (e.g. from roofs or streets). However, practically a certain amount of rainwater entering the sewerage network cannot be avoided.

[17] Existing situation

[18] 1st year of operation phase 1 investments

[19] 1st year of operation phase 2 investments

N°	Design Parameter	Unit	2014[17]	2018[18]	2021[19]	2030	2045
3.4	Institutional entities - rural	l/c/d	-	-	-	-	-
4	Wastewater generation as factor of the water demand						
4.1	Domestic customers	factor	1	1	1	1	1
4.2	Non-domestic customers	factor	1	1	1	1	1
5	Non-Revenue Water (NRW) as share from the water production						
5.1	Total NRW	%	71	55	45	38	25
5.2	Apparent losses	%	25	20	15	11	5
5.3	Real losses (physical losses)	%	45	35	30	26	20
6	Sewer Infiltration rate as share of total water discharged to the wastewater system						
6.1	Sewerage infiltration rate	%	50	45	15	15	15
7	Water demand variation factors (in compliance with SNIP)						
7.1	Daily variation factor	factor	1.1				
7.2	Hourly variation factor water supply	factor	1.68				
7.3	Hourly variation factor wastewater	factor	1.8				
7.4	Peak storm water factor	factor	1.3				
8	Wastewater flow and load parameters for domestic and non-domestic sources						
8.1	Specific Domestic wastewater Load	$gBOD_5/c/d$	60				
8.2	Specific Non-domestic Wastewater Load - maximum admissible BOD_5 concentration for sewer discharge	mg/l	225				

Source: GIZ/MLPS

The assumptions for water demand projection related to financial projections require differentiating between two scenarios: (1) Business as usual and (2) after project implementation (Phase 1 measures). The results of the financial projections are presented in Chapter 6 – Financial and Economic Analysis. While the assumptions presented in the table above represent “Scenario 2 – With Project”, the main assumptions to differentiate between the two scenarios are presented as follows:

- Real (physical) water losses are assumed to remain constant *without* implementing the project measures in Phase 1 (reduction of water losses due to technical assistance measure (e.g. active leakage management, pressure management, etc.);
- Apparent (commercial) water losses are assumed to remain constant *without* implementation of the technical assistance measures (Revenue and metering improvement programme).

5.4 Water demand and wastewater flow projection

The water demand projection (volume of water sold, non-revenue water and water production) is presented in the Table 5-2 (a detailed table is presented in Annex 5.1). As can be seen, the projected water production needs are highest in the year 2045, which will be the basis for design calculation.

Table 5-2: Water demand projection

N°	Parameter	Unit	2014[20]	2018[21]	2021[22]	2030	2045
1	Population in the project area served with water						
1.1	Total population serviced	N°	20,946	21,696	24,859	27,127	27,127
1.2	In urban localities	N°	20,946	21,696	24,859	27,127	27,127
1.3	In rural localities	N°	-	-	-	-	-
2	Volume of water sold in total and disaggregated for different consumers						
2.1	Total volume sold	m³/y	444,747	576,966	761,011	1,157,627	1,534,710
2.2	Domestic customers	m³/y	239,250	328,237	445,195	712,066	1,089,149
2.3	Industrial customers	m³/y	192,813	219,078	267,652	346,547	346,547
2.4	Institutional customers	m³/y	12,684	29,651	48,164	99,014	99,014
3	Total water sold disaggr. for urban and rural areas						
3.1	Urban Localities	m³/y	444,747	576,966	761,011	1,157,627	1,534,710
3.2	Rural localities	m³/y	-	-	-	-	-
4	Non-Revenue Water (NRW) volume disaggregated for total NRW, apparent losses, and real losses						
4.1	Total NRW	m³/y	1,066,243	705,180	622,645	694,576	511,570
4.2	Apparent losses	m³/y	380,823	256,429	207,548	208,373	102,314
4.3	Real losses (physical losses)	m³/y	685,420	448,751	415,097	486,203	409,256
5	The water demand figures considering the demand variation factors						
5.1	Yearly water demand/production	m³/y	1,510,990	1,282,146	1,383,657	1,852,204	2,046,280
5.2	Average daily water demand	m³/d	4,140	3,513	3,791	5,075	5,606
5.3	Maximum daily water demand	m³/d	4,262	3,671	3,999	5,392	6,027
5.4	Average hourly water demand	m³/h	172	146	158	211	234
5.5	Max. hourly water demand	m³/h	216	202	232	324	382

Source: GIZ/MLPS

Wastewater flow and load projections are presented in the Table 5-3 (a detailed table is presented in Annex 5.2). As can be seen, the highest wastewater flow and the highest wastewater load occur in the year 2045, and the highest wastewater load occurs in the year 2045, which will be the basis for design calculation of sewerage network and wastewater treatment plant (if applicable).

Table 5-3: Wastewater flow and load projection

N°	Parameter	Unit	2014[23]	2018[24]	2021[25]	2030	2045
1	Population in the project area served with sewerage						
1.1	Total population serviced	N°	12,501	12,501	16,959	24,414	25,771
1.2	In urban localities	N°	12,501	12,501	16,959	24,414	25,771
1.3	In rural localities	N°	-	-	-	-	-
2	Volume of wastewater charged in total and disaggregated for different customers						
2,1	Total volume of wastewater	m³/y	329,531	402,306	619,798	1,212,073	1,646,100

[20] Existing situation

[21] 1st year of operation phase 1 investments

[22] 1st year of operation phase 2 investments

[23] Existing situation

[24] 1st year of operation phase 1 investments

[25] 1st year of operation phase 2 investments

N°	Parameter	Unit	2014[23]	2018[24]	2021[25]	2030	2045
2,2	By domestic customers	m³/y	134,305	181,739	294,802	632,844	1,034,692
2,3	By industrial customers	m³/y	182,704	199,768	288,360	490,117	517,346
2,4	By Institutional customers	m³/y	12,522	20,799	36,636	89,112	94,063
3	Total wastewater charged disaggregated for urban and rural areas						
3,1	In urban localities	m³/y	329,531	402,306	619,798	1,212,073	1,646,100
3,2	In rural localities	m³/y	-	-	-	-	-
4	The sewer infiltration water based on the determined infiltration rate						
4.1	Sewer infiltration water	m³/y	164,766	181,038	92,970	181,811	246,915
5	The wastewater generation figures considering variation factors						
5.1	Average wastewater flow (dry weather)	m³/y	494,297	583,343	712,767	1,393,884	1,893,015
5.2	Max, daily dry weather flow (Qdmax)	m³/d	1,445	1,708	2,123	4,151	5,637
5.3	Maximum hourly dry weather flow (QDWF)	m³/h	93	112	151	295	400
5.4	Maximum hourly storm water flow (QSWF)	m³/h	121	145	196	383	520
6	Population equivalents in total and disaggregated for different customers						
6.1	Total population equivalent	PE60	14,507	14,767	20,298	30,365	32,052
6.2	By domestic customers	PE60	12,501	12,501	16,959	24,414	25,771
6.3	By Industrial and instit, customers	PE60	2,006	2,266	3,339	5,951	6,282
7	Pollution load – BOD in total and disaggregated for different customers						
7.1	The total BOD_5 load	kg/d	870	886	1,218	1,822	1,923
7.2	By domestic customers	kg/d	750	750	1,018	1,465	1,546
7.3	By industrial and institutional customers	kg/d	120	136	200	357	377

Source: GIZ/MLPS

5.5 Water demand projection versus available water resources and production capacities

It is proposed to design the water treatment plant for the water demand in 2030. According the water demand projection, the maximum daily water demand in year 5,392 m³/h. A phased extension for 2030 and further demand in 2045 shall be considered.

Table 5-4: Water demand projection versus currently available and required future production capacities

N°	Parameter	Unit	Quantity
1	Currently available water production capacity of the existing water treatment plant (originally 32,000 m³/d)	m³/d	9,000
2	Maximum daily water demand in year 2045 (max. future demand)	m³/d	6,027
3	Maximum daily water demand in year 2030 (planning horizon for the water treatment plant)	m³/d	5,392
4	Required water production capacity of the new water treatment plant in year 2021 (start of operation)	m³/d	3,999

Another relevant aspect for the water provision is the transmission main from the water extraction to Edinet and Cupcini. It is planned to rehabilitate this transmission main with two parallel lines with 250 mm.

In order to verify the capacities of the rehabilitated transmission main, hydraulic calculations have been conducted.

The verification of the capacity is done according the allowed water flow velocity. According to the SNiP 2.04.02-84 the maximum acceptable velocity for water in a transport line with diameters OD 250-800 mm is limited to 3 m/s, although for smaller diameters the velocity is limited to 1.5 m/s. The interior diameter of a 250 mm HDPE 100 pipe SDR 17/PN 10 is circa 220 mm and is considered in the calculations.

The peak for water production for Edinet and Cupcini is achieved in 2045 (planning horizon for the transmission main) with an average flow of 234 m³/h or 382 m³/h in peak seasons. The water demand and water production are projected to decrease after 2045.

The maximal acceptable flow which results in a velocity of 3 m/s would be 410 m³/h and will not be achieved. Consequently, the capacity of the transmission main of OD 250 mm is sufficient for the future layout of the water supply system of the town of Edinet and Cupcini.

Table 5-5: Hydraulic verification of the transmission main, projected flow vs, flow velocity

N°	Parameter	Unit	2014[26]	2018[27]	2021[28]	2030	2045
1	Average hourly water demand	m³/h	172	146	158	211	234
2	Flow velocity+ - at average daily water demand	m/s	1.3	1.1	1.25	1.6	1.8
3	Max. hourly water demand	m³/h	216	202	232	324	382
4	Flow velocity+ - at max. hourly water demand	m/s	1.65	1.55	1.8	1.52	2.3
5	Max, capacity of the transm, main++	m³/h					410

Source: GIZ/MLPS

Note:
+ Optimum flow velocity 1.5 m/s, max, according SNIPs 3.0 m/s
++ At the flow velocity of 3.0 m/s

5.6 Unit costs

The prices are based on cost estimation from other studies, tendered projects which are implemented in Moldova and international experience.

5.6.1 Unit costs water supply

The table below shows the unit costs for the relevant water supply components applied for the cost estimations for the investment measures proposed for the Phase 1 and Phase 2.

Table 5-6: Unit costs for water supply facilities

N°	Item	Dimension		Investment costs	
				Unit	Unit cost
1	Water network, distribution or transmission pipe, PE100, SDR17, PN10, Incl. all earth, works, installation works, pipes and fittings				
1.1	Pipe	OD	75	EUR/m	60
1.2	Pipe	OD	90	EUR/m	62
1.3	Pipe	OD	110	EUR/m	65

[26] existing situation

[27] 1st year of operation phase 1 investments

[28] 1st year of operation phase 2 investments

N°	Item	Dimension		Investment costs	
				Unit	Unit cost
1.4	Pipe	OD	125	EUR/m	67
1.5	Pipe	OD	140	EUR/m	70
1.6	Pipe	OD	160	EUR/m	75
1.7	Pipe	OD	180	EUR/m	82
1.8	Pipe	OD	200	EUR/m	90
1.9	Pipe	OD	225	EUR/m	97
1.10	Pipe	OD	250	EUR/m	104
1.11	Pipe	OD	280	EUR/m	124
1.12	Pipe	OD	315	EUR/m	139
1.13	Pipe	OD	355	EUR/m	154
1.14	Pipe	OD	400	EUR/m	174
2	Manhole for distribution system, Incl. all earth works, installation works and fittings				
2.1	Manhole	Dia. mm	1,500	EUR/pc	423
3	House connection, Incl. all earth works, installation works, pipes and fittings				
3.1		pc	1	EUR/pc	250
4	Disinfection facility, Investment costs: incl. Container or small building, technical equipment, electric installations				
4.1	Device	m³/d	100	EUR	20,000
4.2	Device	m³/d	200	EUR	23,000
4.3	Device	m³/d	500	EUR	30,000
4.4	Device	m³/d	1,000	EUR	40,000
4.5	Device	m³/d	2,500	EUR	55,000
4.6	Device	m³/d	5,000	EUR	65,000
4.7	Device	m³/d	6,000	EUR	70,000
5	Submersible pumps, Pumps, technical equipment, electric installations, control system				
5.1	Submersible pump	l/s/ m	19.5/100	EUR	15,000
6	Water Supply Reservoirs				
6.1	Underground Reservoirs				
6.1.1	Reservoir Volume	m³	100	EUR	60,000
6.1.2	Reservoir Volume	m³	150	EUR	85,000
6.1.3	Reservoir Volume	m³	200	EUR	110,000
6.1.4	Reservoir Volume	m³	250	EUR	140,000
6.1.5	Reservoir Volume	m³	500	EUR	200,000
6.1.6	Reservoir Volume	m³	1,000	EUR	320,000
7	Pressure reducing valves (material incl. installations)				
7.1	For pipe diameter	OD	100	EUR/PC	3,500
7.2	For pipe diameter	OD	150	EUR/PC	5,300
7.3	For pipe diameter	OD	200	EUR/PC	6,830
7.4	For pipe diameter	OD	250	EUR/PC	8,770
7.5	For pipe diameter	OD	300	EUR/PC	10,670
7.6	For pipe diameter	OD	400	EUR/PC	18,295
7.7	For pipe diameter	OD	500	EUR/PC	26,020
7.8	For pipe diameter	OD	600	EUR/PC	37,440
8	Water treatment plant for surface water, incl. treatment steps (I) Flocculation and sedimentation (II) Oxidation process with Potassium Permanganate (PPM) or optionally with Ozone, (III) Filtration with sand Filter unit (IV) Filtration with activated carbon filters (V) Disinfection and clear water chamber				
8.1	Plant	N° of pop.	10,000	EUR	1,100,000
8.2	Plant	N° of pop.	15,000	EUR	1,350,000
8.3	Plant	N° of pop.	20,000	EUR	1,800,000
8.4	Plant	N° of pop.	30,000	EUR	2,000,000

Source: GIZ/MLPS

5.6.2 Unit costs wastewater

The table below shows the unit costs for the relevant wastewater components applied for the cost estimations for the investment measures proposed for Phase 1 and Phase 2.

Table 5-7: Unit costs for wastewater facilities

N°	Item	Dimension		Investment costs	
				Unit	Unit cost
1	Sewerage network, collection pipe, PVC, Incl. all earth works, installation works, pipes and fittings				
1.1	Pipe	OD	110	EUR/m	88
1.2	Pipe	OD	125	EUR/m	92
1.3	Pipe	OD	160	EUR/m	140
1.4	Pipe	OD	200	EUR/m	150
1.5	Pipe	OD	250	EUR/m	165
1.6	Pipe	OD	315	EUR/m	185
2	Manhole for collection system, Incl. all earth works, installation works and fittings				
2.1	Manhole	dia. mm	1,000	EUR/pc	1,030
3	House connection, Incl. all earth works, installation works, pipes and fittings				
3.1		pc	1	pc,	500
4	Wastewater pumping stations, Incl. all electro- mechanical equipment, pipes, fittings, housing and installation works				
4.1	Facility	N° of pop.	500	EUR	28,000
4.2	Facility	N° of pop.	1,000	EUR	32,000
4.3	Facility	N° of pop.	2,000	EUR	40,000
4.4	Facility	N° of pop.	5,000	EUR	50,000
4.5	Facility	N° of pop.	10,000	EUR	63,000
4.6	Facility	N° of pop.	15,000	EUR	75,000
4.7	Facility	N° of pop.	20,000	EUR	83,000
5	Wastewater Treatment Plant, according to the EC Directive for urban wastewater treatment incl. primary treatment, secondary treatment (e.g. low load trickling filters, Low load activated sludge process, aerated pond system, constructed wetlands), all construction and installation works, electro- mechanical equipment.				
5.1	Plant	P.E.	1,000	EUR/P.E.	500
5.2	Plant	P.E.	2,500	EUR/P.E.	390
5.3	Plant	P.E.	5,000	EUR/P.E.	340
5.4	Plant	P.E.	10,000	EUR/P.E.	300
5.5	Plant	P.E.	20,000	EUR/P.E.	260
5.6	Plant	P.E.	30,000	EUR/P.E.	250
5.7	Plant	P.E.	35,000	EUR/P.E.	240

Source: GIZ/MLPS

5.7 Proposed investment measures

5.7.1 General

In order to achieve the local development objectives and goals (see Chapter 5.2 Development strategy for water supply and wastewater services) as well as the targets in line with the Regional Sector Programme (RSP), a number of investment measures have been identified and are presented in this chapter. These measures are based on the measures identified in previous assessments (“Possible Project Concept” - PPC) and the findings from this study (reference is made to Chapter 4 Technical Aspects-Existing Situation and Chapter 5.4 Water demand and wastewater flow projection). Water demand and wastewater flow projection.

This chapter contains:

- The main drivers for development of the investment framework;
- A detailed description of the proposed investment measures;
- A prioritisation and phasing of investment measures;
- An option analysis for priority investment measures Phase 1;
- The priority investment plan including cost estimates for each of the investment phases.

5.7.2 Investment framework

Based on the assessments within this study, the local WSS objectives and the RSP, the main drivers for development of the investment framework have been identified and are presented as follows:

5.7.2.1 Water supply

- In Edinet there are 14,507 people (80%) and in Cupcini 6,439 people (72%) currently connected to the water supply system (see Table 5-8 and Chapter 4 – Technical aspects – Existing situation). The LPA plans to extend the water supply networks in both localities. There is no supply shortage for the service area of the ME 'Apa-Canal' Edinet as the current production capacity of 9,000 m³/d is more than sufficient to cover the current as well as the long-term water demand of the serviced area. However, the water treatment plant is already quite outdated and NRW is high (71% of the production);
- The water quality provided in the service area does not reliably comply with the national standards for drinking water quality, depending on the respective raw water (surface water) quality. In order to provide a reliable water quality to the consumer, it is proposed to replace the water treatment plant, starting with 2021. Due to the poor building structure and the outdated electro- mechanical equipment of the existing plant, rehabilitation is not considered;
- In order to increase the efficiency of the water supply system it is recommended to put the focus on the reduction of NRW and on operational improvements by:
  - Rehabilitation of the existing water distribution network in Edinet and Cupcini, which is in large parts older than 30 years;
  - Rehabilitation of the transmission main from the water extraction to Edinet and Cupcini with a length of about 32 km is as well in large parts older than 30 years.
- It is proposed to enlarge the service coverage area within Edinet and Cupcini in order to make use of economies of scale and to improve service quality and living conditions for the population;
- For the medium-term, it is recommended to further optimise the network operation in Edinet and Cupcini, based on the results of the detailed investment plan to be prepared in the frame of the Water Supply Network Analysis and Water Loss Reduction Programme included in the technical assistance measures in Phase 1 (reference is made to Chapter 5.7.6 - Technical Assistance). These measures might inter alia include:
  - Replacement of the remaining defective parts of the water supply network in the medium-term;

  - Establishment of adequate system operation and control comprising pressure zoning, district metering and leakage monitoring with installation of permanent and temporary measure and control spots incl. chambers, measuring and control equipment, valves etc.;
  - Installation of a SCADA system.
- Most of the pumping stations and water storage facilities have been rehabilitated in 2004 and are in satisfying condition and do not need any rehabilitation in a short-term.

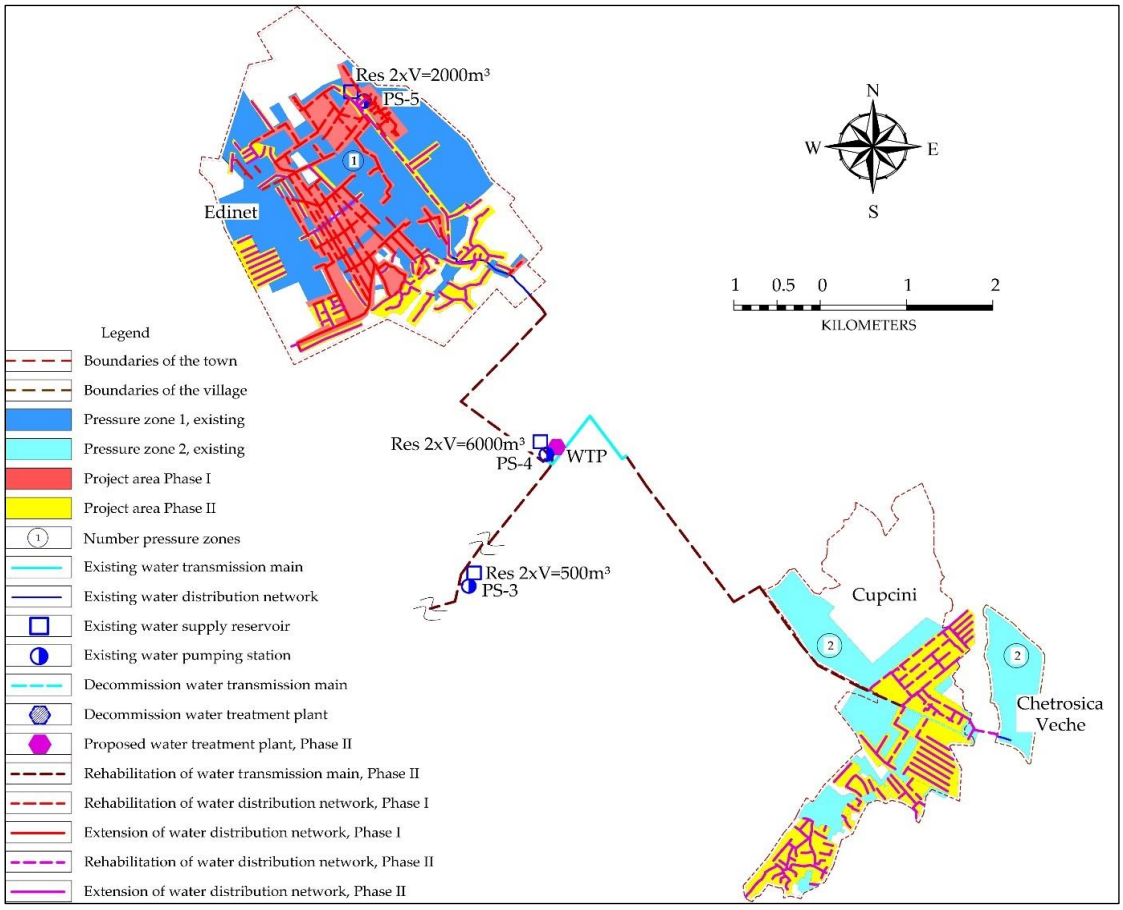
The Table 5-8 shows the development of service connections for the water supply network (existing situation and additional connections for the year 2018 and 2021 as well as for 2030 and 2045). For more detailed projection tables reference is made to Annex 5.3 and Annex 5.4.

Table 5-8: Development of connection rates water supply

Code	Locality	Population connected to the water supply system									
		2014		2018		2021		2030		2045	
		n°	%	n°	%	n°	%	n°	%	n°	%
1	Edinet	14,507	80	15,257	84	16,971	93	18,211	100	18,211	100
2	Cupcini	6,439	72	6,439	72	7,888	88	8,916	100	8,916	100
TOT	**Total**	**20,946**	**77**	**21,696**	**80**	**24,859**	**92**	**27,127**	**100**	**27,127**	**100**

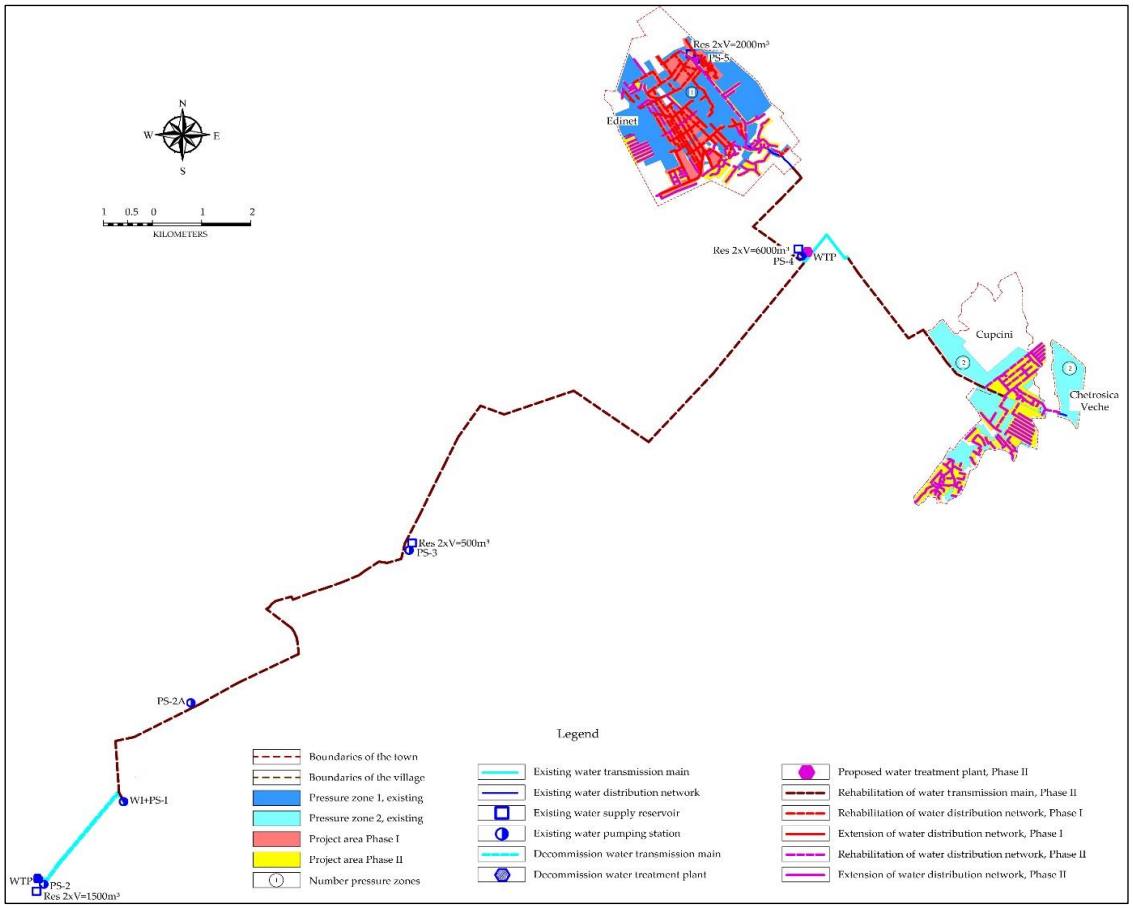
Source: GIZ/MLPS

Figure 5-1: Scheme of the existing water supply system and the proposed extensions in the towns of Edinet and Cupcini



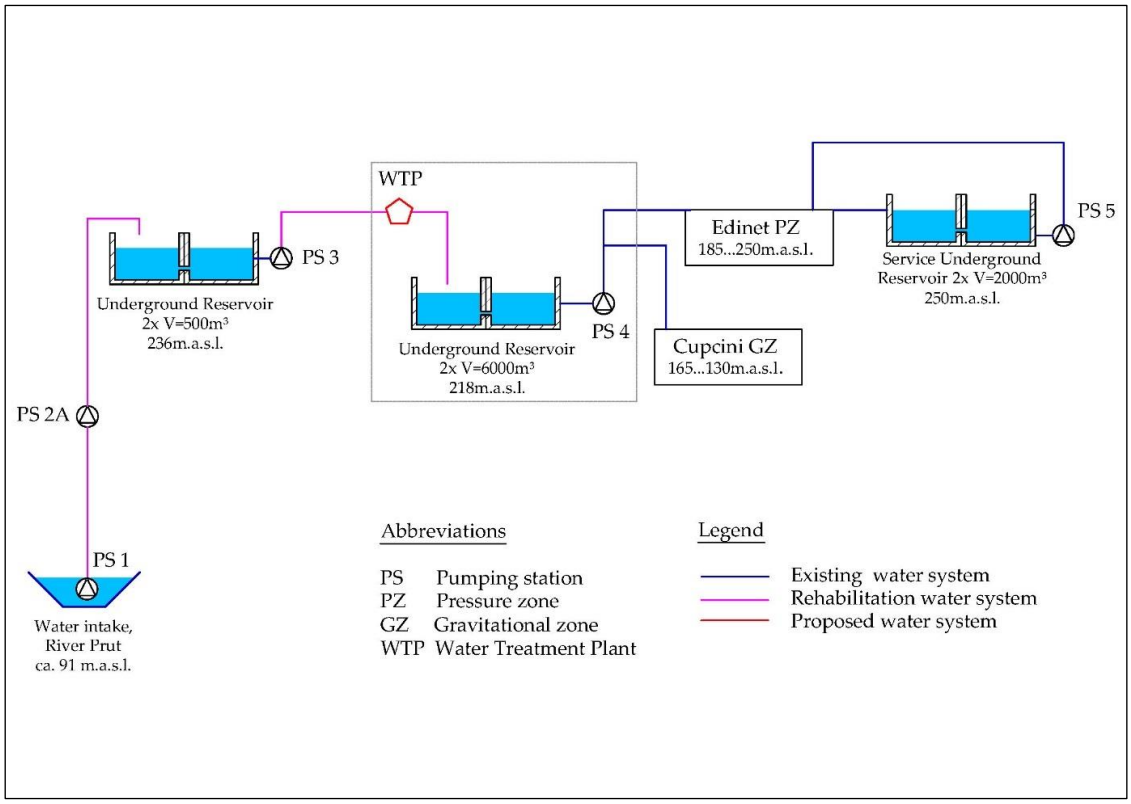
Source: GIZ/MLPS

Figure 5-2: Scheme of the existing water supply system and the proposed extensions in the towns of Edinet and Cupcini including the transmission main



Source: GIZ/MLPS

Figure 5-3: Hydraulic scheme of existing water supply system and the proposed extensions in the town of Edinet



Source: GIZ/MLPS

5.7.2.2 Wastewater

- Currently the towns of Edinet and Cupcini are partly endowed with an existing wastewater system (sewerage network and wastewater treatment are described in Chapter 4 Technical Aspects- Existing Situation of this report). In Edinet 8,293 people (46%) and in Cupcini 4,208 people (47%) are currently connected to the sewerage network (see Table 5-9). The LPA plans to extend the wastewater system in both localities;
- The wastewater treatment plant is in operation however, already quite outdated and can serve for the short-term only. Further the current capacity of the wastewater treatment plant is not sufficient for an extended wastewater system;
- In order to develop the wastewater infrastructure in the rayon, agglomerations (as per EU-definition “an area where the population and/or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to an urban waste water treatment plant or to a final discharge point”) have to be defined for the entire rayon. Further, an assessment (option analysis) will be necessary to decide which of these agglomerations should be grouped to be connected to a Wastewater Treatment Plant (WWTP). It is recommended to include this analysis in a technical assistance component to be implemented in Phase 1 (see Chapter 9 – Procurement strategy and implementation plan). The localities in the vicinity of Edinet will be served in accordance with the results of the agglomeration analysis defined in this Technical assistance component (see above) and possibly with the dates to be negotiated in the EU-accession treaty. Compli-

ance of these localities with EU-environmental regulations (Urban Wastewater Treatment Directive 91/271/EEC) will require grouping the agglomerations into localities (i) below 2,000 P.E., (ii) between 2,000 P.E. and 10,000 P.E., and (iii) above 10,000 P.E. Among the agglomerations in the project area (outside of the town of Edinet) 3 localities (all of them below 2,000 P.E. and thus not subject to the requirements defined in the Urban Wastewater Treatment Directive 91/271/EEC) are to be either endowed with a sewerage network and connected to a WWTP in the medium and long-term, or alternative wastewater systems (on-site sanitation) have to developed in order to ensure adequate wastewater treatment. Among the agglomerations in the project area (outside of the town of Edinet) 3 localities (all of them below 2,000 P.E. and thus not subject to the requirements defined in the Urban Wastewater Treatment Directive 91/271/EEC) are to be either endowed with a sewerage network and connected to a WWTP in the medium and long-term, or alternative wastewater systems (on-site sanitation) have to developed in order to ensure adequate wastewater treatment;

- Highest priority should be given in any case to the collection and treatment of wastewater in Edinet (current population of 18,211) and Cupcini (current population of 8,916) (in line with priorities defined in the Urban Wastewater Treatment Directive 91/271/EEC):
  - Therefore, an extension of the sewerage network in Edinet and Cupcini is proposed. In order to convey the collected wastewater to the WWTP, five WWPS and pressure lines will be necessary as presented in the Figure 5-3;
  - Further the existing sewer as well as pressure lines will be rehabilitated in order to increase the efficiency in the wastewater collection;
  - In the short term (until 2020), it is recommended to continue using the existing WWTP Edinet to treat the wastewater from the drainage areas of the existing network. The Consultant's assessment reveals that due to the condition of the WWTP and its limited capacities a new wastewater treatment plant shall be operated from 2021 onward;
  - The connection rate in the town of Edinet will reach about 57% after Phase 2 (details in Table 5-8) and will linearly increase to 95% in 2045.
- Wastewater generated in Edinet and Cupcini will increase from currently 14,507 P.E. to 20,298 P.E. in 2021 and is projected then to increase to 32,052 P.E. in 2045 (see Chapter 5.4 Water Demand and Wastewater Flow Projection);
- The design capacity of the future WWTP will depend on the above mentioned agglomeration analysis, depending on the number of possible localities to be connected to the WWTP in Edinet. Further planning shall be based on the results of the technical assistance-study to be carried out in Phase 1. For the investment costs estimations in this study a WWTP of a capacity of about 30,000 PE for Edinet and Cupcini is calculated. This should not be understood as presumption of the result of the proposed analysis. The WWTP shall in any case be designed in a way which allows a phased extension.

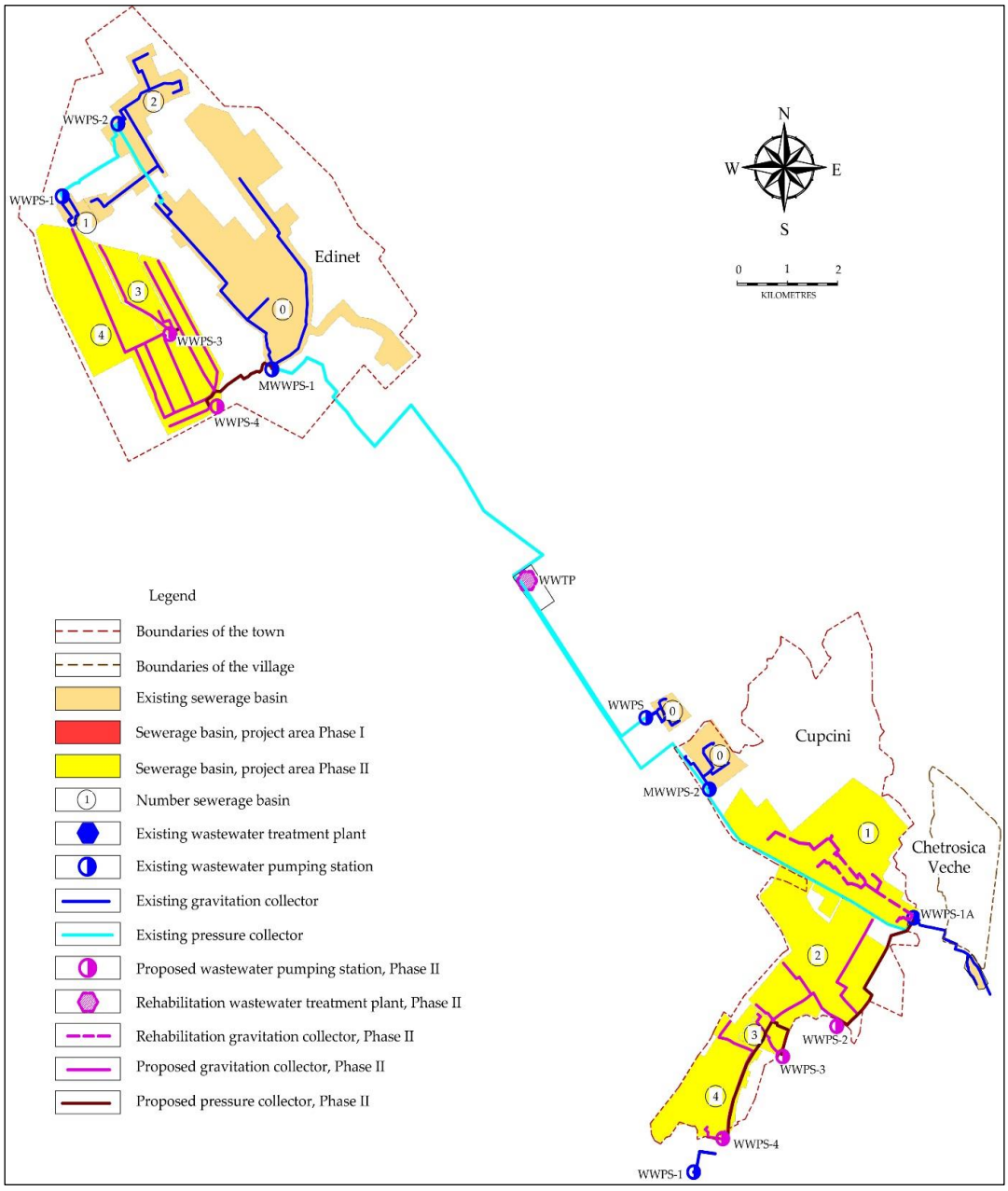
The Table 5-9 shows the development of service connections for the wastewater network (existing situation and additional connections for the years 2018 until 2045). For more detailed projection tables reference is made to Annex 5.5 and Annex 5.6.

Table 5-9: Development of connection rates wastewater

Code	Locality	Population connected to the waste water system									
		2014		2018		2021		2030		2045	
		n°	%	n°	%	n°	%	n°	%	n°	%
1	Edinet	8,293	46	8,293	46	10,376	57	16,390	90	17,300	95
2	Cupcini	4,208	47	4,208	47	6,582	74	8,024	90	8,470	95
TOT	**Total**	**12,501**	**46**	**12,501**	**46**	**16,959**	**63**	**24,414**	**90**	**25,771**	**95**

Source: GIZ/MLPS

Figure 5-4: Scheme of existing wastewater system and the proposed extension in the town of Edinet and Cupcini



Source: GIZ/MLPS

5.7.3 Investment measures - water supply system

5.7.3.1 General description of proposed system

The main deficiencies in the water supply system are as following (see also Chapter 4 Technical Aspects- Existing Situation of this Study):

- High real and apparent Water losses (NRW of 71%);
- High number of pipe bursts due to old and obsolete water supply network in parts of the town;
- Low connection rate of about 80% in Edinet and 72% in Cupcini;
- Water does not comply with national standards.

In order to remediate the above-mentioned deficiencies, the following improvements have been proposed in the water supply sector:

- Rehabilitation of the existing water distribution network in the towns of Edinet and Cupcini;
- Extension of the water distribution network in Edinet and Cupcini;
- Construction of new water treatment plant for Edinet and Cupcini;
- Rehabilitation of the existing transmission main from the water extraction to the towns of Edinet and Cupcini;
- Equipment for operational improvement.

5.7.3.2 Proposed investment measures

Rehabilitation of the water distribution network in the towns of Edinet and Cupcini

Due to high water losses in the distribution networks the operation costs are high and supply security is low (frequent supply interruptions due to pipe repair). Further, total water losses (NRW) in the systems of Edinet and Cupcini are estimated to be in the range of 71% of the water production. About 47% of the existing network of 45.3 km in Edinet, and about 60% of the existing network of 33 km in Cupcini is more than 30 years old. Following replacements are therefore proposed:

- Replacement of 22,435 m of the pipe network (Diameter between 75 and 160 mm) in Edinet, indicated by the ME ‘Apa-Canal’ Edinet as most outworn, in Phase 1 and further 3,245 m in Phase 2;
- Replacement of 12,205 m of pipe network in Cupcini, identified by the ME ‘Apa-Canal’ Edinet for Phase 2;
- Further replacements for Edinet and Cupcini are proposed for the medium- and long-term.

Extension of the water distribution network in the towns of Edinet and Cupcini

It is proposed to further extend the existing water supply system in order to reach full service coverage in the town of Edinet and Cupcini. Following extensions are therefore proposed:

- Extension of the water supply system in Edinet in the central and southern parts of the town as part of the supply zone 1. The total network length for this extension area is 4,520 m, including 350 service connections (Phase 1);

- Extension of the water supply system in Edinet in the central and southern, south-western and western parts of the town as part of the supply zone 1. The total network length for this extension area is 15,705 m, including 800 service connections (Phase 2);
- Extension of the water supply system in Cupcini in the southern and south-western and western parts of the town as part of the supply zone 2. The total network length for this extension area is 14,195 m, including 697 service connections (Phase 2).

The water supply connection rate in Edinet will be increased from 80% to 93%, in Cupcini from 72% to 88% and the coverage rate will reach 100%.

Construction of a new WTP in the town of Edinet

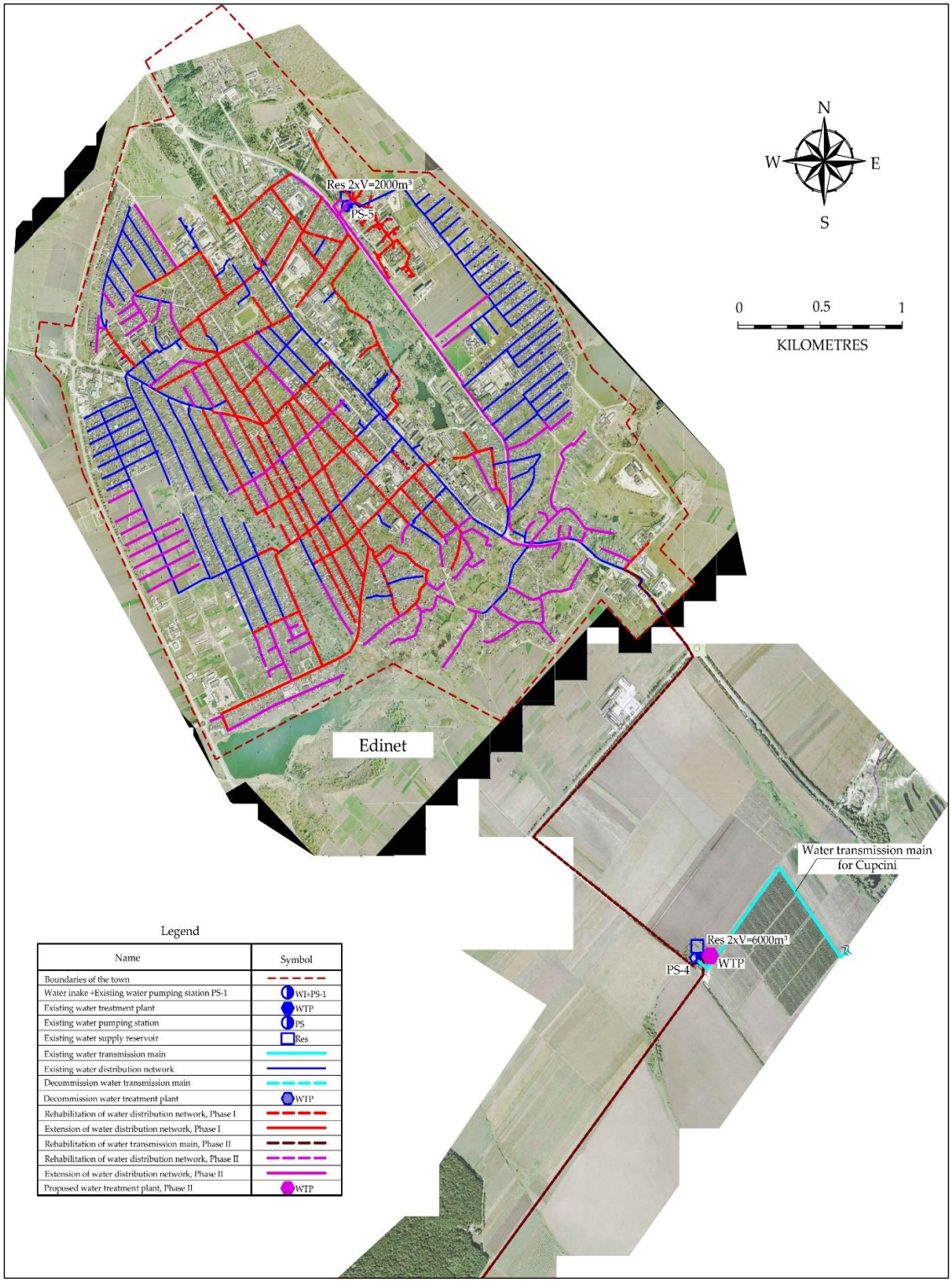
A new WTP is proposed to be constructed in Phase 2 between the SP 1 and SP 4 and shall be operated from 2021 onwards. The design capacity and technology of the future WTP will depend on the results of the technical assistance included in Phase 1, specifically depending on the number of neighbouring localities possibly to be connected to the new WTP in Edinet and the detailed analysis of the raw water. Preliminary assumption is a capacity of about 5,600 m³/d to supply Edinet and Cupcini.

Rehabilitation of the transmission main from the water extraction to Edinet and Cupcini

The rehabilitation of the transmission main from the water extraction to Edinet and Cupcini with a length of about 32 km is proposed. The transmission main is in large parts older than 30 years and it is indicated that about 15% of the physical losses have their origin on this transmission main. Therefore, it is assumed to rehabilitate about 42 km (in parallel lines) in Phase 2, based on the findings of the Water Network Analysis included in Phase 1.

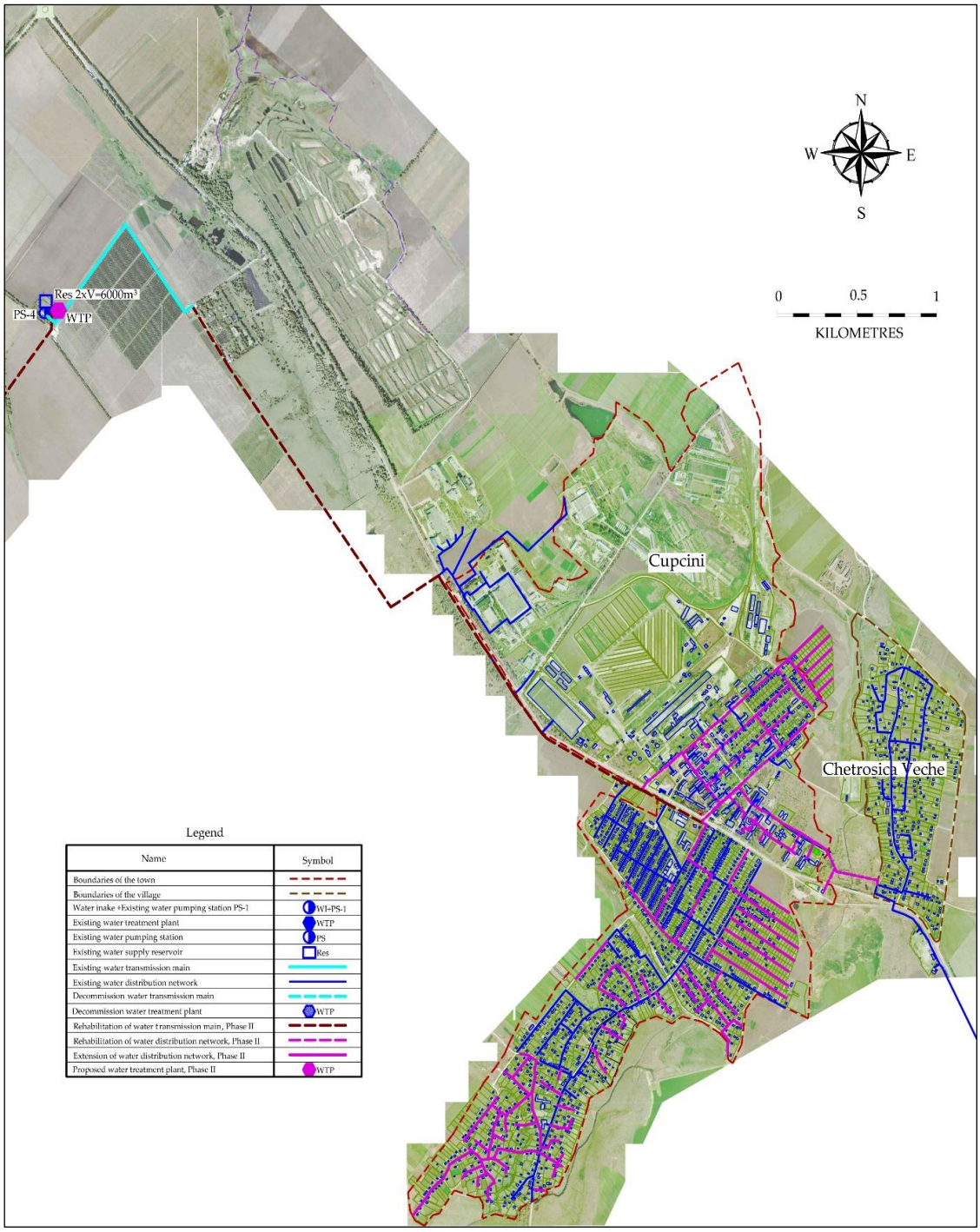
The existing water supply systems and the proposed extension of the water supply systems in the towns of Edinet and Cupcini are presented in the figures below. More detailed maps are provided in Annex 11.

Figure 5-5: The existing water supply system and the proposed extensions in the town of Edinet



Source: GIZ/MLPS

Figure 5-6: The existing water supply system and the proposed extensions in the town of Cupcini



Source: Source: GIZ/MLPS

5.7.4 Investment measures - wastewater system

5.7.4.1 General description of proposed system

The main deficiencies in the wastewater system are as following (see also Chapter 4 Technical Aspects- Existing Situation of this Study):

- Low connection rate of about 46% in Edinet and 47% in Cupcini;
- Large parts of the existing wastewater system in the towns of Edinet and Cupcini is already older than 30 years and is in poor condition, which leads to frequent sewer blockages and emergency driven maintenance;
- The wastewater treatment plant located in Edinet is already quite outdated and can serve for the short-term only (until 2021).

In order to remediate the above-mentioned deficiencies, the following improvements have been proposed in the wastewater sector:

- Extension of the sewerage network in the towns of Edinet and Cupcini;
- Rehabilitation of the existing sewerage network in the towns of Edinet and Cupcini;
- Construction of a new WWTP in Edinet.

5.7.4.2 Proposed investment measures

Extension of the sewerage network in the town of Edinet:

In order to increase the service coverage for Edinet to 87% by 2021 (connection rate of 57%) it is proposed for Phase 2 to extend the wastewater system to the western and south-western part of the town of Edinet (drainage area 3 and 4) for about 18,620 m (OD 200 – 250 mm), 1,135 new service connections, two wastewater pumping stations (WWPS-3 and 4), and pressure mains of 975 m. Due to the topography of the service area, the wastewater system is subdivided into different wastewater collection areas (see the figure below and above). The extension will be operated as follows:

- The wastewater from the newly developed drainage area 4 (see the following schemes) will be collected by a new wastewater system. At the lowest point a new wastewater pumping stations (WWPS-4) is planned, from where the wastewater will be pumped through a new pressure line (length 900 m) to the existing main wastewater pumping station (MWWPS-1) and from there through the existing pressure line to the WWTP;
- The wastewater from the newly developed drainage area 3 (see the following schemes) will be collected by a new wastewater system. At the lowest point a new wastewater pumping stations (WWPS-3) is planned, from where the wastewater will be pumped through a new pressure line (length 75 m) to the drainage area 4 and further through the new WWPS-4 and the existing main wastewater pumping station (MWWPS-1) and pressure line to the WWTP.

Extension of the sewerage network in the town of Cupcini:

In order to increase the service coverage for Cupcini to 95% by 2021 (connection rate of 74%) it is proposed for Phase 2 to extend the wastewater system to the south-western part of the town of Cupcini (drainage area 2, 3 and 4) for about 21,165 m (OD

200 – 315 mm), 1,332 new service connections, three wastewater pumping stations (WWPS-2, 3 and 4), and pressure mains of 3,095 m. Due to the topography of the service area, the wastewater system is subdivided into different wastewater collection areas (see the figure below and above). The extension will be operated as follows:

- The wastewater from the newly developed drainage area 2 (see the following schemes) will be collected by a new sewerage system. At the lowest point a new wastewater pumping stations (WWPS-2) is planned, from where the wastewater will be pumped through a new pressure line (length approx. 1,300 m) to the existing WWPS-1A. From there the wastewater will be pumped through the existing pressure line to the existing MWWPS-2 and through the existing pressure line to the WWTP;
- The wastewater from the newly developed drainage area 3 will be collected by a new wastewater system. At the lowest point a new wastewater pumping stations (WWPS-3) is planned, from where the wastewater will be pumped through a new pressure line (length approx. 500 m) to the as well newly developed drainage area 2, where it is collected by gravity at the new WWPS-2. From where the wastewater will be pumped through the new pressure line to the existing WWPS-1A and further through the existing MWWPS-2 and the existing pressure line to the WWTP;
- The wastewater from the newly developed drainage area 4 will be collected by a new wastewater system. At the lowest point a new wastewater pumping stations (WWPS-4) is planned, from where the wastewater will be pumped through a new pressure line (length approx. 1,300 m) to the as well newly developed drainage area 2, where it is collected by gravity at the new WWPS-2. From where the wastewater will be pumped through the new pressure line to the existing WWPS-1A and further through the existing MWWPS-2 and the existing pressure line to the WWTP.

Rehabilitation of the existing sewerage network and pressure lines in the town of Edinet and Cupcini:

Due to the age of the existing wastewater system (in large parts over 30 years) and frequent problems in the operation, high priority has been given by the ME ‘Apa-Canal’ Edinet to the rehabilitation of the existing sewerage network. It is recommended to conduct a CCTV inspection of the sewerage network in Phase 1 (see Chapter 5.7.6 Technical assistance) and based on its result to identify the sections of the sewerage network that need rehabilitation most urgently. For the purpose of cost estimation in this study, it is assumed for Edinet that about 30% of the sewerage network older than 30 years, which is 7,492 m, shall be rehabilitated in the short term (Phase 2) and the remaining 70% in the medium and long-term as they reached the end of their service period.

For Cupcini it is assumed that 7,370 m of the sewerage network, indicated by the ME ‘Apa-Canal’ Edinet as most outworn, shall be rehabilitated in the short term (Phase 2) and the remaining parts in the medium and long-term.

These measures will improve service quality (less sewer blockages), reduce the operation costs and may reduce infiltration to the sewerage network.

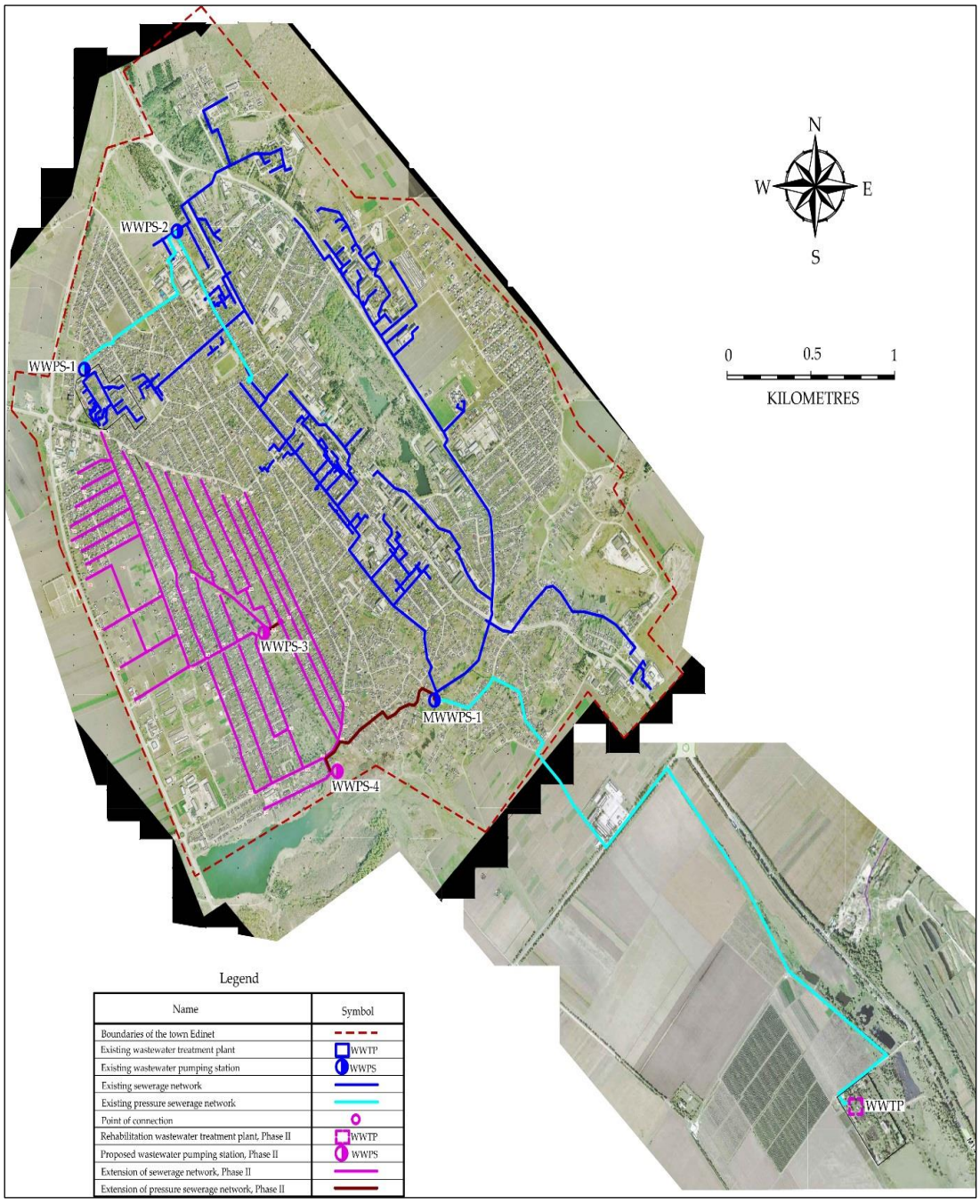
Construction of a new WWTP in the town of Edinet

A new WWTP is proposed to be constructed in Phase 2 on the spot of the existing WWTP and shall be operated from 2021 onwards. The design capacity and technology

of the future WWTP will depend on the results of the sanitation study included in Phase 1, specifically depending on the number of neighbouring localities to be possibly connected to the new WWTP in Edinet. Preliminary assumption is a capacity of about 30,000 P.E. for the future treatment of the wastewater collected in Edinet and Cupcini.

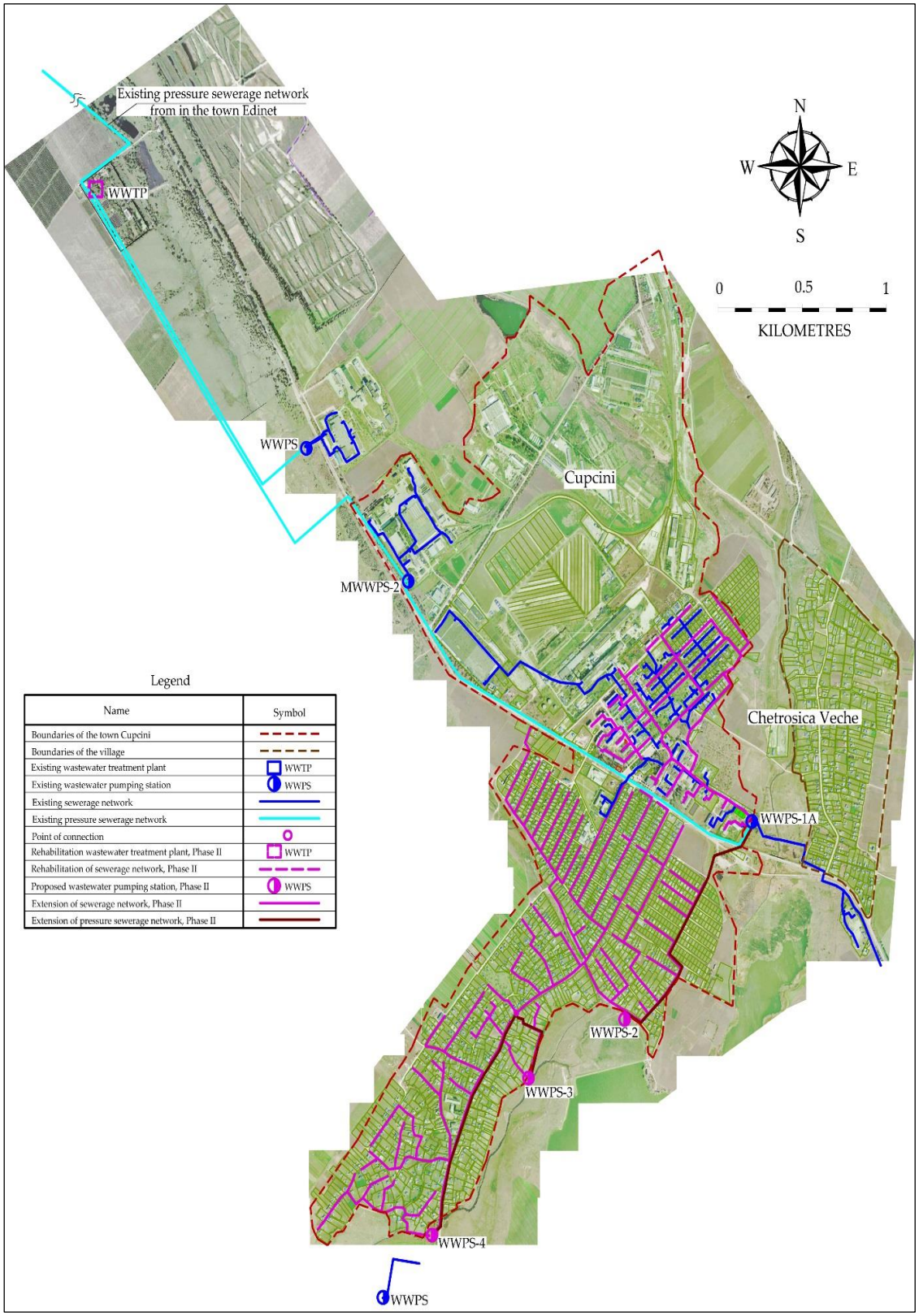
The existing wastewater systems and the proposed extension of the wastewater systems in the town of Edinet and Cupcini are presented in the figures below. More detailed maps are provided in Annex 11.

Figure 5-7: The existing wastewater system and the proposed extensions in the town of Edinet



Source: GIZ/MLPS

Figure 5-8: The existing wastewater system and the proposed extensions in the town of Cupcini



Source: GIZ/MLPS

5.7.5 Operational improvement

Operational improvements in water and wastewater services presume knowledge about the condition of the facilities and a minimum of monitoring of the operation. Therefore, a tentative list of equipment (confirmation by The ME 'Apa-Canal' Edinet during the detailed design stage needed) is considered for the Phase 1.

In order to assess the condition of the facilities and to ensure adequate Operation and Maintenance (O&M) for the wastewater system, procurement of the following equipment is proposed:

- Laboratory equipment for measuring key parameters (BOD5, COD, Nitrogen, Phosphor, Suspended solids, etc.) and flow meter. It is recommended to measure quality and volume of wastewater effluents at the outlet of the existing main collector during dry and wet weather conditions in order to ensure that sufficient data are available for designing the new WWTP;
- Sewer cleaning and other equipment needed in order to maintain the sewerage network according to best practice;
- CCTV inspection equipment in order to assess in details the condition of the sewerage network and based on these results to plan sewer rehabilitation works.

For improvement of the operational performance in the water supply, the following equipment should be procured:

- Portable ultrasonic flow meter and installed flow meters;
- Manometers and pressure loggers;
- Leak detection equipment including pipe locator and acoustic detection equipment and correlator;
- Pipe repair equipment (excavator, trucks…);
- Other equipment to be specified during the detailed design study (e.g. hardware and software, maintenance tools, water meter calibration unit, etc.).

5.7.6 Technical assistance

Technical assistance (TA) measures will be necessary aimed at:

- Improving operational performance in the water and wastewater sector;
- Assessing in detail the required investment in the wastewater sector (agglomeration analysis and option analysis);
- Assessing in detail the investment needs for sewerage network rehabilitation;
- Ensuring high quality standard for implementation of works (detailed designs[29], tender documents and supervision of works).

The scope of work for the technical assistance measures should include inter alia the following:

[29] In case of works contracts based on FIDIC Red-book.

Table 5-10: Technical Assistance

Component	Objectives	Measures
Design and Engineering for Phase 1 investments	To ensure high quality and timely implementation of works and technical assistance measures through support of the Project Implementing Agency[30] (i) in preparing all necessary documentation for tendering of the works for Phase 1 Investment measures, (ii) in tendering procedures, (iii) during the implementation period in project management, works supervision and monitoring of technical assistance measures	A) **Preparation of Detailed Design and Tender Documentation** for Phase 1 investment measures including (i) works contracts, (ii) equipment, (iii) design built contracts (if applicable), service contracts for follow-up TA measures. The services should also include (i) topographic survey and geotechnical investigations, (ii) all necessary measurements to prepare detailed designs and to confirm and justify the investment measures (e.g. flow measurements at transmission mains, water quality, etc.). The Consultant should further prepare all necessary documentation for obtaining required permits in accordance with the national legislation. B) Support during **tendering** of contracts including (i) preparation of reports and minutes of meetings (ii) communication, (iii) support in contract negotiations and preparation of contracts. C) Support of **Project Implementing Agency** in Project Management during contract implementation period (construction and defects liability period) including (i) establishment of adequate project management structures, (ii) preparation of detailed layout designs, construction designs (structural designs, shop drawings, etc.) and detailed pipeline routings, (iii) supervision of works, (iv) preparation of all necessary reports requested by the donor and the Project Implementing Agency (e.g. cash-flow reports, etc.), (v) training in project management and other areas identified as capacity weakness.
Corporate Development Programme	To improve the corporate planning capacity and to become a self-sustaining entity with commercially sustainable operations through improvement of the operational, financial and environmental performance of the operator.	• Corporate Development including improvements in (i) human resource development, (ii) service agreement with municipality and customers, (iii) strategy development, (iv) information system, (v) asset management; • Financial Performance Improvement including improvements in (i) accounting budgeting and cash management, (ii) billing system and revenue collection procedures, (iii) reporting procedures, (iv) reduction of apparent (commercial) water losses; • Operational Performance Improvement including (i) staff efficiency, (ii) water loss reduction, (iii) energy efficiency, (iv) operation and maintenance procedures; • Environmental Management including (i) preparation of Environmental and Social Action Plan and support in implementing the action plan (ii) improve overall environmental procedures; • Prepare a Capacity Building Programme for all

[30] Reference is made to Chapter 9.3 – Project Implementation Plan (Set-up of a Project Implementation Structure)

Component	Objectives	Measures
		areas of improvement.
Stakeholder Participation Programme	To ensure that all stakeholders are committed to the investment project and are involved during preparation and implementation phase. In particular, the measures aim at enhancing public ownership by encouraging water conservation, increasing public participation in the provision of water services (service quality, rehabilitation activities, tariffs integrating poverty and social issues) and raising public awareness on issues related to the project implementation and water use	Raise customer awareness through education campaigns: • Identification of information needs; • Prepare Information campaign Plan and support the implementation/ Facilitation of dialogue between clients and the Company • Creation of and support to information exchange platform for customers; • Creation of an Advisory Committee comprising all major stakeholders; • Encourage transparency in decision-making; • Sustainability of dialogue.
Water Supply Network Analysis and Water Loss Reduction Programme	To improve the knowledge of water supply networks as a basis for preparation of a sound medium and long-term investment plan. To reduce water losses in the system through planning and implementing a comprehensive (i) strategy, (ii) action plan, (iii) capacity building programme.	A) **Network analysi**s: Carry out comprehensive network analysis including (i) flow measurements at defined locations in the network (water intake, reservoirs, etc.), (ii) pressure measurements, (iii) analysis of system failures (pipe break data), (iv) analysis of pipe material, (v) preparation of Network Information System (NIS) including field data collection for mapping, (vi) hydraulic modelling and zoning, (vii) detailed investment plan for medium and long term development of the network (replacement, zoning, metering, etc.), (viii) training of operator's staff in applying the NIS and hydraulic modelling software tools. B) **Water loss reduction**: Prepare a water loss reduction strategy (in accordance with IWA best practice) including (i) recommendations for improvement of the organisation structure of the operator (e.g. set-up a water loss reduction department within the operator's organisation, recruitment of staff, etc.); (ii) prepare water balance (analyse components of the water balance in accordance with IWA standard procedures), (iii) recommend strategy and policy for reduction of water losses (e.g. pressure management, DMA/active leakage control, etc.), (iv) prepare detailed action plan for water loss reduction and leakage control including financial requirements, staff capacities required, time steps, methodology, etc.), (v) prepare a capacity building programme to support the operator in implementing the action plan. C) **Water treatment plant**: Prepare the design parameters for the water treatment plant (implementation in Phase 2), (i) based on the network analysis, (ii) the water loss reduction programme, (iii) updated water demand projection (under consideration of possible connection of localities in the vincity of Edinet and the transmission main and regional planning)
Medium to Long-	To prepare a medium to long-	To assess in detail the required medium and long-

Component	Objectives	Measures
term Sanitation Study	term rayon investment plan for wastewater (Master Plan for Sanitation) and define number and capacity of WWTPs.	term investment needs in the wastewater sector based on (i) detailed assessment of wastewater system including flow and load measurements for sewerage treatment and wastewater network analysis[31], (ii) definition of agglomeration borders in the rayon (as defined in EU Urban Wastewater Treatment Directive), (iii) preparation of option analysis for collection and treatment of wastewater (grouping of agglomerations to a wastewater treatment plan), (iv) preparation of strategy for localities not suitable for collection of wastewater (on-site sanitation, alternative systems, etc.), (v) preparation of wastewater treatment process options, (vi) preparation of a wastewater sludge management strategy and plan (vii) preparation of a medium to long-term investment plan for wastewater systems (collection, treatment and on-site sanitation), (viii) environmental and social impact assessment and (ix) economic and financial analysis. Further, the study should assess if other localities in the vicinity of the towns of Edinet and Cupcini should be connected to the WWTP in Edinet. Finally, based on the above agglomeration analysis, the study should define the necessary capacity and propose a staged development (including the feasibility of an extension of the existing WWTP)

Source: GIZ/MLPS

5.8 Prioritisation and phasing of investment measures

5.8.1 Criteria for phasing

The proposed investment measures described above in Chapter 5.7 have been grouped into:

- Short-term;
- Medium-term;
- Long-term measures.

The short-term measures are referred to as *Priority Investment Measures* and are again sub-divided into two sub-phases (Phase 1 and Phase 2). The investment measures were phased according to the following criteria:

- Technical criteria (logical steps / order for implementation, robustness of investment measure (no-regret measures);
- Capacity of operator to implement and operate the system;

[31] Procurement strategy for CCTV inspection of sewerage network should be prepared under this assignment including comparison of an option with procurement of own equipment and staffing and outsourcing of all works to the contractor. For the retained option a detailed action plan and draft specifications for a work contract should be prepared.

- Affordability;
- Available budget for investment expenditures;
- Contribution to health and environmental targets.

The main result of this phasing exercise is to identify priority measures which can be implemented immediately after completion of this feasibility study and which should be completed by end of 2017 (first year of operation in 2018). These measures are grouped in Phase 1 and constitute "*The Project*".

5.8.2 Justification for phasing

The following qualitative approach was used to apply the criteria presented in the previous section.

Table 5-11: Proposed investment measures and phasing

N°	Investment Measures	Proposed Phase[32]	Justification for phasing
1	Water Supply	PH 1 and PH2	High priority due to all criteria: (i) Water supply has to be implemented before wastewater system[33] (ii) Improvement of system's efficiency (reduction of losses etc.); (iii) high contribution to public health improvement (correspondence with drinking water standards - is supported with the investments)
1.1	Rehabilitation of the water distribution network in the towns of Edinet and Cupcini	PH 1 and PH2	The measure will reduce the number of pipe bursts and water losses, and the service quality for the population will be improved (less supply interruptions). Further, only after reducing the water losses a proper basis for designing of a new water treatment plant is provided. About 22 km (47%) out of 45.4 km of the existing network in Edinet is at the end of its service life and needs to be replaced and the short and medium term (see Chapter 4 Technical Aspects- Existing Situation). The ME 'Apa-Canal' Edinet has identified 22.4 km as highest priority to be replaced in Phase 1. Further 3.25 km will be replaced in Phase 2. About 20 km (60%) out of 33 km of the existing network in Cupcini is at the end of its service life and needs to be replaced and the short and medium term (see Chapter 4 Technical Aspects- Existing Situation). The ME 'Apa-Canal' Edinet has identified 12.2 km as highest priority to be replaced in Phase 2.
1.2	Renovation of water supply network in the towns of Edinet and Cupcini	MT	It is recommended to further optimize network operation, based on the results of the detailed investment plan to be prepared in the frame of the water Supply Network Analysis and Water Loss Reduction Programme included in the technical assistance measures in Phase 1. These measures might inter alia include (i) Replacement of defective parts of the remaining water supply network, (ii) Establish adequate system operation and control, (iii) installation of SCADA. These measures require substantial input from the operator (high investment needs and complexity of measures). In order to avoid overloading of the operator during the relatively short project period, a gradual development in the medium term

[32] PH 1: Phase 1, PH 2: Phase 2, MT: Medium Term, LT: Long-Term

[33] Without functioning water supply system, the wastewater system cannot be functional

N°	Investment Measures	Proposed Phase[32]	Justification for phasing
			(stretched over several years) is proposed.
1.3	Extension of the water distribution network in the towns of Edinet and Cupcini	PH 1 and PH2	High priority is given to this measure in order to increase the coverage rate for Edinet and Cupcini in order to make use of economies of scale and to improve service quality and living conditions for the population. Following measures are proposed for Phase 1: • Extension of the water supply system in Edinet in the central and southern parts of the town. The total network length for this extension area is 4,520 m, including 350 service connections. Following measures are proposed for Phase 2: • Extension of the water supply system in Edinet in the central and southern, south-western and western parts of the town. The total network length for this extension area is 15,705 m, including 800 service connections; • Extension of the water supply system in Cupcini in the southern and south-western and western parts of the town. The total network length for this extension area is 14,195 m, including 697 service connections.
1.4	Rehabilitation of the transmission main from the water extraction to Edinet and Cupcini	PH2	The rehabilitation of the transmission main from the water extraction to Edinet and Cupcini with a length of about 32 km is proposed. The transmission main is in large parts older than 30 years and it is indicated that about 15% of the physical losses have their origin on this transmission main. Therefore, it is assumed to rehabilitate about 42 km (as parallel lines) in Phase 2, based on the findings of the Water Network Analysis included in Phase 1.
1.5	Construction of new water treatment plant in Edinet	PH 2	A new WTP is proposed that shall be operated from 2021 onwards. Only after Phase 1, once the NRW is reduced and controlled a reliable design basis for the plant will be available. The design capacity and technology of the future WTP will depend on the results of the technical assistance included in Phase 1, specifically depending on the number of neighbouring localities possibly to be connected to the new WTP in Edinet and the detailed analysis of the raw water. Preliminary assumption is a capacity of about 5,600 m³/d to supply Edinet and Cupcini.
1.6	Equipment for operational performance improvement	PH 1	High priority to reduce real water losses (e.g. leak detection and flow meters, hydraulic modelling software and hardware, etc.) and commercial water losses (billing hard- and software, etc. The equipment shall be procured in parallel to the implementation of technical assistance measures in order to ensure its effectiveness.
2.	Wastewater System	PH 2	As a reliable and efficient water supply system is the basis for a reliable wastewater system, the most urgent rehabilitation and extension measures for the water supply system are proposed for Phase 1. Further additional studies (e.g. agglomeration study as mentioned above in Chapter 5.7.2 - Investment framework) will be necessary to design the proposed investment components for wastewater. This is also included in technical assistance component of Phase 1. Therefore, a reliable basis for the rehabilitation and extension of the wastewater system is provided only in Phase 2. Following measures are proposed for Phase 2:

N°	Investment Measures	Proposed Phase[32]	Justification for phasing
			• High Priority for the wastewater system is given to the rehabilitation of the existing sewerage network in the town of Edinet and Cupcini in order to ensure adequate functioning of the overall system and to reduce environmental impact; • Extensions of the sewerage network for the town of Edinet and Cupcini are proposed in order to achieve almost full service coverage in the town of Edinet; • New WWTP in Edinet.
2.1	Extension of sewerage network in Edinet and Cupcini	PH 2	It is proposed for Phase 2 to extend the wastewater system in Edinet to the western and south-western part of the town (drainage area 3 and 4) for about 18,620 m, 1,135 new service connections, two wastewater pumping stations, and pressure l of 975 m. It is proposed for Phase 2 to extend the wastewater system in Cupcini to the south-western part of the town (drainage area 2, 3 and 4) for about 21,165 m, 1,332 new service connections, three wastewater pumping stations, and pressure mains of 3,095 m.
2.2	Rehabilitation of the existing sewerage networks in the towns of Edinet and Cupcini	PH 2 MT/LT	Based on the results of CCTV inspection (proposed in technical assistance measures in Phase 1) a phased rehabilitation of the existing sewerage network is proposed. In Phase 2, the rehabilitation of about 7,492 m of the existing sewerage network in Edinet, which is 30% of the sewerage network older than 30 years and 7,370 m in Cupcini, indicated by the ME 'Apa-Canal' Edinet as most outworn, is proposed. The rehabilitation of the remaining parts is proposed for the medium- and long-term. These measures will improve service quality (less sewer blockages), reduce the operation costs and may reduce infiltration to the sewerage network.
2.3	Construction of a new WWTP in the the town of Edinet	PH 2	A new WWTP is proposed to be constructed in Phase 2 on the spot of the existing WWTP and shall be operated from 2021 onwards. The design capacity and technology of the future WWTP will depend on the results of the sanitation study included in Phase 1, specifically depending on the number of neighbouring localities to be possibly connected to the new WWTP in Edinet. Preliminary assumption is a capacity of about 30,000 P.E. for the future treatment of the wastewater collected in Edinet and Cupcini.
2.4	Equipment for operational performance improvement	PH 1	Procurement of equipment has high priority for operational performance improvement and preparation of sanitation study (wastewater flow and load measurement should be available during the study in order to improve reliability of the applied design values for the WWTP). CCTV inspection and sewer cleaning trucks have been identified as high priority equipment by the ME 'Apa-Canal' Edinet in order to improve operational performance and to prepare sewer rehabilitation programmes.
3.	Technical Assistance		
3.1	Design, engineering, and supervision for Phase 1 investments	PH 1	Mandatory for implementation of works contracts for Phase 1.
3.2	Corporate Devel-	PH 1	Should start as early as possible (in Phase 1) in order to in-

N°	Investment Measures	Proposed Phase[32]	Justification for phasing
	opment Programme		crease the capacity of the operator and to generate additional revenues for implementing long-term investment measures (e.g. pipe replacements).
3.3	Stakeholder Participation Programme	PH 1	Should be implemented before and in parallel to the works contracts of Phase 1 (start as early as possible during design phase).
3.4	Water Supply Network analysis and Water Loss Reduction programme	PH 1 (PH 2)	Should be carried out in parallel to the design stage of phase 1 investment measures in order to ensure that part of its results are available for designing phase 1 investments. In case of insufficient budget, this measure could be split into two phases (follow up in phase 2 in order to determine long-term network development needs).
3.5	Medium to long-term Sanitation Study	PH 1	Should be implemented as soon as possible (in Phase 1) in order to ensure that all wastewater investment measures (in particular design and construction of WWTP) can be implemented in Phase 2.

Source: GIZ/MLPS

5.9 Option analysis for investment measures

Possible options for the priority investment measures proposed to be implemented in Phase 1 were identified and analysed (if applicable), while for measures in Phase 2 the options have been identified but will be analysed in subsequent studies (see technical assistance measures above). Detailed options (such as pipe materials, type of pumps, zoning options, etc.) will be carried out in the subsequent detailed design stage (technical assistance measure 3.1. and 3.4).

Options analysis for Phase 1:

In Phase 1 rehabilitation and extension of the existing water supply network and the extension of the network in the town of Edinet are proposed.

For urban areas like the town of Edinet, no other systems than the already established centralised water supply system could be identified. Regarding the proposed project measures, there is no other option than to put priority on the rehabilitation of the existing water supply system in order to make the system stable and more efficient (reduction of the high NRW etc.).

The proposed first water network extension in Phase 1 will improve living conditions for the population and will help to make use of economies of scale in the water supply which again contributes to the system's efficiency.

The proposed improvements for the water supply system directly support the planned new water treatment plant, as a reliable design basis is only provided after reduction and control of losses.

Measures in the wastewater sector are not considered as an option for Phase 1 as a functioning water supply system is the basis for a wastewater system. Improvements and extensions in the wastewater system are planned for Phase 2. Therefore, no other options are considered and analysed for Phase 1.

Identified options for Phase 2:

Construction of a new WTP in the town of Edinet

The raw water used for the water supply system requires standard treatment for non or moderately polluted surface water. Following treatment steps are assumed:

- Flocculation and sedimentation;
- Oxidation process with Potassium Permanganate (PPM) or optionally with Ozone;
- Filtration with sand filter unit and carbon filters (optionally);
- Disinfection.

The identified options are:

- The solely technical treatment in a WTP as listed above (and well known in Moldova);
- The use of river bank filtration as raw water source.

Generally, riverbank filtration is a low-cost and efficient alternative water treatment for drinking-water application. The pumped water is a mixture of both groundwater present in the aquifer and infiltrated surface water from the river. Depending on the degree of filtering and contaminants attenuation the river bank filtration acts at a minimum as a pre-treatment, additional treatment may be provided to the pumped water prior to the distribution.

The major benefits which can be generated are:

- Simplified technical water treatment and/or minimised need for adding chemicals like disinfectants and coagulants to surface water to control pathogens;
- Decrease costs to the community without increasing or even reducing risk to human health.

The feasibility of river bank filtration shall be assessed in the design phase for water treatment plant.

Rehabilitation of the existing sewerage network and extension of sewerage network in the town of Edinet and Cupcini

In Phase 2 the rehabilitation of the existing wastewater system and the extension of the sewerage networks in Edinet and Cupcini are proposed. Other systems for wastewater collection in urban areas (like Edinet and Cupcini) than the extension of the already established centralised wastewater system are not considered. Therefore, no other option for wastewater collection is considered and analysed.

Construction of a new WWTP in the town of Edinet

In order to define the required capacity of the WWTP (extensions) an assessments of the agglomerations (localities in the vicinity of the towns of Edinet and Cupcini) to be possibly connected to the central WWTP in Edinet has to be carried out. This assessment includes an options analysis comparing central versus decentralised options for each of the agglomerations/localities. Hence, for each agglomeration the assessment reveals if the preferred option will be a connection to the WWTP in the town (centralised option) or if a decentralised solution is the least cost option (e.g. separate WWTP

for each locality). Further, the agglomeration boarders have to be assessed, defining clearly, which part of the service area should be connected to a central sewerage network and which part of the service area should better be served through on-site sanitation (e.g. septic tanks, etc.). This assessment should be carried out at least at rayon level (or even beyond administrative borders) and should include all localities in a defined study area (typically at master plan level). As the scope of this feasibility study is limited to the preselected urban localities (towns), this study has to be carried out within the scope of the subsequent technical assistance measure in Phase 1 (see above).

5.10 Proposed priority investment plan

The phased investment plan is presented in the tables below. The total investment costs for Phase 1 have been estimated at € 2.9 MEUR and for Phase 2 at € 35.6 MEUR (see Table 5-12, 5-13, 5-14).

Table 5-12: The investment plan for Phase 1

N°	Component	Units	Quantity	Unit costs	Total cost
				EUR	EUR
1.	Water supply				
1.1	Rehabilitation of the water distribution network in the town of Edinet				
1.1.1	Water distribution network HDPE pipe OD 160	m	7,895	75	592,125
1.1.2	Water distribution network HDPE pipe OD 110	m	7,640	65	496,600
1.1.3	Water distribution network HDPE pipe OD 90	m	1,945	62	120,590
1.1.4	Water distribution network HDPE pipe OD 75	m	4,955	60	297,300
ST 1.1	Subtotal 1.1 Rehabilitation of water distribution network				1,506,615
1.2	Extension of the water distribution network in the town of Edinet				
1.2.1	water distribution network HDPE pipe OD 100	m	2,345	65	152,425
1.2.2	water distribution network HDPE pipe OD 90	m	2,175	62	134,850
1.2.3	Manholes, ϕ 1,500	pcs	15	423	6,345
1.2.4	Service connections	pcs	350	250	87,500
ST-1.2	Subtotal 1.2 Extension of the water distribution network				381,120
2	Equipment and tools for operational performance improvement (water supply and wastewater)	LS	1	200,000	200,000
ST-1&2	Sub-Total (1+2)				2,087,735
3.	Technical assistance				
3.1	Design, engineering, and supervision (12% of investment costs)				250,528
3.2	Technical Assistance (Corporate Development Programme, Stakeholder Participation Programme, Water Supply Network Analysis and Water Loss Reduction Programme, Medium to Long-term Sanitation Study)	LS	1	300,000	300,000
ST-3	Sub-TOTAL Technical assistance (3.1+3.2)				550,528
4.	Contingencies (10% of 1+2+3)				263,826
GT 1	Grand TOTAL for Phase 1 (Investment costs + TA + Contingencies) (1+2+3+4)				2,902,090

Source: GIZ/MLPS

Table 5-13: The investment plan for Phase 2

N°	Component	Units	Quan-tity	Unit costs	Total cost
				EUR	EUR
A	Edinet				
1	Water supply				
1.1	Rehabilitation of the water transmission main				
1.1.1	from PS1 to PS2A - water transmission main HDPE pipe OD 250	m	6,110	104	635,440
1.1.2	from PS2A to PS4 - water transmission main HDPE pipe OD 250	m	38,990	104	4,054,960
1.1.3	PS4 to water distribution network Edinet town - water transmission main HDPE pipe OD 250		3,350	139	465,650
ST-1.1	Subtotal 1.1 Rehabilitation of water transmission main				5,156,050
1.2	Construction of water treatment plant	pcs	1	2,000,000	2,000,000
1.3	Extension of the water distribution network in the town of Edinet				
1.3.1	water distribution network HDPE pipe OD 75	m	15,705	60	942,300
1.3.2	Manholes, ϕ 1,500	pcs	12	423	27,495
1.3.3	Service connections	pcs	150	250	200,000
ST-1.3	Subtotal 1.3 Extension of the water distribution network				1,169,795
1.4	Rehabilitation of the water distribution network in the town of Edinet				
1.4.1	water distribution network HDPE pipe OD 315	m	2,980	139	414,220
1.4.2	water distribution network HDPE pipe OD 250	m	165	104	17,160
1.4.3	water distribution network HDPE pipe OD 225	m	100	97	9,700
ST-1.4	Subtotal 1.4 Rehabilitation of the water distribution net-work				441,080
ST-1	Subtotal water supply (1.1+1.2+1.3+1.4)				8,766,925
2.	Wastewater				
2.1	Extension of the sewerage network in the town of Edinet				
2.1.1	Sewerage network PP/PVC pipe OD 250	m	1,380	165	227,700
2.1.2	Sewerage network PP/PVC pipe OD 200	m	17,240	150	2,586,000
2.1.3	Manholes, ϕ 1,000	pcs	28	1,030	28,428
2.1.4	Pressure main PE OD 90-110	m	75	62	4,650
2.1.5	Pressure main PE OD 160	m	900	75	67,500
2.1.6	Service connections	pcs	1,135	500	567,500
ST-2.1	Subtotal 2.1 Extension of the sewerage network				3,481,778
2.2	Wastewater pumping station				
2.2.1	Construction of new wastewater pumping station	LS	1	28,000	28,000
2.2.2	Construction of new wastewater pumping station	LS	1	50,000	50,000
ST-2.2	Sub-total 2.2 Wastewater pumping stations				78,000
2.2	Rehabilitation of sewerage network in the town of Edi-net* (OD 200-250)	m	7,492	165	1,236,163
2.5	Construction of a WWTP (for Edinet and Cupcini))	P.E.	29,667	250	7,416,750
ST-2	Subtotal Wastewater (2.1+2.2+2.3+2.4+2.5)				12,212,69

N°	Component	Units	Quan-tity	Unit costs	Total cost
				EUR	EUR
					2
GT	Total Costs for Edinet Phase 2				20,979,617
B	Cupcini				
1	Water Supply				
1.1	Rehabilitation of the water transmission main PS4 to water distribution network in Cupcini - water transmission main HDPE pipe OD 200	m	3,500	90	315,000
1.2	Rehabilitation of the water distribution network in the town of Cupcini				
1.2.1	water distribution network HDPE pipe OD 160	m	2,810	75	210,750
1.2.2	water distribution network HDPE pipe OD 100	m	4,530	65	294,450
1.2.3	water distribution network HDPE pipe OD 90	m	1,555	62	96,410
1.2.4	water distribution network HDPE pipe OD 75	m	3,310	60	198,600
ST-1.2	Subtotal 1.2 Rehabilitation of the water distribution network				800,210
1.3	Extension of the water distribution network in the town of Cupcini				
1.3.1	water distribution network HDPE pipe OD 160	m	250	75	18,750
1.3.2	water distribution network HDPE pipe OD 90	m	4,195	62	260,090
1.3.3	water distribution network HDPE pipe OD 75	m	9,750	60	585,000
1.3.4	Manholes, ϕ 1,500	pcs	50	423	21,150
1.3.5	Service connections	pcs	697	250	174,250
ST-1.3	Subtotal 1.3 Extension of the water distribution network				1,059,240
ST-1	Subtotal water supply (1.1+1.2+1.3)				2,174,450
2	Wastewater				
2.1	Rehabilitation of the sewerage network in the town of Cupcini				
2.1.1	Sewerage network PP/PVC pipe OD 315	m	730	185	135,050
2.1.2	Sewerage network PP/PVC pipe OD 200	m	6,640	150	996,000
ST-2.1	Subtotal 2.1 Rehabilitation of the sewerage network				1,131,050
2.2	Extension of the sewerage network in the town of Edinet				
2.2.1	Sewerage network PP/PVC pipe OD 315	m	420	185	77,700
2.2.2	Sewerage network PP/PVC pipe OD 250	m	1,110	165	183,150
2.2.3	Sewerage network PP/PVC pipe OD 200	m	19,635	150	2,945,250
2.2.4	Manholes, ϕ 1000	pcs	423	1,030	435,999
2.2.5	Pressure main PE OD 90-110	m	3,095	62	191,890
2.2.6	Service connections	pcs	1,332	500	666,000
ST-2.2	Subtotal 2.2 Extension of the sewerage network				4,499,989
2.3	Wastewater pumping station				
2.3.1	Construction of new wastewater pumping station	LS	1	20,000	20,000
2.3.2	Construction of new wastewater pumping station	LS	1	40,000	40,000
2.3.3	Construction of new wastewater pumping station	LS	1	50,000	50,000
ST-2.3	Sub-total 2.3 Wastewater pumping stations				110,000
ST-2	Subtotal Wastewater (2.1+2.2+2.3)				5,741,039
GT	Total Costs for Cupcini Phase 2				7,915,489

N°	Component	Units	Quan-tity	Unit costs	Total cost
				EUR	EUR
SUM	Summary for Total Investment Costs for all localities				
1	Edinet Town				
1.1	Water Supply				8,766,925
1.2	Wastewater				12,212,692
ST-1	Sub-total capital investment costs Edinet Town				20,979,617
2	Cupcini Town				
2.1	Water Supply				2,174,450
2.2	Wastewater				5,741,039
ST-2	Sub-total capital investment costs Cupcini Town				7,915,489
TOT	Total capital Investment cost all localities (1+2)				
T1	Water Supply				10,941,375
T2	Wastewater				17,953,731
TOT	Total capital Investment cost all localities				28,895,106
TA	Technical Assistance				
	Design, engineering, and supervision (12% of investment costs)				3,467,413
CON	Contingencies (10% of Investment costs and TA)				3,236,252
GT 2	Grand TOTAL for Phase 2 (Investment costs + TA + Contingencies)				35,598,770

Source: GIZ/MLPS

Table 5-14: Summary of the investment plan for Phase 1 and Phase 2

N°	Component	Costs Phase 1	Costs Phase 2	Costs Phase 1 & 2
		EUR	EUR	EUR
1	Water supply and wastewater, capital investments			
1,1	Water supply	1,887,735	10,941,375	12,829,110
1,2	Wastewater		17,953,731	17,953,731
1,3	Equipment and tools for operational performance improvement (water supply and wastewater)	200,000		
ST-1	Sub-total capital investments water supply and wastewater	2,087,735	28,895,106	30,982,841
2	Technical assistance	550,528	3,467,413	4,017,941
3	Contingencies	263,826	3,236,252	3,500,078
Total	**Total Costs Phase 1 & 2**	**2,902,090**	**35,598,770**	**38,500,859**

Source: GIZ/MLPS

6 Financial and economic analysis

6.1 Assumptions for financial and economic analysis

The financial model is structured in nominal Moldovan lei (MDL), the base year is 2014 and forecast begins in 2015.

The financial and economic analysis was based on macroeconomic assumptions on a forecast of GDP per capita, wages increase and electricity prices described below (Macroeconomic forecast).

The financial and economic analysis was prepared using incremental analysis, which considers the differences in the costs and benefits between the 'do something' alternative(s) and a single counterfactual without the project, that is, in principle, the BAU[34] scenario[35], in reference to the EU Guide to Cost-Benefit Analysis (further EU guide) of investment projects. The project was prepared using following assumptions:

- The water supply service area will be extended with 245 households in Edinet in 'with project' scenario and no extension of the service area is forecasted for the BAU scenario;
- The wastewater service area is restricted to the current service area of 'Apa-Canal' Edinet, no expanding of the service area is forecasted for both scenarios;
- The connection rate increases in the existing service area to 100% as the targets was set by 2030;
- Apparent losses (Commercial losses) will decrease down to the target of 15% until 2021 and down to the 5% in 2045;
- Physical losses will decrease down to the target of 30% until 2021 and down to the 20% in 2045;
- Fixed costs and depreciation do not change, except increases in salaries as described in the macroeconomic forecast;
- Variable costs are proportional to the unit water consumption.

The details of the financial and economic analysis are presented in Annex 6, Tables 1-25 as follows:

- Table 1. Macroeconomic forecast;
- Table 2. Investment costs for water supply;
- Table 3. Depreciation rates for water supply;
- Table 4. Summary of investment costs for water supply;
- Table 5. Depreciation for water supply;
- Table 6. Gross value of new assets for water supply;
- Table 7. Net assets for water supply;
- Table 8. Depreciation costs for water supply;
- Table 9. Variable costs – summary;

[34] Business as Usual

[35] In fact, the BAU scenario is an adjusted "do-minimum" scenario used as the reference solution. This is because in some cases, the BAU (do-nothing) scenario cannot be considered acceptable because it produces catastrophic effects.

- Table 10. Fixed costs;
- Table 11. Total costs;
- Table 12. Calculation of the water and wastewater tariff;
- Table 13. Tariff affordability;
- Table 14. Profits and losses - with project;
- Table 15. Profits and losses - without project;
- Table 16. Working Capital - with project;
- Table 17. Working Capital - without project;
- Table 18. Balance sheet - with project;
- Table 19. Balance sheet - without project;
- Table 20. Cash flow - with project;
- Table 21. Cash flow - without project;
- Table 22. Financial analysis on profitability of the investment;
- Table 23. Calculation of NPV on own capital;
- Table 24. Economic analysis;
- Table 25. Sensitivity analysis.

The financial analysis was prepared in an annual presentation and covers a time horizon of 30 years. Calculation of NPV was conducted for a 30-year reference period as the most appropriate infrastructure investments in the WSS sector and also advised by EU guide for water and environment (Table 2.2 of the guide which provides reference time horizon in years).

Historical financial data for 2012, 2013 and 2014 are used as the basis for the financial model. Data from 2014 is used as basis for the current costs structure.

The exchange rate used for the analysis represents the average exchange rate for the 2015 (the period from 1 January to 1 November) and is 1 EUR = 20.78 MDL. (Source: (https://www.bnm.md/en/content/official-exchange-rates))

6.1.1 Macroeconomic forecast

Gross domestic product (GDP) is the monetary value of all the finished goods and services produced within a country's borders in a specific time period. GDP is usually calculated on an annual basis. The major source for the GDP forecast is the Poverty Reduction Strategy[36].

The National Development Strategy (NDS)—known as 'Moldova 2020'—was approved by the Parliament of the Republic of Moldova on July 11, 2012 and officially published on November 30, 2012. The Strategy is not only a policy guide for the Government of Moldova but also the base for relations with IMF and other IFOs. The Strategy sets the priorities for country development for the time horizon 2012-2020. At the same time the Strategy assumes two development scenarios: base case scenario and scenario Moldova 2020.

The base case scenario, which regards a continuation of trends of the last decade, assumes that Moldova will develop as it has done to date, with the same economic, so-

[36] http://www.imf.org/external/pubs/cat/longres.aspx?sk=40895.0

cial, political phenomena, with rising remittances and the same pace of reforms. The base case scenario estimates an average annual GDP growth of 4.7% during 2012-2020.

The implementation of the Strategy's priorities, considering the direct and quantifiable effects of each priority, supplements this annual growth rate by more than 1.2% annually, thus forming the alternative scenario Moldova 2020, which in this study is called the optimistic scenario. The annual supplement to the additional GDP growth will emerge gradually, but will accelerate rapidly and sustainably, from 1.1% (2015) to 2.1% (by 2020), continuing beyond the analysis horizon used in this study. The difference is small at first glance, but in developed economies an annual GDP growth difference of 2% is sometimes the difference between stagnation and growth, or the difference between normal growth and economic boom. Hence, the alternative scenario assumes that, due to effects only, in 2020 the GDP will be 12% higher compared to the base case scenario and, with each year beyond 2020, this difference will grow significantly. Along with the implementation of these priorities, the annual income per capita by 2020 will be on average 12% higher compared to the base case scenario and 79% higher compared to 2011.

Taking into account that the National Development Strategy 2012-2020 also serves as the Poverty Reduction Strategy (PRS) and is the official basis for internal programming and for bilateral relations between the Government of the Republic of Moldova and the IMF and other international financial institutions, it may be concluded that the annual percentage changes in GDP presented in the Strategy can serve as a reference for the feasibility study projections.

Table 6-1: Gross Domestic Product annual percentage of change based on the information provided by Poverty Reduction Strategy (%)

Scenario/ Years	2015	2016	2017	2018	2019	2020
Base case scenario, %	4,70	4,60	4,65	4,70	4,65	4,70
Moldova 2020 scenario (optimistic), %	5,80	5,90	6,40	6,50	6,40	6,70
Pessimistic, %	2,35	2,30	2,33	2,35	2,33	2,35

Source: GIZ/MLPS

The base case scenario in the Poverty Reduction Strategy assumes that in the period 2012 – 2020, the annual GDP growth rate will be on average 4.70%. The Moldova 2020 scenario assumes that GDP will be higher than in the base case scenario in 2015 by 1.10% and in 2020 by 2.10%. Table 6-1 presents GDP growth estimates from 2015-2020 based on the assumptions and figures provided in the PRS. This study includes also a third scenario, pessimistic, where growth is half of that in the base scenario.

During the development of this feasibility study, the World Bank and IMF changed their GDP forecasts for the Republic of Moldova, due to social and political events that recently took place in region and the country itself. In this context, the World Bank has revised its GDP forecast downward, as shown in the following table.

Table 6-2: Gross Domestic Product projection by World Bank (%)

Scenario/ Years	2015	2016	2017
Base case scenario, %	-2.0	1.5	4.00

Source: http://www.worldbank.org/content/dam/Worldbank/GEP/GEP2015b/Global-Economic-Prospects-June-2015-Europe-and-Central-Asia-analysis.pdf

Applying the same methodology used in the Poverty Reduction Strategy, the GDP growth for all three scenarios has been estimated and is presented in the table below.

Table 6-3: GDP annual percentage of change in the feasibility study (%)

Scenario/ Years	2015	2016	2017	2018	2019	2020
Base case scenario, %	-2.0	1.5	4.0	4.0	4.0	4.0
Optimistic scenario, %	-2.0	3.00	4.5	5.0	5.0	5.0
Pessimistic scenario, %	-2.0	0.8	2.0	2.0	2.0	2.0

Source: GIZ/MLPS

Extending the GDP projections beyond 2020, it is assumed that the high growth of 4% annually will continue until 2035 as a result of structural reforms. However, in the later years the GDP growth will gradually slow, achieving the growth of 3% in the period of 2035-2044. The GDP growth forecasts for the period 2025-2045, estimated according to the above assumptions are presented in Table 6-4. In the optimistic scenario, the GDP growth will remain higher, while in the pessimistic scenario there will be stagnation.

Table 6-4: GDP annual percentage of change projection 2025-2045 (%)

Scenario/ Years	2025	2030	2035	2040	2045
Base case scenario, %	4.0	4.0	3.0	3.0	3.0
Optimistic scenario, %	5.0	5.0	5.0	5.0	5.0
Pessimistic scenario, %	2.0	2.0	1.5	1.5	1.5

Source: GIZ/MLPS

The base case scenario was used further in the financial analysis and financial calculations.

6.1.2 Wages forecast

According to the National Bureau of Statistics of the Republic of Moldova, the gross average monthly salary was MDL 4,172.0 in 2014, which was higher by 10.8% compared to the gross average salary in 2013. For the period 2009-2014, the average salary growth rate was 8.7%. The table below presents the gross average salaries and the salary growth rate for the period 2005 – 2014.

Table 6-5: Gross average monthly salary (MDL)

Indicator / Years	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Gross average monthly salary, MDL	1,319	1,697	2,065	2,530	2,748	2,972	3,194	3,478	3,765	4,172
Salary growth rate, %	19.5	28.7	21.7	22.5	8.6	8.2	7.5	8.9	8.3	10.8

Source: (http://statbank.statistica.md/pxweb/Dialog/varval.asp?ma=SAL0108_en&ti=Gross+average+monthly+salary+by+economic+activities+and+sectors%2C+2004-2010&path=../Database/EN/03%20SAL/SAL01/serii%20anuale/&lang=3)

The gross average salary for the next four years (2015-2018) is described on the macro economic forecast of the Moldovan Ministry of Economy. The table below presents the gross average salaries and the salary growth rate for 2015 – 2018.

Table 6-6: The forecast of gross average monthly salary for the next years (MDL)

Indicator / Years	2015	2016	2017	2018
Gross average monthly salary, MDL	4,500	4,925	5,400	5,900
Nominal growth rate, %	7.9	9.4	9.6	9.3

Source: (http://www.mec.gov.md/ro/documents-terms/situatia-macroeconomica-prognozare-macroeconomica)

The base case scenario, which regards a continuation of trends of the last decade, assumes that Moldova will develop as it has done to date, with the same economic, social, political phenomena.

The base case scenario estimates an average monthly salary growth of 9.0% during 2012-2020. The optimistic scenario (Moldova 2020) assumes that gross monthly salary will be higher than in the base case scenario in 2015 - 2020 by 2.0%. The pessimistic scenario assumes that the salary growth will be half of the provided by base scenario.

Table 6-7 presents gross monthly salary growth estimates for the period 2015-2020 based on the assumptions and figures provided by the Moldovan Ministry of Economy.

Table 6-7: The forecast of gross average monthly salary growth for the next years (%)

Scenario/Years	2015	2016	2017	2018	2019	2020
Base Case scenario, %	7.9	9.4	9.6	9.3	9.3	8.5
Pessimistic scenario, %	3.95	4.70	4.80	4.65	4.66	4.26
Optimistic scenario, %	9.9	11.4	11.6	11.3	11.3	10.5

Source: GIZ/MLPS

Extending the projections of gross average monthly wages beyond 2020, it is assumed that the high growth of about 6.3% annually will continue until 2025 as a result of structural reforms and the growth of the economy. For the period 2025-2035, the growth will slow down up to approximately 4.3% annually. In later years, it is estimated that growth will gradually slow, achieving the rate of 3% in the period of 2035-2044.

The gross average monthly salary forecast for the period 2020-2045 is presented in the table below.

Table 6-8: The forecast of gross average monthly salary growth, 2020-2045 (%)

Scenario/Years	2020	2025	2030	2035	2040	2045
Base Case scenario, %	8.5	5.6	4.3	3.6	3.0	2.7
Pessimistic scenario, %	4.26	2.78	2.17	1.79	1.52	1.35
Optimistic scenario, %	10.5	7.6	6.3	5.6	5.0	4.7

The base case scenario was used in this feasibility study.

6.1.3 Household income forecast

According to National Bureau of Statistics of the Republic of Moldova the disposable household income was (in 2014), in person per month: MDL 2,292.6 in Chisinau, MDL

1,697.2 in the North, MDL 1,564.3 in the Centre and MDL 1,526.6 in the South Region[37].

In 2014 the disposable household income was MDL 1,767.5 on average at national level, MDL 2,111.1 in urban and MDL 1,505.7 in rural areas.

The forecast for disposable household income was estimated based on disposable household income per capita per month from 2014 and increased according to the assumptions for the annual real wage growth. The following tables present the forecast for disposable household income for the period 2015-2020 and 2020-2045.

Table 6-9: Forecast of disposable household income, 2015-2020[38]

Scenario/Years	2015	2016	2017	2018	2019	2020
Base Case scenario, MDL	1,730	1,781	1,863	1,944	2,021	2,102
Pessimistic scenario, MDL	1,730	1,756	1,796	1,835	1,871	2,066
Optimistic scenario, MDL	1,730	1,816	1,936	2,058	2,161	2,837

Source: GIZ/MLPS

Table 6-10: Forecast of disposable household income, 2020-2045[39]

Scenario/Years	2020	2025	2030	2035	2040	2045
Base Case scenario, MDL	2,102	2,558	3,112	3,786	4,389	4,940
Pessimistic scenario, MDL	1,909	2,107	2,327	2,569	2,767	2,937
Optimistic scenario, MDL	2,269	3,008	3,838	4,899	6,252	7,600

Source: GIZ/MLPS

6.1.4 Electricity prices forecast

Electricity prices have a significant influence on costs of providing services and therefore on the tariffs that customers should pay. While electricity prices in Moldova are below the European average, they are among the highest when compared to disposable household income. Thus, the following factors will affect electricity prices:

- Regulation and government policy keeping prices low;
- Regional price of gas as a major fossil fuel used in the power generation in Moldova;
- Demand for the electricity in the region;
- Situation in Transnistria, from where Moldova imports electricity at a low price due to subsidized gas prices in Transnistria;
- Development of grid connections to Romania and Ukraine;
- General growth of the country's GDP and increase in disposable household income, which may provide the government with the possibility of relaxing control on electricity prices.

[37] http://statbank.statistica.md/pxweb/Dialog/view.asp?ma=NIV0103_EN_t&ti=Disposble+incomes+average+monthly+per+capita+by+Years%2C+Sources+of+income%2C+Unit+and+Zones&path=./quicktables/EN/04%20NIV/NIV01/&lang=3

[38] Per capita per month (MDL)

[39] Per capita per month (MDL)

Based on these factors, the feasibility study makes following assumptions:

- By 2020, the real increase in electricity prices will be limited to 1% annually, with the exception of 2016, when according to Administrative Board Decision of National Agency for Energy Regulation of the Republic of Moldova no. 153 of July 18, 2015, the electricity price was increased by 37%;
- In years 2020-2030, it will be proportional to the half of GDP increase;
- After 2030, it will be proportional to the GDP increase;
- In the pessimistic scenario, it will be proportional to half of GDP increase by 2020 and then it will be proportional to the GDP increase;
- In the optimistic scenario, there will be annual real growth of 1%.

The following table summarizes the assumed future electricity price increases:

Table 6-11: Increase of electrify prices (%)

Scenario/ Years	2015	2016	2017	2018	2019	2020	2030	2040
Base case scenario, %	0.0	37.0	1.0	1.0	1.0	1.0	2.0	4.0
Pessimistic scenario, %	0.0	37.0	2.3	2.4	2.3	2.4	4.0	3.0
Optimistic scenario, %	0.0	37.0	1.0	1.0	1.0	1.0	1.0	1.0

Source: GIZ/MLPS

The base case scenario is used in the feasibility study and further in the financial analysis and calculations.

6.2 Evaluation of the financial capacity of the Operator

6.2.1 Analysis of the current financial situation of the Operator

6.2.1.1 Analysis of the Balance Sheet

The WSS operator's Balance Sheet reveals a decrease of the fixed assets in 2014 (see Table 6-12).

Table 6-12: Balance Sheet of 'Apa-Canal' Edinet

Balance Sheet	Raw Code	2012 (MDL)	2013 (MDL)	2014 (MDL)
ASSETS				
LONG-TERM FIXED ASSETS				
Intangible assets	010	2,500	2,500	0
Accumulated Depreciation-Intangible Assets	020	-2,500	-2,500	0
Intangible assets' book cost	030	0	0	0
Incomplete fixed assets	040	18,734,341	841,190	828,441
Fixed Assets	060	61,324,762	79,419,727	75,691,267
Depreciation and depletion of long-term fixed assets	080	-39,204,699	-40,098,975	-48,263,354
Long-term fixed assets' book cost	090	40,854,404	40,161,942	28,258,354
Total Non-Current Assets	180	40,854,404	40,161,942	28,258,354
CURRENT ASSETS				
Stocks of goods and materials				
Raw materials	190	712,386	821,706	890,202
Inventory	210	19,055	27,101	15,270
Stocks of goods and materials	250	731,441	848,807	905,472

Balance Sheet	Raw Code	2012 (MDL)	2013 (MDL)	2014 (MDL)
Short-term receivables				
Trade accounts receivables	260	1,604,752	1,663,673	3,532,516
Advances	290	217,341	133,498	51,328
Receivables related to budget	300	2,100	245,455	8,586
Receivables from staff	320	34,620	36,697	14,513
Deferred income	330	72,500	53,939	68,125
Short-term receivables	350	1,931,313	2,133,262	3,675,068
Cash				
Settlement Account	400	90	209	137
Cash	410	103,952	28,416	177,019
Cash and equivalents	440	104,042	28,625	177,156
Other current assets	450	5,869	7,067	25,773
Total Current Assets	460	2,772,665	3,017,761	4,783,469
TOTAL - ASSETS	**470**	**43,627,069**	**43,179,703**	**33,039,823**
LIABILITIES AND OWN EQUITY				
EQUITY				
Share capital and capital surplus				
Share capital	480	93,903	93,903	93,903
Share capital and capital surplus	520	93,903	93,903	93,903
Other provisions	550	23,661,908	23,661,908	23,661,908
Correction of previous periods' results	570	3,839,735	-3,800	186,470
Retained profit (uncovered loss) of previous years	580	-13,033,138	-1,238,285	-11,135,087
Net income (loss) of the reporting period	590	-2,074,882	106,998	-3,467,749
Retained earnings (uncovered loss)	610	-11,238,285	-11,135,087	-14,416,366
Differences from revaluation of long-term assets	620	2,804,559	2,804,559	2,804,559
Subsidies	630	23,034,559	22,929,136	12,476,257
Non capital assets	640	25,839,118	25,733,695	15,280,816
Total Equity	650	38,356,644	38,354,419	24,620,261
LONG-TERM LIABILITIES				
Long-term bank loans	660			1,106,000
Special purpose funding and receipts	720	112,357	12,357	12,069
Long-term accrued liabilities	760	112,357	12,357	12,069
Total Long Term Liabilities	770	112,357	12,357	1,118,069
SHORT-TERM LIABILITIES				
Short-term bank loans	780	409,000	0	0
Total short-term financial liabilities	820	409,000	0	0
Commercial account payables	830	1,192,880	1,234,906	2,983,456
Advances received	850	36,107	61,169	26,213
Short-term accounts payables	860	1,228,987	1,296,075	3,009,669
Wages owed	870	2,026,702	1,960,814	2,293,385
Other employee liabilities	880	3,289	2,010	755
Insurance	890	790,596	974,364	1,002,348
Debt settlement related to the budget	900	605,545	449,972	911,713
Value Added Tax and excises to be paid	910	53,053	51,015	51,015
Other current liabilities	950	40,896	78,677	32,608
Short-term accrues liabilities	960	3,520,081	3,516,852	4,291,824
Total Short Term Liabilities	970	5,158,068	4,812,927	7,301,493
TOTAL – EQUITY and LIABILITIES	**980**	**43,627,069**	**43,179,703**	**33,039,823**

Source: 'Apa-Canal' Edinet

The following conclusions results from the Balance Sheet analysis:

- The largest assets category is long-term assets, which constituted 85.5% of the total in 2014. It should be mentioned that the operator's assets decreased from MDL 43.6 million in 2012 to MDL 33.0 million in 2014;
- Liabilities show that the operator is financed mainly from permanent capital where we observe an increase of the equity and an increase of the subsidies in 2013;
- The share of short-term debts in 2014 is 22.1% from the total liabilities. The operator honours its current liabilities in due time.

6.2.1.2 Analysis of the Profit and Losses Statement

The Profit and Losses Statement for the period 2012-2014 is shown in the following Table 6-13.

Table 6-13: Profit and Losses Statement of 'Apa-Canal' Edinet

Income Statement	Row Code	2012 (MDL)	2013 (MDL)	2014 (MDL)
Income from sales	010	13,861,540	13,823,077	13,126,226
Cost of sales	020	9,306,243	10,354,495	10,988,214
Gross profit (gross loss)	030	4,555,297	3,468,582	2,138,012
Other operating income	040		59,975	73,644
Commercial expenses	050	602,587	685,070	726,043
General and administrative expenses	060	2,531,316	2,514,799	2,355,761
Other operating expenses	070	585,622	479,865	523,042
Result from operating activities: profit (loss)	080	835,772	-151,177	-1,393,190
Result from investing activities: profit (loss)	090	-3,116,077	52,752	-2,744,310
Result from financial activities: profit (loss)	100	205,423	205,423	669,751
Result from financial and economic activities: profit (loss)	110	-2,074,882	106,998	-3,467,749
Extraordinary result: profit (loss)	120			
Profit (loss) before tax	130	-2,074,882	106,998	-3,467,749
Income tax	140			
Net profit (net loss)	150	-2,074,882	106,998	-3,467,749

Source: 'Apa-Canal' Edinet

The operator has losses from operating activities in 2012 and in 2014, nevertheless the profit was accumulated from financial and investing activities in 2013, which contribute to provisions accumulation.

The evolution of the operator's income; cost of sales and net profit for the period of 2012-2014 is presented in the Figure 6-1.

Figure 6-1: Operator's income, cost of sales and net profit (MDL)

Source: GIZ/MLPS

6.2.1.3 Cash flow analysis

The Cash Flow Statement for the period 2012-2014 is shown in Table 6-14.

Table 6-14: Cash Flow Statement of 'Apa-Canal' Edinet

Cash Flow Statement	Row Code	2012 (MDL)	2013 (MDL)	2014 (MDL)
Operating activities				
Cash inflows from sales	010	14,563,748	13,501,826	12,883,538
Cash paid to suppliers and contractors	020	7,265,672	7,421,949	7,674,311
Cash payments to employees and social security contributions	030	5,384,690	5,634,815	5,297,433
Interest payments	040	98,264	39,405	129,752
Income tax payments	050	186,571		55,170
Other cash payments	070	1,622,574	481,074	684,341
Net cash flow from operating activities	080	5,977	-75,417	-957,469
Financing activities				
Cash proceeds from credits and loans	150			1,500,000
Repayments of loans	160			394,000
Net cash flow from financial activity	210	0	0	1,106,000
Net cash flow before extraordinary items	220	5,977	-75,417	148,531
Net cash flow	240	5,977	-75,417	148,531
Positive (negative) foreign exchange differences	250			
Cash balance at the beginning of the year	260	98,065	104,042	28,625
Cash balance at the end of the reporting period	270	104,042	28,625	177,156

Source: 'Apa-Canal' Edinet

6.2.1.4 Financial indicators

A series of indicators derived from the financial statements were calculated based on the data collected (see Table 6-15).

Table 6-15: Financial Indicators

No	Financial Indicators	2012	2013	2014	Indicators limits
1	Current Liquidity Ratio	0.54	0.63	0.66	1.0 – 2.0
2	ROE, %	-5.4	0.3	-14.1	
3	ROA, %	-4.8	0.2	-10.5	
4	Operating Profitability, %	6.0	-1.1	-10.6	> 0
5	Debts Service Converge Ratio	0.88	0.89	0.75	<1.2
6	Financial Ratio	0.12	0.11	0.25	
7	Accounts Receivable Turnover, days	51	54	81	< 30
8	Accounts Payable Turnover, days	48	89	72	< 30

Source: GIZ/MLPS

- The profitability indicators (2, 3, 4) have oscillating values, but are generally negative for 2012-2013. This means that operator covers its current costs partially;
- Debt ratio indicators (5, 6) show a reduced weight of debt for the short-term period, promoting a short-term self-financing strategy;
- Liquidity indicator (1) shows a constant capacity of paying in the short-term, but demonstrates low cash reserves;
- The collection of receivables shows an increase in the collection period from 51 days in 2012 to 81 days in 2014. The accounts payable period increased from 48 days in 2012 to 72 days in 2014.

6.2.1.5 Revenue analysis

The revenues from the provision of water and wastewater services are presented in Table 6-16.

Table 6-16: Revenues from water supply and wastewater services[40]

Consumers	Revenues		Volumes	
	(MDL)	(%)	(m^3)	(%)
WATER SUPPLY SERVICES	**7,603,778**	**100.0**	**444,747**	**100.0**
Population	2,992,621	39.4	239,250	53.8
Budgetary Consumers	280,901	3.7	12,684	2.9
Private Entities	4,330,256	56.9	192,813	43.4
WASTEWATER SERVICES	**5,290,396**	**100.0**	**329,531**	**100.0**
Population	1,410,204	26.7	134,305	40.8
Budgetary Consumers	228,028	4.3	12,522	3.8
Private Entities	3,652,164	69.0	182,704	55.4

Source: 'Apa-Canal' Edinet

The operator differentiates tariffs by customer groups and tariffs are approved by the Local Council (see Table 6-17). The tariffs are indicated without VAT.

[40] 'Apa-Canal' Edinet, 2014

Table 6-17: Evolution of tariffs, 2013-2015

Tariffs for consumers	2013 (MDL / 1m^3)	2014 (MDL / 1m^3)	2015 (MDL / 1m^3)
Budgetary Consumers	34.15	34.15	34.15
• Water supply	19.15	19.15	19.15
• Wastewater services	15.00	15.00	15.00
Private Entities	34.15	34.15	34.15
• Water supply	19.15	19.15	19.15
• Wastewater services	15.00	15.00	15.00
Population	23.00	23.00	23.00
• Water supply	12.50	12.50	12.50
• Wastewater services	10.50	10.50	10.50
Weighted average		28.74	
• Water supply		15.57	
• Wastewater services		13.17	

Source: 'Apa-Canal' Edinet

In the period of 2013 - 2015, the tariffs for WSS services did not change. This fact demonstrates that the operator's activity is not based on the principle of cost recovery. Also, in accordance with the operator's data the weighted average tariffs were calculated.

6.2.1.6 Detailed cost structure

The operator's detailed cost structure for water and wastewater services is shown in Table 6-18.

Table 6-18: Detailed cost structure of 'Apa-Canal' Edinet, 2014

Cost category	Amount (MDL)	Percentage (%)
WATER SUPPLY SERVICES	**9,132,540**	**100.0**
Electricity (for pumping)	3,918,511	42.9
• For pumping	3,869,080	-
• For water treatment	27,280	-
• For office, heating and other purposes	22,151	-
Chemicals for water treatment	114,592	1.3
Salaries of employees working at water supply	2,463,754	27.0
• Number of employees (pers.)	63	-
• Average monthly salary per employee	3,259	-
Social benefits (pension fund/insurance)	665,214	7.3
Depreciation	667,098	7.3
Maintenance costs for water supply	936,668	10.3
Tax for water capturing	366,703	4.0
WASTEWATER SERVICES	**3,571,516**	**100.0**
Electricity (for wastewater treatment)	353,645	9.9
• For pumping	286,110	-
• For wastewater treatment	67,535	-
Salaries of employees working at wastewater services	1,525,181	42.7
• Number of employees (pers.)	39	-
• Average monthly salary per employee	3,259	-
Social benefits (pension fund/insurance)	411,799	11.5
Depreciation	632,729	17.7
Maintenance costs for wastewater services	641,262	18.0
Other costs	6,900	0.2
ADMINISTRATION AND OVERHEAD	**1,889,005**	**100.0**
Salaries of employees working in administration	663,939	35.2

Cost category	Amount (MDL)	Percentage (%)
• Number of employees (pers.)	15	-
• Average monthly salary per employee	3,689	-
Social benefits (pension fund/insurance)	179,264	9.5
Maintenance costs for administration	569,057	30.1
Fuel for transport for administration	37,274	2.0
Insurance costs	7,995	0.4
Other overhead costs	301,723	16.0
Financial costs	129,753	6.9

Source: 'Apa-Canal' Edinet

It can be noticed that the majority of the costs are for salaries and electricity.

6.2.1.7 Investments

The operator obtained co-financing for external sources for investments and capacity development as follows (see Table 6-19).

Table 6-19: Investments

Investments	Source	Period	Amount (MDL)
Total			30,046,000
Reconstruction of the water and wastewater system, pumps purchasing	Denmark	2003-2005	30,000,000
Reparation of the water supply network	NEF	2010	46,000

Source: 'Apa-Canal' Edinet

6.2.2 Information on existing loans (if any)

The Operator benefits for the long-term loan in 2014 in amount of MDL 1.5 million. The interest rate for the loan is 13% per year and the loan should be repaid till the end of 2015.

6.2.3 Creditworthiness capacity of the Operator

Capacity to repay a loan is the most important criterion used to assess the operator's creditworthiness. The loan repayment shall be less than the net profit and depreciation if there are no investment and financial activities. Unfortunately, the operator uses cash surpluses generated from depreciation to decrease working capital. In conclusion, the operator presently has no creditworthiness capacity.

6.3 Financial analysis

6.3.1 Investment costs

The total investment outlays amount to MDL 60.31 million (EUR 2.90 million). The outlays include:

- Rehabilitation of water network – 22.44 km;
- Extension of water network – 4.52 km;
- Equipment and tools;
- Detailed design and procurement;
- Technical assistance, supervision and capacity development;
- Contingencies.

The presented construction costs were prepared using conceptual design estimates. Using the information obtained, the costs were estimated based on expert experience from many years of design works, tenders and investment supervision in water management. Also, in preparation of investment plan was taking into consideration the priority objectives regarding the development of water supply system and wastewater system established by Local Public Administration and WSS operator. In the calculations, the experts took into account the different investment conditions. The costs are inclusive of VAT.

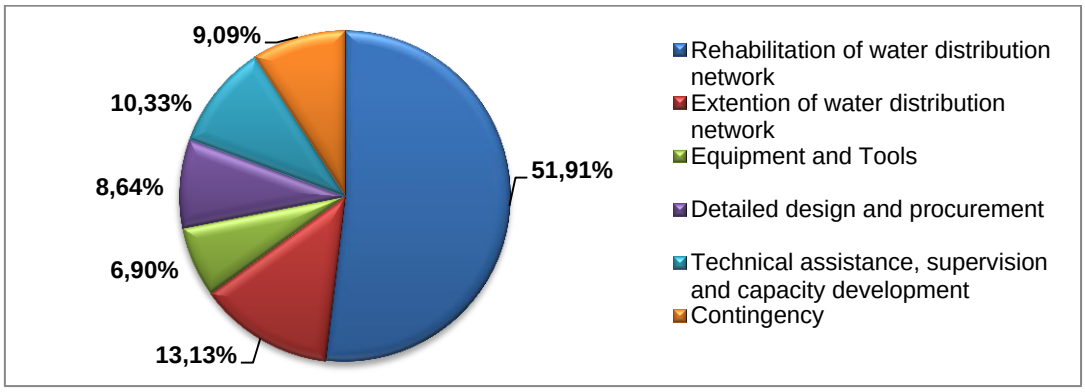
Table 6-20: Summary of the investment costs (MDL mil.)

Project investment outlays	Amount	%
Rehabilitation of water network	31.31	51.91
Extension of water network	7.92	13.13
Equipment and Tools	4.16	6.90
Detailed design and procurement	5.21	8.64
Technical assistance, supervision and capacity development	6.23	10.33
Contingency	5.48	9.09
Total	**60.31**	**100.00**

Source: GIZ/MLPS

The main part of investment costs about 65.0% will be for the extension of water network, manholes and household connections. Capacity development and technical assistance will be around 19% of the total investment cost. Also, in the project are provided various and unforeseen expenditures in the amount of 9% of investment costs.

Figure 6-2: Structure of the project investment costs



Source: GIZ/MLPS

6.3.2 Financing of the project and assessing the need for additional funding

6.3.2.1 Additional sources of income

There are two additional sources of project financing: 'local contribution' and tariffs. Local contributions – co-financing of capital investment projects by citizens – are widely used in Moldova. The possible local contributions were proposed based on the experi-

ence in Moldova in implementing other investment projects. Accordingly, the estimated contribution of citizens is MDL 1,000 MDL per household connected to the system[41].

These funds will be spent on the local wastewater network, thus households already connected to the local wastewater system will not contribute because usually they already had been contributing to the construction of the network. Thus only households not connected to sanitation system were taken into account.

It is estimated that 245 households will be connected to the water network in the first year of the project realization. The estimation of the citizens contribution is amounted to MDL 0.25 million.

Tariffs could be a source of financing of the WSS capital project, in particular to help repay existing and future loans. On the other hand, if the development of water and wastewater systems will be realized through loans, than the tariffs calculated, will exceed the affordable constrains. In addition, currently 'Apa-Canal' Edinet has no creditworthiness capacity. Therefore, for this project the tariff will not be used to contribute to project financing.

As indicated when calculating the financial gap (see Chapter 6.3.7 'Financial performance of the project'), project is not profitable (FNPV(K)~=0) when own contribution is MDL 14.32 million. This means that apart from citizen contributions of MDL 0.25 million, the additional MDL 14.08 million needs to be provided from other sources.

6.3.2.2 Financial plan

The total investment outlays will be financed by:

- Domestic and international donors;
- Citizens providing local contribution;
- National sources (national development funds, local and central budgets, water operator).

The following methods for assessing the amount to be financed from each source of financing were used:

Table 6-21: Methods used for assessing the amount to be financed from each source of financing

Source of financing	Method used to estimate share in project financing
Citizens providing local contribution	The practice of 'local contribution' – co-financing of capital investment projects, including water supply, by citizens – is widely used in Moldova. The estimate was based on experience from other projects in Moldova. The estimated contribution of citizens is MDL 1,000 per household which will be connected to the wastewater system.
Domestic and international donors	The assumption is that remaining part of the investment costs will be financed by donors. Donors may not spend more than the estimated 'financing gap'[42]. The calculation of the required donor contribution takes into account that the project should not lead to financial losses for residents and communes. The social discount rate of 5% is used to determine the financial net present value (FNPV(K)) of the project. The donor contribution is then determined at the level at which FNPV(K) is equal to zero.
Water utility	The water utility may co-finance the project from tariffs. As the level of tariff is above affordability level, it means that currently the water utility will have no capacity to co-

[41] This is not the total household spending capacity, as the connection to the water supply system also has to be financed.

[42] This is not an EU financing gap calculation, however, it is based on a similar assumptions.

Source of financing	Method used to estimate share in project financing
	finance the project from tariffs. Also, currently 'Apa-Canal' Edinet has no creditworthiness capacity.

Source: GIZ/MLPS

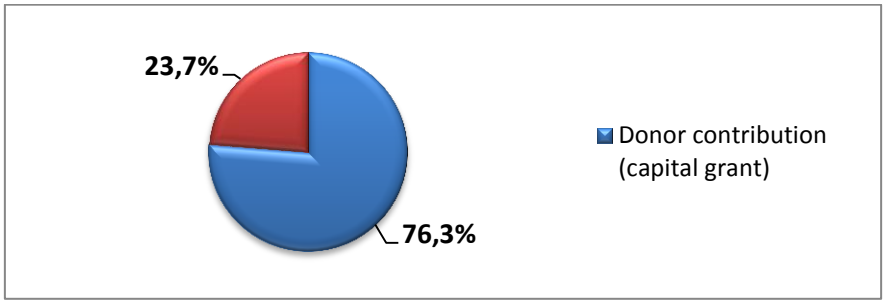
The following table presents the investment outlays and their financing:

Table 6-22: Summary of the financing sources (MDL mil.)

Project financing sources	Amount (MDL mln.)	Percentage (%)
Citizens providing local contribution	0.25	0.41
Domestic and International donors	45.98	76.25
Other domestic sources	14.08	23.34
Water utility	0.00	0.00
Total	**60.31**	**100.00**

The donor contribution was estimated as 76.3% of the total investment costs, while the local sources' contribution is 23.7%, which will be split down by citizens' contribution about 0.4% and other domestic sources 23.3%.

Figure 6-3: Structure of project financing (%)



Source: GIZ/MLPS

The project will be implemented during the period of three years and the implementation schedule is as indicated in the following table. For the first year, it is assumed that the project will be implemented in 10%, for the second year is foreseen 50% and for the third year 40%.

Table 6-23: Summary of the investment implementation schedule (MDL mil.)

Project investment outlays	2015 (MDL mil.)	2016 (MDL mil.)	2017 (MDL mil.)	Total (MDL mil.)
	10%	50%	40%	
Rehabilitation of water network	3.13	15.66	12.52	31.31
Extension of water network	0.79	3.96	3.17	7.92
Equipment and Tools	0.42	2.08	1.66	4.16
Detailed design and procurement	0.52	2.61	2.08	5.21
Technical assistance, supervision and capacity development	0.62	3.12	2.49	6.23
Contingency	0.55	2.74	2.19	5.48
Total	**6.03**	**30.16**	**24.13**	**60.31**

Source: GIZ/MLPS

6.3.3 Forecast of operating costs

A detailed cost structure of 'Apa-Canal' Edinet for the year 2014 was presented in Section 6.6.2.1.6 (Detailed cost structure). The cost structure was used as a basis for the expenditure forecast with and without the project.

The following assumptions were used for the expenditure forecast:

- **Direct costs for labour – salaries and benefits**. In the project the labour cost is calculated based on forecasted enterprise staff number (Description of enterprise staff is provided in Chapter 7.6 'Corporate development of the operator'). For both options (BAU and with project) it have been used an average real growth rate equal to the wages increase forecast. Three scenarios of wages increase were prepared (see Chapter 6.1.2 'Wages forecast'), but for the financial forecast the base case scenario is presented;
- **Direct costs (chemicals for treatment and water abstraction fee).** Currently, these costs are estimated to be 0.32 MDL/m^3 of water treated. No real cost increase is forecasted;
- **Direct costs (electricity)**. The following assumptions were used for unit consumption of water/wastewater:
  - **For water pumping stations**. The electricity consumption for the pumping stations is estimated to be 1.626 kWh/m^3;
  - **For water treatment plant**. The electricity consumption for the pumping stations of SP2 is estimated to be 0.012 kWh/m^3;
  - **For wastewater pumping stations**. The electricity consumption for the pumping stations of SP1 is estimated to be 0.087 kWh/m^3;
  - **For wastewater treatment plant**. The electricity consumption for the wastewater treatment plant is estimated to be 0.385 kWh/m^3.

Electricity costs are estimated taking into account the electricity prices and the electricity consumption. Price of energy[43] for the reference period is adjusted by forecast of real changes of electricity prices. Electricity consumption is calculated resulting from electricity consumption based on unit of water/wastewater (1 m^3 of water/wastewater) multiplied by total volume of water/wastewater production:

- **General administration costs**. General administration costs are currently MDL 1.89 million annually. For the expenditure forecast, due to limited expansion of the service area, it is assumed that the costs will increase with the GDP growth rate forecasted for both scenarios (BAU and with project). The GDP growth forecast is presented in the macroeconomic forecasts, where was developed three scenarios of GDP growth (base case, optimistic and pessimistic). The base case scenario was used in the financial forecast;
- **Depreciation**. Currently, depreciation is at the level of MDL 1.3 million annually. However, depreciation costs will increase to about MDL 2.97 million annually, after the investments in new assets have been implemented, beginning with the year 2018.

[43] It has to be noted that current electricity price for pumping stations is 1.57 MDL/kWh, and for wastewater treatment plant the average electricity price is 1.62 MDL/kWh.

The depreciation costs are taken into account for project sustainability analysis, and are taken into account in the tariff policy discussion. Details on depreciation forecast are presented in Annex 6, Tables 3-8, which also include calculation of net assets that is further used for the balance sheet forecast.

The operational costs forecasts are presented in the following table.

Table 6-24: Summary of the operational costs projections (MDL mil.)

Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Variable costs water	MDL mil.	4.24	4.65	5.57	5.16	5.03	4.96	5.71	9.47	14.53
Electricity for pumping	MDL mil.	3.87	4.14	5.11	4.74	4.62	4.56	5.30	8.96	13.99
Water treatment costs	MDL mil.	0.37	0.51	0.46	0.42	0.41	0.40	0.42	0.51	0.54
Fixed costs water	MDL mil.	5.87	5.87	6.21	7.54	9.43	9.61	10.62	12.85	15.67
Salaries and related costs	MDL mil.	3.13	3.13	3.22	3.37	2.51	2.61	3.18	4.70	6.38
Maintenance - old assets	MDL mil.	0.00	0.00	0.00	0.00	2.00	2.04	2.25	2.75	3.20
Maintenance - new assets	MDL mil.	0.00	0.00	0.06	0.36	0.60	0.60	0.60	0.60	0.60
Depreciation of fixed assets	MDL mil.	0.67	0.67	0.83	1.67	2.34	2.34	2.34	1.92	1.92
General and administrative expenditures	MDL mil.	1.11	1.11	1.13	1.18	1.02	1.06	1.30	1.92	2.60
Other costs	MDL mil.	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Total costs for water	MDL mil.	10.10	10.52	11.78	12.70	14.46	14.58	16.33	22.32	30.20
Wastewater service	**Unit**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2024**	**2034**	**2044**
Variable costs wastewater	MDL mil.	0.35	0.37	0.53	0.56	0.58	0.57	1.08	2.15	3.80
Electricity for pumping	MDL mil.	0.35	0.37	0.53	0.56	0.58	0.57	1.08	2.15	3.80
Wastewater treatment costs	MDL mil.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fixed costs water	MDL mil.	3.99	3.99	4.06	4.19	3.67	3.76	4.45	5.82	7.31
Salaries and related costs	MDL mil.	1.94	1.94	2.00	2.09	1.17	1.22	1.69	2.51	3.40
Maintenance - old assets	MDL mil.	0.00	0.00	0.00	0.00	0.50	0.51	0.56	0.69	0.80
Depreciation of fixed assets	MDL mil.	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
General and administrative expenditures	MDL mil.	0.78	0.78	0.79	0.82	0.72	0.75	0.91	1.34	1.82
Other costs	MDL mil.	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Total costs for wastewater	MDL mil.	4.35	4.36	4.59	4.74	4.25	4.33	5.52	7.97	11.11
TOTAL COSTS	**MDL mil.**	**14.45**	**14.89**	**16.37**	**17.44**	**18.72**	**18.91**	**21.86**	**30.29**	**41.31**

Source: GIZ/MLPS

The summary of the variable costs forecast are provided in Annex 6, Table 9. The fixed costs are presented in Annex 6, Table 10 and total (fixed and variable) in Table 11.

6.3.4 Revenue forecast (including the calculation of tariffs)

6.3.4.1 Forecast of the tariff

To estimate revenues for the water supply and wastewater services in the future, the average tariff for the service is calculated. This is done by taking into account:

- Operating and maintenance cost of the system, including: direct costs of labour, electricity costs, chemicals, fuel, maintenance costs, financial and administrative costs;
- Application of polluter-pays principle and full cost recovery tariff (including depreciation) in the long run;
- Need to generate positive cumulative cash flow of the operator to maintain sustainable operations. This requires that the tariff calculation includes reserves for irregular receivables.

The Table 12 in the Annex 6 contains a calculation of the tariff with and without depreciation. The proposed tariff takes into account the full cost recovery principle and affordability. The full cost recovery principle means that the operational costs and capital costs should be covered by the tariff. If the tariff with depreciation exceeds the assumed affordability limit, a lower tariff needs to be proposed, albeit one that fully covers operating costs. Based on the foregoing the future tariff is proposed as illustrated in the following table.

Table 6-25: Tariff calculation for the option 'with project' (MDL mil.)

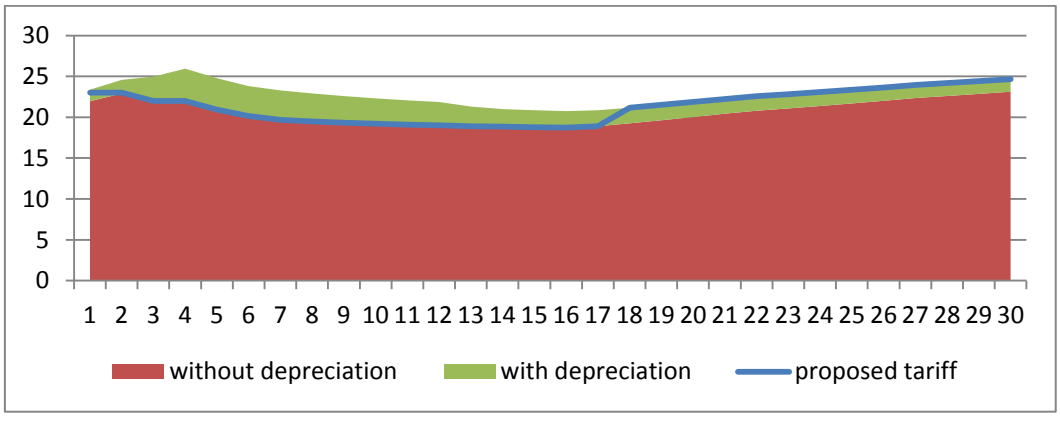
Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Variable and fixed costs	MDL mil.	9.58	9.86	10.94	11.03	12.13	12.24	14.00	20.40	28.28
Depreciation	MDL mil.	0.67	0.67	0.83	1.67	2.34	2.34	2.34	1.92	1.92
Interest and financial costs	MDL mil.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reserve for irregular receivables	MDL mil.	0.00	0.53	0.53	0.51	0.51	0.44	0.41	0.56	0.75
Sale of water	ths m^3	444.7	472.8	500.9	529.0	577.0	606.0	750.5	1,046.5	1,255.6
Tariff without depreciation	MDL / m^3	21.54	21.96	22.91	21.82	21.89	20.92	19.20	20.02	23.12
Tariff with depreciation	MDL / m^3	23.04	23.37	24.57	24.97	25.94	24.78	22.31	21.86	24.65
Proposed average tariff	MDL / m^3	15.57	23.00	23.00	22.00	22.00	20.92	19.20	21.86	24.65
Wastewater service	**Unit**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2024**	**2034**	**2044**
Variable and fixed costs	MDL mil.	3.71	3.73	3.96	4.11	3.62	3.70	4.89	7.34	10.48
Depreciation	MDL	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63

Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
tion	mil.									
Interest and financial costs	MDL mil.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reserve for irregular receivables	MDL mil.	0.00	0.22	0.21	0.19	0.15	0.13	0.14	0.20	0.28
Sale of wastewater	ths m^3	329.5	347.7	365.9	384.1	402.3	420.5	831.9	1,194.1	1,443.2
Tariff without depreciation	MDL / m^3	11.27	11.35	11.38	11.19	9.37	9.10	6.05	6.31	7.46
Tariff with depreciation	MDL / m^3	13.19	13.17	13.11	12.84	10.94	10.61	6.81	6.84	7.89
Proposed average tariff	MDL / m^3	13.17	13.17	13.00	12.00	10.94	10.61	6.81	6.84	7.89

Source: GIZ/MLPS

The following Figure 6-4 illustrates the evolution of the proposed tariffs. During the construction period when the capital costs will increase significantly and water sales are limited approximately to the same level, it is proposed that tariff does not contain depreciation costs. This would stimulate the water consumption and will keep the tariffs below affordability constraints. After the project is completed, the water consumption will increase because of new consumers connecting to the system; when possible, the tariff should include depreciation. The estimation shows that a full cost recovery tariff can be applied starting with year 18 of the forecast for water supply service and in year 4 for the sanitation system.

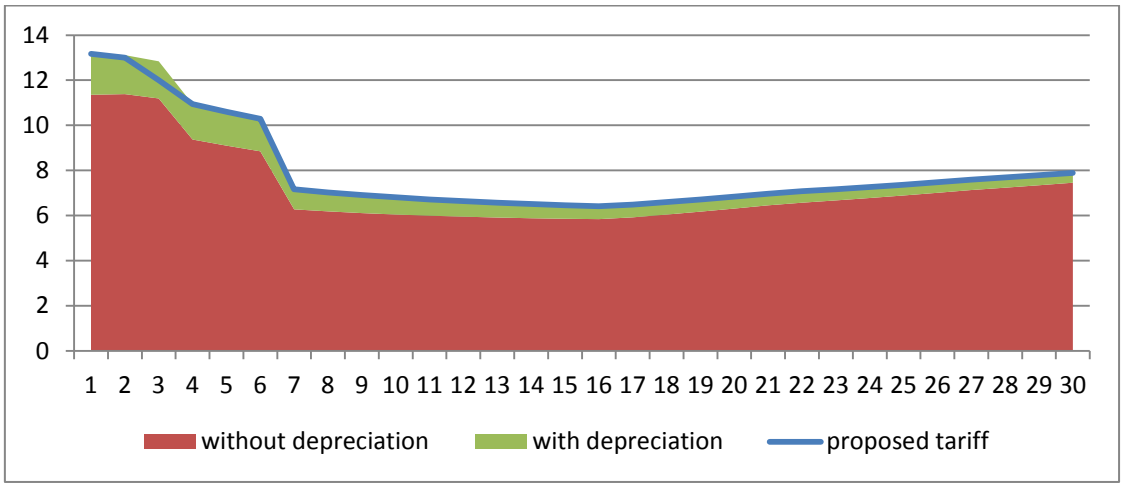
Figure 6-4: Forecast of the tariff for water (MDL/m^3)



Source: GIZ/MLPS

The tariff of water is forecasted to be about MDL 21.35 per m^3 on average for the entire forecast period. The financial projections, however, do not take into account the effect of inflation. As a result, the real decrease or increase of tariffs will depend of the development of costs and their variation.

Figure 6-5: Forecast of the tariff for wastewater (MDL/m^3)



Source: GIZ/MLPS

The tariff for wastewater is forecasted to be about MDL 7.94 per m^3 on average for the whole projected period. Also, the financial projections do not consider the effect of inflation, but the real decrease or increase of tariff will depend on how costs develop and fluctuate.

6.3.4.2 Tariff affordability

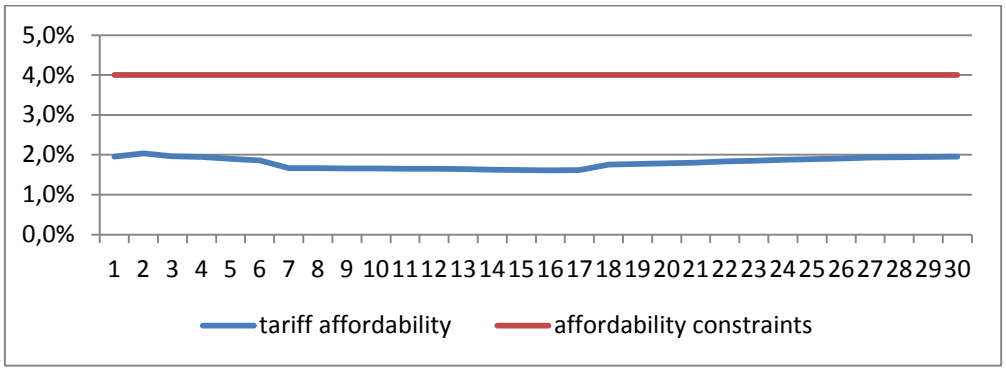
The affordability of tariffs, expressed as the ability of households to pay for services, is estimated as the household expenditures on water and wastewater services expressed as a percentage of disposable household income. For Eastern Europe countries, a common benchmark figure for the affordability threshold for water and wastewater services is 4%. As discussed, the tariff should cover at least operating and maintenance costs and should not exceed a level covering these costs together with capital costs (depreciation). In the event the calculated tariff is higher than the affordable tariff, a subsidy to the price from the LPA should be proposed. Tariff affordability, based on household bills for WSS services as a percentage of disposable household income, is presented in Table 13 in Annex 6.

During the entire period of the financial projections, the average tariff will constitute about 1.8% of average disposable household income, which means that it is within the limits of the affordability threshold of 4%.

For the first years of the project implementation, it is proposed that tariff does not contain the capital cost component (depreciation). Otherwise, the proposed tariff would be too high and the affordability constraint would lead to a further decrease of water consumption. The average bill in these years does not exceed 4% of average disposable household income.

The proposed bill for water as a percentage of disposable household income is presented by Figure 6-6.

Figure 6-6: Proposed tariff and tariff affordability (MDL/m^3)



Source: GIZ/MLPS

6.3.4.3 Revenue forecast

The calculation of revenues was based on the demand analysis taking into account water demand and the proposed tariff for water and wastewater services. The revenues forecast for each service is presented in the Table 6-26.

Table 6-26: Revenues forecast for the option 'with project' (MDL mil.)

Water supply service	**Unit**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2024**	**2034**	**2044**
Sale of water	ths m^3	444.7	472.8	500.9	529.0	577.0	606.0	750.5	1,046.5	1,255.6
The weighted average tariff for water	MDL/ m^3	15.57	23.00	23.00	22.00	22.00	20.92	19.20	21.86	24.65
Revenues from water service	MDL mil.	6.93	10.87	11.52	11.64	12.69	12.68	14.41	22.88	30.95
Wastewater service	**Unit**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2024**	**2034**	**2044**
Sale of waste-water	ths m^3	329.5	347.7	365.9	384.1	402.3	420.5	831.9	1,194.1	1,443.2
The weighted average tariff for waste-water	MDL/ m^3	13.17	13.17	13.00	12.00	10.94	10.61	6.81	6.84	7.89
Revenues from sanitation service	MDL mil.	4.34	4.58	4.76	4.61	4.40	4.46	5.66	8.17	11.39
Total Revenues	**MDL mil.**	**11.26**	**15.45**	**16.28**	**16.25**	**17.10**	**17.14**	**20.07**	**31.04**	**42.35**

Source: GIZ/MLPS

The water demand will increase from 444.7 thousand m^3 per year to 1255.6 thousand m^3 year at the end of the period of analysis. This increase is determined by the growth

of water consumption per capita from 31.3 l/c/d to 110 l/c/d in 2045 and the increase of consumers by 6,181.

The wastewater inflow is calculated based on the wastewater generation per capita and the number of consumers. It is assumed that the number of consumers will grow from the current number of 12,501 to 25,771 persons and the wastewater generation will increase from the current 29.4 l/c/d up to 110 l/c/d in 2045.

The tariff for water services will decrease from 23.0 MDL/m^3 to approximately 19.70 MDL/m^3 in the period 2015-2021, and then the will increase slowly to 24.65 MDL/m^3. For the sanitation service the tariff will be higher in the first 6 years and will constitute about 12.00 MDL/m^3, and after that will decrease and will constitute approximately 7.00 MDL/m^3 in the period 2021-2045.

6.3.5 Income statement and balance sheet forecast

6.3.5.1 Income statement

The profit and loss (income) statement illustrates the financial performance of the operator in each year of the reference period. It should be noted, however, that financial statements are more relevant instruments to assess the financial situation of business entities/commercial companies. The negative values of net profit are acceptable and do not mean that the operator will face cash flow problems during the implementation phase. In the long-term, however, financial losses mean that the revenue from tariffs do not cover O&M and capital costs.

The financial results from the provision of water supply services will be negative in the period 2016 – 2031, and after that it will be positive. The average annual profit is expected to be about MDL 64.0 thousand in the period 2032-2045. For sanitation services, the financial results of the service will be positive with the exception of the year 2017. The average annual profit for the sanitation service will be about MDL 19.0 thousand. The calculation of net profit for each service in the 'with project' option is presented in Table 6-27.

Table 6-27: Net profit forecast for the 'with project' scenario (MDL mil.)

Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Sale of water	MDL mil.	6.93	10.87	11.52	11.64	12.69	12.68	14.41	22.88	30.95
Costs of water services	MDL mil.	10.25	10.52	11.78	12.70	14.46	14.58	16.33	22.32	30.20
Gross profit from water services	MDL mil.	-3.32	0.35	-0.26	-1.06	-1.77	-1.90	-1.93	0.56	0.75
Wastewater service	**Unit**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2024**	**2034**	**2044**
Sale of wastewater	MDL mil.	4.34	4.58	4.76	4.61	4.40	4.46	5.66	8.17	11.39
Costs of wastewater services	MDL mil.	4.35	4.36	4.59	4.74	4.25	4.33	5.52	7.97	11.11
Gross profit from wastewater services	MDL mil.	-0.01	0.22	0.17	-0.13	0.15	0.13	0.14	0.20	0.28
Total gross profit	MDL mil.	-3.33	0.57	-0.09	-1.20	-1.62	-1.77	-1.79	0.76	1.03
Income tax	MDL	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.09	0.12

Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
	mil.									
Net profit	MDL mil.	-3.33	0.50	-0.09	-1.20	-1.62	-1.77	-1.79	0.67	0.91
Cumulated net profit	MDL mil.		0.50	0.41	-0.79	-2.41	-4.18	-13.30	-21.42	-13.43

Source: GIZ/MLPS

The forecast of income statement for 'with project' and BAU scenarios, is presented in Annex 6, Tables 14 and 15.

6.3.5.2 Balance sheet

The balance sheet illustrates the 'net worth' of the company. It reveals the company's assets, liabilities and owner's equity at certain point of time (e.g. end of the year). The balance sheet forecast is presented in Annex 6, Tables 18 and 19 for with project and BAU scenario.

6.3.6 Cash flow and financial indicators forecast

6.3.6.1 Working capital

The working capital sheet illustrates the current assets and current liabilities of the company and is use to estimate balance sheet and cash flow. The following assumptions were made in the calculation of working capital (see Table 6-28):

Table 6-28: Assumptions for working capital

Current assets or liabilities	Average payment period
Inventory	30 days
Short-term receivables	30 days
Accounts payable to suppliers	30 days
Accounts payable to employees	30 days

Source: GIZ/MLPS

The forecast of working capital is presented in the Annex 6, table 16 and 17 for the 'with project' and BAU scenario.

6.3.6.2 Cash flow and financial sustainability

A cash flow analysis was carried out for the project. The cash flow statement is a basic instrument used to assess the financial sustainability of the project of improving the operator's infrastructure. The purpose of carrying out a cash flow analysis is to verify whether the project operator faces of cash flow constraints. The projections were made for the entire reference period, i.e. 30 years. As cumulative cash flow is positive in each year of project analysis, the project is considered **financially sustainable**. The cash flow is presented in the Table 6-29:

Table 6-29: Cash flow forecast for the 'with project' scenario (MDL mil.)

Indicator	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Financial inflows	MDL mil.	0.00	19.19	43.08	40.41	17.00	17.17	20.15	31.16	42.46
Donor contribution (capital grant)	MDL mil.	0.00	4.60	22.99	18.39	0.00	0.00	0.00	0.00	0.00
Own contribution	MDL mil.	0.00	1.43	7.16	5.73	0.00	0.00	0.00	0.00	0.00
Revenues from sale	MDL mil.	0.00	15.45	16.28	16.25	17.10	17.14	20.07	31.04	42.35
Increase in current liabilities	MDL mil.	0.00	-2.30	-3.35	0.04	-0.10	0.03	0.08	0.11	0.12
Financial outflows	MDL mil.	0.00	17.04	45.13	39.29	15.99	15.95	18.96	27.93	38.99
Investment costs	MDL mil.	0.00	6.03	30.15	24.12	0.00	0.00	0.00	0.00	0.00
Costs of providing services	MDL mil.	0.00	13.59	14.90	15.14	15.75	15.94	18.89	27.73	38.76
Increase in current assets	MDL mil.	0.00	-3.14	0.07	0.03	0.24	0.01	0.07	0.10	0.11
Income tax	MDL mil.	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.09	0.12
Net cash flow (in-flow - outflow)	MDL mil.	0.00	2.14	-2.05	1.12	1.01	1.22	1.19	3.23	3.47
Cumulated cash	MDL mil.	0.18	2.32	0.27	1.39	2.40	3.62	9.39	27.67	61.28

Source: GIZ/MLPS

The detailed cash flow analysis is presented in Annex 6, Tables 20 and 21 for 'with project' and BAU scenarios.

The amount of the financial surplus is not sufficient to repay a new loan to finance the investment costs of MDL 60.31 million. In the first years of the project, the net cash flow is insignificant, and is increasing in value in later years. During the 30-year period of analysis, the project is expected to generate a MDL 61.28 million cumulative cash flow, which can be used for capital investments to reduce water losses and expand services, as required.

It has to be emphasised that Table 20 in Annex 6 – as its major purpose is to present project sustainability – does not present incremental values but values for the 'with project' scenario.

6.3.7 Financial performance of the project - NPV and IRR calculation

The analysis of NPV was based on discounting the incremental cash flows (operating surpluses) generated by WSS operator. The nominal discount rate used for the financial analysis was 5% over the entire forecast period.

In estimating NPV, no re-investment rate was assumed and thus it was assumed that the generated funds (available funds at the end of each year) are not re-invested (e.g. paid into term deposit accounts or put into treasury bills). This assumption avoids distortions in the NPV due to differences in the price of capital because usually the present reinvestment rate differs from the price of capital (in the present case the discount rate).

A key element in determining the NPV of a project is the residual value of assets, defined at the end of the forecast period. The residual value was defined at a level equal to the net present value of the fixed assets at the end of the forecast period.

The NPV analysis was conducted using an incremental cash flow model. This means that the financial projections were constructed in such a manner so as to identify additional cash flows attributable to the project.

Table 22 in Annex 6 presents the incremental cash flows used to calculate the FNPV(C) of the project. FNPV(C) means that financial net present value of the investment is calculated. This indicator and FRR(C) - Financial Rate of Return of the Investment – illustrate the profitability of the investment project. Inflows include the increase in revenues associated with increasing the volume of water and wastewater services provided. On the expenditures side, investment outlays and changes in operating costs were taken into account.

It is important to point out that the project involves an increase in the amount of water delivered and volume of wastewater discharged. For this reason, the return on the investment should be viewed from the social rather than financial perspective.

The calculated NPV at a 5% discount rate for a 30-year operating period is negative. This attests to the fact that the project does not generate a return and is financially unprofitable.

This is a typical result for a project in which costs are incurred (capital and operating) but revenues do not significantly increase. Public sector investments often generate similar results.

Negative financial indicators (rate of return) for a project cannot serve as the sole basis for determining whether a project should be pursued. These results, however, serve as the basis for estimating the social benefits associated with the project.

FNPV (C)=	-41,12	MDL million
FRR (C)=	-1%	

Source: GIZ/MLPS

The financial analysis on profitability of the own capital contribution was also conducted. The analysis is similar to that presented above, but takes into account the capital contribution to the project only and does not count grant (donor) contribution to the project.

Table 23 in Annex 6 presents the incremental cash flows used to calculate the financial net present value of own capital of the project - FNPV(K). Financial Rate of Return of the own capital (FRR(K)) indicates the profitability of the own capital invested in the project and is equal to 5%.

The results are close to 0, what is according to the assumption that external co-financing should not lead to profitability of own funds used.

FNPV (K) =	0.0	MDL million
FRR (K) =	5%	

Source: GIZ/MLPS

6.3.8 Sensitivity analysis

A sensitivity analysis was conducted to analyse the forecast in the event of changes in the following variables:

- **Investments costs**. The sensitivity was conducted for investments costs varying from 100% to 125% of the calculated values;
- **Real wage increase**. The real wage increase indicator is used in the financial model to determine the costs of employment and also to determine the increase in disposable household income. The sensitivity analysis was done not by changing a single indicator on annual real wage increase, but rather switching the entire forecast for the entire time horizon of the project. Thus, three forecasts of real wage increase were prepared (as described in the section on macroeconomic assumptions):
  - Base case;
  - Half base case;
  - Pessimistic.
- **Real GDP growth**. Similarly to real wage increase, three forecasts of real GDP growth were prepared. The real GDP growth is used in the financial model to forecast increase in water demand from industry and institutions. The proposed forecasts are: base case, optimistic, pessimistic;
- **Costs of electricity**. The financial analysis assumed an increase in the costs of electricity. As electricity costs are a large component of total costs, the sensitivity analysis also covers these costs. Similarly to real GDP growth, three forecasts of real increase of electricity prices were prepared.

For each variable, the sensitivity analysis provides results for:

- FNPV(C);
- FRR(C);
- FNPV(K);
- FRR(K);
- Financial sustainability (TRUE/FALSE – indicating whether the cumulated cash flow is positive during the entire time horizon of the analysis).

The results of sensitivity analysis are presented in Annex 6, Table 25.

The analysis shows that project is sensitive an increase in investment costs. The influence of investment costs, however, is limited due to the fact that majority of investments costs are assumed to be co-financed by donors. Nevertheless, in none of the cases did the project lose financial sustainability (cumulated cash flow less than zero).

6.3.9 Cost-benefit analysis / economic analysis

Preparing an economic analysis (Cost-Benefit Analysis, or CBA) is important for infrastructure projects; especially those co-financed using international donor aid.

The objective of a CBA is to analyse a measure's impact on society's well-being in the region (or country) in which the project is implemented. This approach is what makes a CBA different from a financial analysis, which only takes into account the costs and benefits that accrue to the investor as a result of the measure. A CBA should include

the total costs and benefits from the perspective of the public that benefits from the project. The fundamental rule in selecting projects holds that benefits from the measure should exceed its costs. In essence, for a CBA this means that the measure should generate a positive economic net present value (ENPV).

In describing the economic effectiveness of the project, the CBA includes the following indicators:

- ENPV;
- ERR.

The starting point for calculation of these indicators is the financial cash flows from the financial analysis.

Many methods exist to estimate the social costs and benefits for CBA purposes. The general rule holds that outlays on the project should be described in terms of their opportunity cost, while the benefits (effects) of the measure should be measured by the society's willingness to pay to obtain a given effect. Often the benefits transfer technique is used, which involves extrapolating results from studies from sectors and projects similar to the analysed project.

6.3.9.1 Analysis of socio-economic costs

Price distortions on means of production

Shadow prices arise when distortions occur in a given market, which lead to the costs of a factor of production to differ from the cost that society incurs. Market distortions may be caused by the existence of a monopoly, quotas and price regulation.

Due to the competitive market for factors of production, no price distortions on factors of production were considered. Only electricity prices – which are regulated – differ from market values and appropriate corrections have been made.

Wage distortions

The scale of the project is low and given the unemployment rate in Moldova, it is not expected to distort wages.

Tax aspects

The project does not involve negative tax aspects.

External costs

Investments in water and wastewater networks involve external costs generated due to the temporary exclusion of land and streets from use; yet, these costs are taken into account in investment outlays (possible damages/compensation, repairs of the road). Moreover, the project has a positive impact on the natural environment and no other external costs are expected.

A CBA should take into account social costs that are not compensated and that have a significant impact for the wider public apart from those that refer directly to the project.

The decline in the value of land in the vicinity of the wastewater treatment plant, water storage tank, water towers and pumping stations – these types of objects do not motivate buyers, which means that land in the vicinity will have a lower value – could be an external cost. Yet, the facilities' location was selected outside built-up areas, close to the existing water production facilities and will not be significant or will have minimal impact.

Non-financial costs

It is not expected that the project will involve non-financial costs.

Social costs resulting from additional employment

Additional employment is not required for the project operation. It is required for the project implementation but will not distort the labour market and thus social costs do not arise due to the investment.

6.3.9.2 Analysis of socio-economic benefits

Price distortions on the means of production

The effect of engaging unemployed persons during construction was taken into account. This aspect is described in the section on social benefits from additional employment.

Tax aspects

Transfers include all taxes, fees, financial costs and subsidies. These should be excluded from a CBA because they do not constitute a cost to society but rather a transfer of income (a tool for the redistribution of income). They do not contribute to an increase or decline in social welfare.

Value Added Tax

The VAT contained in investment outlays is a transfer and the cash flows used to calculate ENPV have been corrected by the amount of this tax.

External benefits

The concept of external effect is associated with the imperfections of the functioning of the market. An external effect occurs when the actions of one economic actor cause a change in the welfare of another economic actor and this change is not compensated. In other words the external effect occurs if the utility function or production function of entity ‘A’ contain real (that is. monetary) variables, the value of which were determined by other entities (person, company, government) without their taking into account the impact on the level of welfare of actor ‘A’.

In the present project, a number of external benefits arise due to implementation. Among the main external effects the following should be mentioned:

- Health effects due to reduction of pollution in the water;
- Social effects due to uninterrupted water supply;
- Economic development effects.

Health benefits

The approach to estimating benefits from water quality improvement programmes involves determining the positive health effects that will result from the programme and assigning a monetary value to them. This approach, however, requires precise study of the relationships between pollution in the source and a response (e.g., improvement of health. reduction in morbidity). This relationship is described in a dose-response function. While these studies have been conducted in EU countries for various pollutants, their application in water quality improvement programmes have many limitations.

The economic valuation of the benefits from implementing a water quality improvement programme is difficult due to the low number of studies conducted on this issue as well

as the need to determine precisely the physical effects of these programmes (knowledge of the dose-response relationship is essential).

Evaluating the benefits based on data from studies conducted in other countries does not yield authoritative results due to the differences in the conditions that prevail in project impact area. Further limitations in evaluating programme benefits are due to the inability of estimating some benefits in monetary terms. The literature indicates that these results should be viewed in the context of many assumptions, limitations and uncertainties in evaluating benefits. Limitations include, inter alia, lack of available data on illnesses caused by water pollution; underestimation of economic costs of water pollution, etc., P. Faircloth[44] describes four types of benefits of implementing water quality improvement programmes:

- Health benefits;
- Amenity benefits;
- Non-use benefits;
- Benefits for water users – agriculture, households.

Another problem is that, although, it is obvious that the amount of pollution in water will be reduced quantitative data on nitrates and other pollutions differs from commune to commune and are not available. The situation in communes where there is no water supply is even more difficult to estimate. However, there are studies that estimate, especially health benefits. ECOTEC report[45] provides estimation of benefits of avoided water-related diseases. Per capita value for Romania (good proxy for Moldova) is EUR 27 per capita and this value was used for the estimation.

New business enterprises

The demand analysis uses the annual increase in businesses proportional to the GDP increase. Currently, the supply system is not able to provide water for new businesses. This situation is due to high level of leakages in the water distribution network in Edinet and Cupcini, and lack of the network in other localities. The situation reduces the possibilities of business development or the business will have to find other sources of water - this may cause very high social costs if the project is not implemented (or high social benefits for the project implementation). Having in mind, limitations in valuation of the social benefits from establishing new businesses, shadow prices for delivery of water from new business were used. The shadow price was estimated at 30 MDL/m^3, as equal to the production price and distribution costs (including distribution by cisterns). The shadow price was applied to the water demand from business.

Non-financial benefits

Apart from those described elsewhere in this chapter no non-financial benefits in this project were identified.

Social benefits resulting from additional employment

In a CBA, additional employment is a cost because the project is using labour resources that become unavailable for alternative social purposes.

Two separate methods exist of estimating the social benefits of additional employment:

[44] Peter Faircloth (Cranford Economics) and others “Approximation of Environmental legislation A Study of the Benefits of Compliance with the EU Environmental Acquis”

[45] The benefits of compliance with the environmental Aquis for the candidate countries

- Using accounting wages below the current wages in the project;
- Estimating the income multiplier of investment revenues on the social income resulting from the project that will be higher than the income for private investors.

Both methods have disadvantages and limitations. In this CBA results are corrected so that the cost of employing persons from the ranks of unemployed is equal to zero.

The following social effects from additional employment were taken into account in the analysis:

- Increase in the number of jobs during investment implementation (temporary effect);
- New jobs resulting from the economic development made possible due to investment implementation.

The first effect was estimated and described in detail below, while the second effect is not quantified.

Increase in jobs during investment implementation

Project implementation results in additional employment. This will be a temporary effect from the infrastructure investments, in which a significant portion of the investment outlays is associated with labour. Full automation is not possible during construction of the water and sewerage networks, especially in excavation works, and thus the required labour includes a significant portion of low qualified workers from the ranks of the unemployed. Due to the lack of detailed data on outlays, typical cost estimates of similar project scopes were analysed in order to determine the share of wages for low qualified labour in total outlays. Based on this analysis, a share of 30% of such labour in outlays was assumed and in the CBA this result was adjusted so that the cost of employing these persons was equal to zero.

Reducing developmental disparities among regions

The project's impact on reducing developmental disparities among regions results foremost from the expansion of access to technical infrastructure. Tasks completed under the project have a positive impact on increasing investment also in the entire region.

Two aspects are of key importance for reducing the level of development between regions:

- Expansion of infrastructure is the basic element of development in the region and is viewed by residents as a requirement. A lack of infrastructure leads to a degradation in the region and an outflow of persons toward areas that are better developed;
- The second element in reducing developmental disparities between regions is linked to the strict relationship between the expansion of communal infrastructure – including water– and economic development. The project provides not only for constructing water pipes but also gives the possibility for business development in commercial and service (agriculture) areas. The lack of a water capacity is a large barrier to development of these areas because transporting water by cisterns is much more expensive. This discourages potential investors from developing activities in the area that is lacking basic infrastructure.

6.3.9.3 Economic rate of return (ERR) and economic net present value (ENPV)

Table 24 in Annex 6 contains a calculation of the economic rate of return (ERR) and the economic net present value (ENPV).

This table includes the results of the financial analysis that were corrected for transfers, external effects and price distortions on factors of production.

The net cash flow balance was corrected for the social costs and benefits described earlier:

- Fiscal corrections:
  - VAT.
- Price distortions:
  - Engaging unemployed persons during construction;
  - Price distortions for electricity prices.
- External effects:
  - Shadow prices related to business development;
  - Benefits of avoided water-related diseases.

The calculation does not take into account the grant because it is a transfer.

After making the above corrections, the surplus after corrections was calculated; this in turn was the basis for calculating the economic rate of return (ERR) and the economic net present value (ENPV). The calculated ERR is 21% while the ENPV is MDL 86.46 million at a discount rate of 5%.

The CBA lists many factors that were not expressed in monetary terms. If it were possible to estimate them, the value of ERR would be considerably higher. The positive result of the economic analysis (ENPV greater than zero) indicates that from a public perspective, the project should be implemented.

7 Institutional development

7.1 Potential for WSS services area extension

With respect to the regionalisation of water supply and wastewater services in administrative-territorial units included in this feasibility study, by operating jointly the services and developing the projects related to these services infrastructure, the parties have expressed a consensus of opinion.

The existing operator in the town of Edinet, ME ‘Apa - Canal’ Edinet has stated that extension of water supply and wastewater services area to other administrative units is one of the company's strategic development activities.

Representatives of local public administrations of the town of Edinet and the town of Cupcini have agreed to appoint ME ‘Apa - Canal’ Edinet as regional operator, to whom they intend to delegate the management of water supply and wastewater services.

Opinions of the local authorities/operator on the regionalisation of Water Supply and Sanitation (WWS) services in the Edinet Rayon were received following discussions at meetings of the project working groups and from questionnaires completed by each administrative-territorial unit.

7.2 Competence of local public administration and inter-municipal cooperation

The Constitution of the Republic of Moldova (RM) states in Article 109 that the public administration in administrative-territorial units is based on the principles of local autonomy, decentralisation of public services, eligibility of authorities of local public administration and consultations with citizens on local problems of major interest. Thus, Moldova returned to the principle of autonomy through decentralisation and transfer of major responsibilities to local authorities.

The deliberative authorities of administrative-territorial units have the exclusive competence on the set-up, organisation, coordination, monitoring and control of water supply and wastewater services. They have also the competence of management and operation of the public goods which make up the administrative-territorial units’ public infrastructure associated with those services.

According to the Law no. 303 on water supply and sanitation public service dated December 13, 2013, the local councils have the competence to:

- Draw up and implement own business operations and development plan on water supply and wastewater public services for short/mid/long term;
- Approve tariffs of water supply and wastewater public services;
- Manage water supply and sewerage public systems as the integrated components of the administrative-territorial units’ infrastructure;
- Approve the regulations and specifications of the service;
- Select the method of management and approve the documentation on organisation and conducting of procedures regarding management delegation;
- Approve the performance indicators of the services.

The management of services concerns the organisation, operation and control of water supply and wastewater services under the conditions laid down by local public administrations.

Management of water supply and wastewater services can be organised in two ways, the choice being left to the discretion of local public administrations:

- Direct management through specialised structures (divisions, departments) organised within the local public administrations;
- Delegated management, defined as a type of management through which the local authorities assign one or more operators to manage directly this service, namely the management and operation of water supply and wastewater systems, under a contract of management delegation. Delegated management is performed via a management delegation contract between one or more administrative-territorial units, as granting authority, and an operator as a delegate. The basis for awarding such a contract of management delegation is the public tendering in compliance with the applicable procedures.

The form of management is determined by the decisions of the deliberative authorities of the administrative-territorial units, depending on the nature and status of the service, the need to ensure the best price / quality ratio, present and future interests of administrative-territorial units, and size and complexity of public utility systems.

The legal basis for local public administration cooperation on water supply and wastewater services development is mentioned in law no. 303[46], local public administration level 1 (LPA 1):

- Decide on administrative-territorial units association for the purpose of setting up, organising and encouraging investments in the relevant systems of water supply and wastewater services;
- Use own financial resources/or goods to increase the operator's assets to provide water supply and wastewater services.

The development of water supply and wastewater services requires a level of investment in infrastructure that far exceeds the financial capacities of most local authorities. In addition, localities lack staff specialised in service provision as well as experience in the preparation and implementation of projects.

Thus, the recommended solution to address the lack of sufficient financial and human resources capacity is to organise and operate the services at the regional level, in order to ensure sustainable development and efficiency of activities through achieving economies of scale.

7.3 Institutional model for regionalisation

From the institutional point of view, regionalisation is achieved by reorganisation of existing public services owned by local authorities. For the current project, regionalisation is achieved through two institutional elements:

[46] Art. 8 of Law no. 303 on water supply and sanitation public service dated December 12, 2013

- Regional operator, a public equity company founded by one or more administrative-territorial units, to which water supply and wastewater services are delegated through delegated management contract;
- Contract on delegated management services. The administrative-territorial units through local authorities delegate the management of water supply and wastewater services to the regional operator through a single delegated management contract.

The relationship between these institutions will be regulated by constitutive act of the regional operator and by delegated management contract.

7.3.1 Regional operator

A regional operator can be considered the operator organised as a business enterprise with public equity owned by one or more administrative-territorial units. It provides water supply and wastewater public services within the area of several administrative-territorial units, ensuring management and operation of the systems related to these public services.

The main activities of the regional operator will be abstraction/intake, treatment and distribution of drinking water; wastewater collection and treatment; performing other activities as well in accordance with the legislation in force, necessary to achieve the goal of activity established by constituent act.

The regional operator is responsible for the provision of water supply and wastewater public services within the area of administrative-territorial units that have delegated the management of the service. The operator also bears responsibility for the management, operation, maintenance, renewal and extension, where appropriate, of all fixed assets (systems) subject to the contract.

All administrative-territorial units take charge of the activities carried out by regional operator activities under the provisions specified in the constitutive act.

The regional operator can be set up on the basis of the existing operator following one of two ways:

- Reorganisation of the ME ‘Apa – Canal’ Edinet.
  Reorganisation through transformation of the legal person, applicable in this case, means the continuity of legal person’s activity, having the same rights of property and corresponding liabilities, ensuring uninterrupted operation of the assets and continuous production of benefits.
  The process of transformation does not imply the transfer of rights and obligations from one legal person to the other because it does not disappear, but continues its existence in a different legal form;
- Setting up of a new business enterprise with wholly public equity, whose founders are administrative-territorial units only in the area where regional operator will provide the service.
  In this case the ME ‘Apa - Canal’ Edinet will not stop the work and will provide other municipal public services.

Another important point is to identify the organisational-legal form of a new regional operator, in accordance with legislation in force and specificity of the public service.

Given the subject of activity, namely the provision of the water supply and wastewater services and legal provisions in force as well, the following are the organisational-legal forms that can be taken in the future: the municipal enterprise with more founders, limited liability company, and joint stock company.

Table 7-1: Comparative analysis of the organisational-legal forms

	Municipal enterprise (inter-municipal)	Limited liability company	Joint-stock company
Regulatory framework	• Government Decision no. 387 of 06.06.1994 regarding the approval of regulations' model of Municipal Enterprise; • Civil Code (Law no. 1107-XV of June 6, 2002); • Law on entrepreneurship and enterprises no. 845-XII from 01.03.1992; • Law on State Registration of Legal Entities and Individual Entrepreneurs No. 220-XVI from 10.19.2007.	• Law on Limited Liability Companies no. 135-XVI of 06.14.2007; • Civil Code (Law no. 1107-XV of June 6, 2002); • Law on entrepreneurship and enterprises no. 845-XII from 01.03.1992; • Law on State Registration of Legal Entities and Individual Entrepreneurs No. 220-XVI from 10.19.2007.	• Law on Joint Stock Companies no.1134-XIII of 04.02.1997; • Civil Code (Law no. 1107-XV of June 6, 2002); • Law on entrepreneurship and enterprises no. 845-XII from 01.03.1992; • Law on State Registration of Legal Entities and Individual Entrepreneurs No. 220-XVI from 10.19.2007.
Governing bodies	• The head (director); • Boards of directors (if needed).	• General meeting of shareholders; • The council of enterprise; • Enterprise's manager; • Auditor.	• General meeting of shareholders; • The council of enterprise; • Executive body; • Auditing committee.
Responsibilities of governing bodies	The director manages the daily operations of enterprise; its responsibilities are set out in the employment contract concluded between the founder and head of the company.	• General meeting of shareholders is the supreme body of the enterprise (art. 48-61 of Law no. 135-XVI dated 06.14.2007)); if enterprise has only one shareholder, the rights and liabilities of general meeting are taken over by the latter (art. 62 of Law no. 135-XVI dated 06.14.2007); • Council of the enterprise (at least 3 people) is its executive body (art. 64-68 of Law no. 135-XVI dated 06.14.2007 and constituent act); • The company may have one or more managers (art. 69-76 of Law no. 135-XVI dated 06.14.2007); • Auditor is enterprise's supervisory body; the general meeting may appoint one or more	• Shareholders general meeting is the supreme leading body (art. 50-64 of Law no. 1134-XIII dated 04.02.1997); • Council of the enterprise performs general management and control over enterprise's activities (art. 65-68 of Law no. 1134-XIII dated 04.02.1997); • The executive body carries out the management of enterprise's current activities (art. 69-70 of Law no. 1134-XIII dated 04.02.1997); • Auditing Committee exercises control over financial and economic activity of enterprise (art. 71-72 of Law no. 1134-XIII dated 04.02.1997).

	Municipal enterprise (inter-municipal)	Limited liability company	Joint-stock company
		auditors; the enterprise may instead appoint an independent audit censor (art. 77-79 of Law no. 135-XVI dated 05.14.2007).	
Legal liability	• The enterprise is liable for the obligations assumed by entire property it owns under ownership right; • The administrative-territorial units are not responsible for the obligations of municipal enterprises; • Municipal enterprises are not responsible for the obligations of administrative-territorial units.	• The company is liable for its obligations with all its assets; • Shareholders are not liable for enterprise's obligations; they bear the risk of losses resulting from the enterprise's activity within their participation in the share capital.	• The enterprise is liable for its obligations by entire property it owns under ownership right; • The enterprise is not liable for obligations of its shareholders; • Shareholders are not liable for enterprise's obligations and bear the risk of losses within the value of shares belonging to them.
Setting up conditions	• Setting up decision and enterprise charter is adopted by founder (local council); • Incorporation from the moment of registration by State Registration Chamber.	• Enterprise can be set up by one or more natural and/or juridical persons; • Number of associates shall not be more than 50; • Founding agreement is signed by all founders and notarised; charter is approved by single founder; • It is registered by State Registration Chamber.	• Enterprise can be set up by one or more persons; • Both natural and juridical persons can be founders of enterprise; • Shareholders can be natural and juridical persons from Republic of Moldova, other countries, stateless citizens, foreign countries and international organisations; • Contract conclusion (decision taken on enterprise setting up); founders subscription to shares and constituent assembly holding; enterprise contract (statement on enterprise setting up) loses its force since enterprise is registered; charter approval by founding members; • Incorporation from the moment of registration by State Registration Chamber.
Constituent acts	Local council decision on enterprise setting up and its charter	Founding agreement or enterprise charter (art.12 of Law no.135-XVI of 06.14.2007)	Founding agreement (or founding statement) and enterprise charter (art.32 of Law no.1134-XIII of 04.02.1997)
Initial equity	Not regulated	Equity capital shall not be less than 5,400 MDL (art. 21 para 2 of Law no. 135-XVI of 06.14.2007)	Equity capital shall not be less than 20,000 MDL (art. 40 of Law no. 1134-XIII of 04.02.1997)
New members acceptance	No members	Allowed in accordance with charter provisions	Allowed in accordance with charter provisions

	Municipal enterprise (inter-municipal)	Limited liability company	Joint-stock company
Strengths	• The best known organisational-legal form for public services provision; • A separate legal entity having own property and budget; • The loans taken are guaranteed by the Local Public Administration; • Subsidies from Local Public Administrations.	• The most applicable • Organisational-legal form for delegated public services in the rural area; • More mobility and capacity to respond to the economic and financial changes; • Possibility to access loans for investments; • Independence from Local Public Administrations; • More simple procedure on setting up and registration.	• Possibility to attract investments for development; • More mobility and capacity to respond to the economic and financial changes; • More profitable services when provided on larger area (regional or rayon level) • Higher transparency of activity and management of public goods.
Weaknesses	• Outdated legal regulations in this sector; • Limited possibility for investments; • Dependence on founding Local Public Administrations; • High probability on budgeting dependence and political influence on tariffs level.	• It is subject to all risks of market economy; • It is seen through concern for personal benefits to the detriment of the public interest.	• It is subject to all risks of market economy; • More complex registration procedures; • More complex structure and operating mode; • Not practical for rural areas.

Source: GIZ/MLPS

Taking into account all mentioned above and considering the regionalisation policy for water supply and wastewater sector by creating stronger operators, it is proposed that the optimal legal form for conversion of the existing operator is joint-stock company.

Setting up of the regional operator will be made in compliance with Civil Code, Law on entrepreneurship and enterprises no. 845-XII of 01.03.1992, Law on Joint Stock Companies no. 1134-XIII of 04.02.1997, Law on State Registration of Legal Entities and Individual Entrepreneurs no. 220-XVI of 10.19.2007.

7.3.2 Delegated management contract

Under a delegated management contract, an LPA as delegator assigns to a licensed operator as a delegatee, acting on own risk and responsibility, the rights and obligations to provide full water supply and wastewater services for a specified period of time. Alternatively, only some specific activities may be delegated to the operator, including the rights and obligations to manage and operate the technical infrastructure associated with services provided, in return for a management fee.

The delegated management contract establishes specific rights and obligations of each party on the provision of water supply and wastewater services, development of investment programs, and achievement of the certain performance levels. The provisions of the delegated management contract are stipulated in Law no. 303[47].

[47] Art. 13, par. 8 of Law no. 303

In this way, the regional operator bears responsibility for the management, operation, maintenance, renovation and expansion of fixed assets, pursuant to the contract.

In the regionalisation process, a delegated management contract for water supply and wastewater services is an agreement between regional operator (delegatee), on the one hand, and the local authority (delegator) on the other.

One approach would be to draw up a single contract for the entire project area (town of Edinet, town of Cupcini), signed by each administrative-territorial unit separately, corresponding to the jurisdiction of all administrative-territorial units that delegate water supply and wastewater services to the operator.

The following addendums are mandatory to be attached to the delegated management contract:

- Technical specifications regarding provision of service;
- Regulations on provision of service;
- Inventory of movable and immovable assets, which are associated with the service provided, including public or private property;
- Protocols on the take-over assets listed in 3rd subparagraph.

Regardless of the stipulations in the contract, the ownership of public assets and the responsibility for providing water supply and wastewater services at affordable prices remains with the local public administrations. Since the assets remain under public ownership, they need to be reclaimed by their owner (administrative-territorial units) upon termination of the contract.

The delegated management contract is typically concluded for a long period of time. The tariff policy aims at full cost recovery and is applied by the regional operator in accordance with the applicable regulations issued by ANRE, under the control and with the approval of the administrative-territorial unit. The financing and commercial risk is assumed by reorganised operator.

Delegating management is made by direct award, as stipulated in Law no. 303[48].

7.4 Steps to implement institutional framework

7.4.1 Selecting the management model of water supply and wastewater public services

At this stage, local public administrations (town of Edinet and town of Cupcini) should decide on the management model for water supply and wastewater services, specifically direct management or delegated management.

Under Law no. 303[49], this phase begins with the preparation by local authorities of a study to substantiate and identify optimal solutions for water supply and wastewater services delegation.

After that, the Local Councils from each administrative-territorial unit have to approve this study as part of the regionalisation process.

[48] Art.13, par. 12 of Law no. 303

[49] Art. 13, par. 14 of Law no. 303

Based on the study findings and proposed solutions, local councils then adopt decisions on the management model.

A decision on delegation of service management to a single / regional operator provides the grounds for taking the next step.

7.4.2 Regional operator

The starting point is the local council decisions approving studies, which substantiate this regionalisation and identification of the optimal institutional model regarding regionalisation in Edinet Rayon.

Establishment of a working group to identify the fastest and most viable solution for the setting up regional operator. This activity has the character of a recommendation, but creates prerequisites for a detailed analysis of the future operator.

Adoption of the decision on reorganisation through transformation of the ME 'Apa - Canal' Edinet or decision on new business enterprise setting up.

Establishing new operator will be subject to the provisions of the Civil Code, Law on entrepreneurship and enterprises no. 845-XII from 01.03.1992, the Law on joint stock companies no. 1134-XIII of 04.02.1997, the Law on state registration of legal entities and individual entrepreneurs no. 220-XVI from 10.19.2007, and it is recommended to be organised as a joint stock company.

This stage ends with acquiring legal personality of the new operator by registering at the State Registration Chamber.

7.4.3 Delegation of water supply and wastewater services

The activities necessary for water supply and wastewater public services delegation to regional operator are under competence of deliberative authorities from administrative-territorial units in the project area. Thus, local councils in the town of Edinet and town of Cupcini are responsible for:

- Drawing up and approving the delegated management contract and awarding this contract directly to the regional operator;
- Defining and elaborating performance indicators for water supply and wastewater services provided to consumers;
- Elaborating and approving the regulations and specifications of water supply and wastewater services;
- Ensuring the signature of the contract by executive authorities, for and on behalf of administrative-territorial units.

In this process it is recommended that negotiations should be carried out at the same time with all interested parts involved and a single delegated management contract have to be signed by all administrative-territorial units, including clauses and annexes specific to each administrative-territorial unit.

7.5 Timeframe for regionalisation process of water supply and wastewater services

The regionalisation of the water supply and wastewater services needs time because the legislation is quite rigid regarding deadlines that must be followed and the required activities are complex and time-consuming.

In addition, local authorities in Moldova point to the lack of legal and regulatory framework that would guide the entire regionalisation process.

Given the steps needed to introduce regionalisation of services, as well as time limits imposed by legislation, an outline time schedule with approximate limits is as follows:

Table 7-2: Timeframe for regionalisation process, water supply and wastewater services

N°	Method chosen for setting up the regional operator	Steps	Time
a)	Reorganisation of ME 'Apa - Canal' Edinet	• Reorganisation of the ME 'Apa - Canal' Edinet into Joint Stock Company with Edinet Town Council as a sole shareholder; • Increase of the authorised capital stock through acceptance of the new shareholders, in person of administrative-territorial units Edinet and Cupcini; • Delegation of the management of the water supply and wastewater services to the new set up operator.	5-7 months 5-7 months 3 months
b)	Setting up of a new business enterprise	• Setting up of the Joint Stock Company, whose founders (shareholders) are Edinet Local Council; Cupcini Local Council; • Delegation of the management of the water supply and wastewater services to the new set up operator.	6-9 months 3 months

Source: GIZ/MLPS

Given the fact that at the present time there is water supply and wastewater services operator in the town of Edinet, it is recommended the reorganisation of the ME 'Apa - Canal' Edinet into Joint Stock Company (regional operator) as an optimal solution.

Following the deadlines foreseen by legislation in force and taking into account the practical aspects of regionalisation of water supply and wastewater services, it can be stated that the whole process will coincide with Phase 1 of the feasibility study implementation (the Project). Once Phase 2 starts, the full regionalisation of water supply and wastewater services within the localities of the Edinet Rayon will be completed.

7.6 Corporate and human resources development of the operator

The existing institutional setup of the ME 'Apa - Canal' Edinet will require considerable changes, in order to meet the increasing demands of the expanding service area.

In general, ME 'Apa-Canal' Edinet currently overstaffed, as the staff efficiency indicator is 10.43 W&WW staff per 1,000 W&WW connections, while an average value for Moldova is 5.51.

At this point, it is rather difficult to propose an efficient institutional model, as the beneficiary localities have to decide first on the legal form of company (e.g. joint-stock company, municipal company etc.) and ways of service management (e.g. delegated to the Company, certain activities outsourced to third-parties etc.). This may have an impact over the number of staff and internal procedures.

The following factors are expected to improve the institutional and operational capacity of the company:

- Increased level of automation. Introduction of automated systems for the existing water production, pumping and distribution facilities, as well as wastewater pumping, will have a positive impact on the reduction of the number of technicians and

operating staff. Introduction of a SCADA system will improve data management and will require less administrative effort;

- Introduction of Management Information System. This is expected to reduce the burden over the accounting, economic, human resources and customer service departments and may contribute to the optimisation of administration;
- Implementation of a dispatch centre. Regular monitoring and control of all service localities will help determine if customer service targets are being met. A mobile emergency team may replace local operating staff;
- Outsourcing of activities. Outsourcing may be suggested for billing system or specialised services (e.g. heavy equipment works).

Most of the mentioned activities shall be further developed under the corporate development programme proposed as part of the technical assistance in the first phase of implementation of the priority investment programme (i.e., the Project). This corporate development programme should also provide a general direction for institutional development, in close relation to the phasing of infrastructure investments.

For the Project (first phase of investments until 2018), no extension of water services over the rural localities is planned, while most of investments will be spent on rehabilitation and extension of the existing water supply network in the town of Edinet. However, an slight increase of 1% in total number of water consumers is foreseen by 2018 on account of the urban population from the town of Edinet who are going to be connected to the local water supply network. No extension of wastewater services within the town of Edinet is foreseen for this period of time.

This means that the proposed investments for Phase 1 do not require increase of the Operator staffing. Therefore, the company needs to improve its staff efficiency to be able to operate WSS in a sustainable manner.

It is projected that the utility will tend to reach an average staff efficiency indicator for Moldovan utilities of 5.5 water and wastewater staff per 1,000 total connections, with the first benchmark of 6.5 staff persons per 1,000 water and wastewater connections in 2018. Basing on the projected number of future water and wastewater consumers, this would result in total need of 72 staff persons in 2018. In absolute values this means a decrease by 46 persons, as compared to the current situation. This could be done on account of the staff which approaches retirement age.

As for the second phase (2018-2021), an extension of both water and wastewater service areas is foreseen in urban and rural communities. This will require increase in water and wastewater staff. It is estimated that the Operator shall tend to keep the same staff optimisation pace, as in the first phase (2015-2018), and will achieve the staff efficiency indicator of 5.5 W&WW staff per 1,000 W&WW connections by 2021. It is expected that that number of water and wastewater staff will be increased insignificantly by hiring workers in wastewater sector. The reduced staff from the first phase can be hired for the new positions in the second phase. In order to avoid interruptions in the staff activities, a smooth HR strategy shall be foreseen, which will link improvement of operational efficiency and reallocation/optimisation of staffing.

In the meantime, continuous slow reduction of administration and support staff is foreseen. The staff projections are provided in the Table below:

Table 7-3: Staff projections of the operator

Indicator	Unit	Current Situation, as of 2015	Projected Situation for 2018	Projected Situation for 2021
Number of water staff	people	63	45	45
Number of wastewater staff	people	39	21	24
Number of administrative and other W&WW staff	people	12	6	6
Total Number of staff	people	114	72	75
Number of water connections	conn.	6,845	7,073	8,074
Number of wastewater connections	conn.	4,085	4,077	5,500
Water & related admin staff per 1,000 W connections	pers./ 1,000 con	10.23	6.93	6.07
WW & related admin staff per 1,000 WW connections	pers./ 1,000 conn.	10.77	5.64	4.73
Total staff per 1,000 W&WW connections	pers./ 1,000 conn.	10.43	6.50	5.50

Source: GIZ/MLPS

In order to facilitate further institutional development of the Operator, the Phase 1 investments foresee a Technical Assistance for Corporate Development.

7.7 FOPIP

Because the process of regionalisation of water supply and wastewater services requires a relatively long period of time comprising several stages that have to be completed in order to implement the institutional framework, active support of the national / local authorities is absolutely necessary to complete this process successfully.

Also, given the need for sequencing in the process of establishment of the regional operator, based on the existing services operatorME ‘Apa – Canal’ Edinet , it is the priority and extremely important to develop its capacity to take over some administrative units, whose operational and financial results are reduced or even non-performing.

Based on mentioned above, a Financial and Operational Performance Improvement Program (FOPIP) for the regional operator is necessary to elaborate for the benefit of all administrative-territorial units involved in the project.

The program of improving financial and operational performances should have the objective to provide assistance in/for:

- Compliance with legal provisions in the water and wastewater sector;
- The process of regionalisation;
- Regional operator to become sustainable and able to implement investment projects etc.

In this regard, the main activities will comprise support for institutional reorganisation; improving staff performance and efficiency; support for improving operational and technical performance; and financial and business performance improvement, among others.

8 Environmental and social assessment for the Feasibility Study

8.1 Executive summary and conclusions

It is proposed to rehabilitate and extend the water supply and wastewater system in the towns of Edinet and Cupcini.

The Feasibility Study for the towns of Edinet and Cupcini has been developed in the WSS sector by the Project “Modernisation of Local Public Services” (MLPS Project, intervention area 2) and it refers the following components:

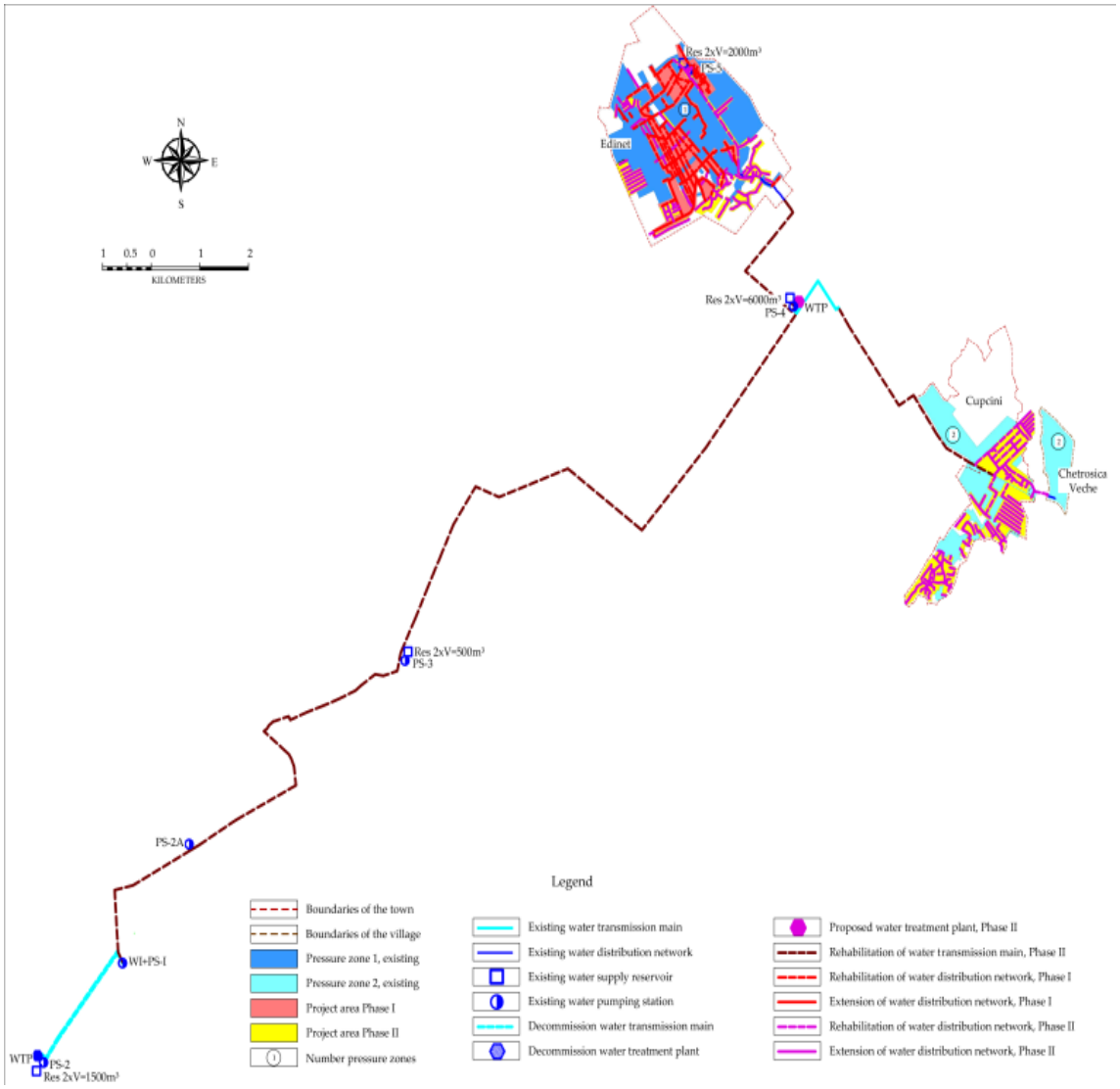
- Water Supply System:
  - Rehabilitation of water transmission main – 40,100 m;
  - Rehabilitation of water transmission main PS4 – Edinet town – 3,350 m;
  - Rehabilitation of water distribution network in Edinet town – 25,680 m;
  - Extension of water distribution network in Edinet town – 20,225 m;
  - Rehabilitation of water transmission main PS4 in Cupcini town – 3,500 m;
  - Rehabilitation of the water distribution network in Cupcini town – 12,205 m;
  - Extension of the water distribution network in Cupcini town – 14,195 m;
  - Construction of Water Treatment Plant – 1 unit.
- Wastewater System:
  - Rehabilitation of sewerage network in Edinet town – 7,492 m;
  - Extension of sewerage network in Edinet town – 19,595 m;
  - Construction of wastewater pumping station in Edinet town – 2 units;
  - Rehabilitation of Wastewater Treatment Plant (WWTP) – 1 unit;
  - Rehabilitation of sewerage network in Cupcini town – 7,370 m;
  - Extension of sewerage network in Cupcini town – 24,260;
  - Construction of wastewater pumping stations in Cupcini town – 3 units.

The investment programme includes short, medium and long term measures designed for a planning horizon until the year 2045. The priority short-term measures are divided into two phases as follows:

- Phase 1 – priority measures to be implemented until 2018, which in the context of this FS is considered the “The Project”;
- Phase 2 – priority measures to be implemented between 2018 and 2021 (this period might be extended depending on the availability of funds and the capacity of the operator or implementing agency).

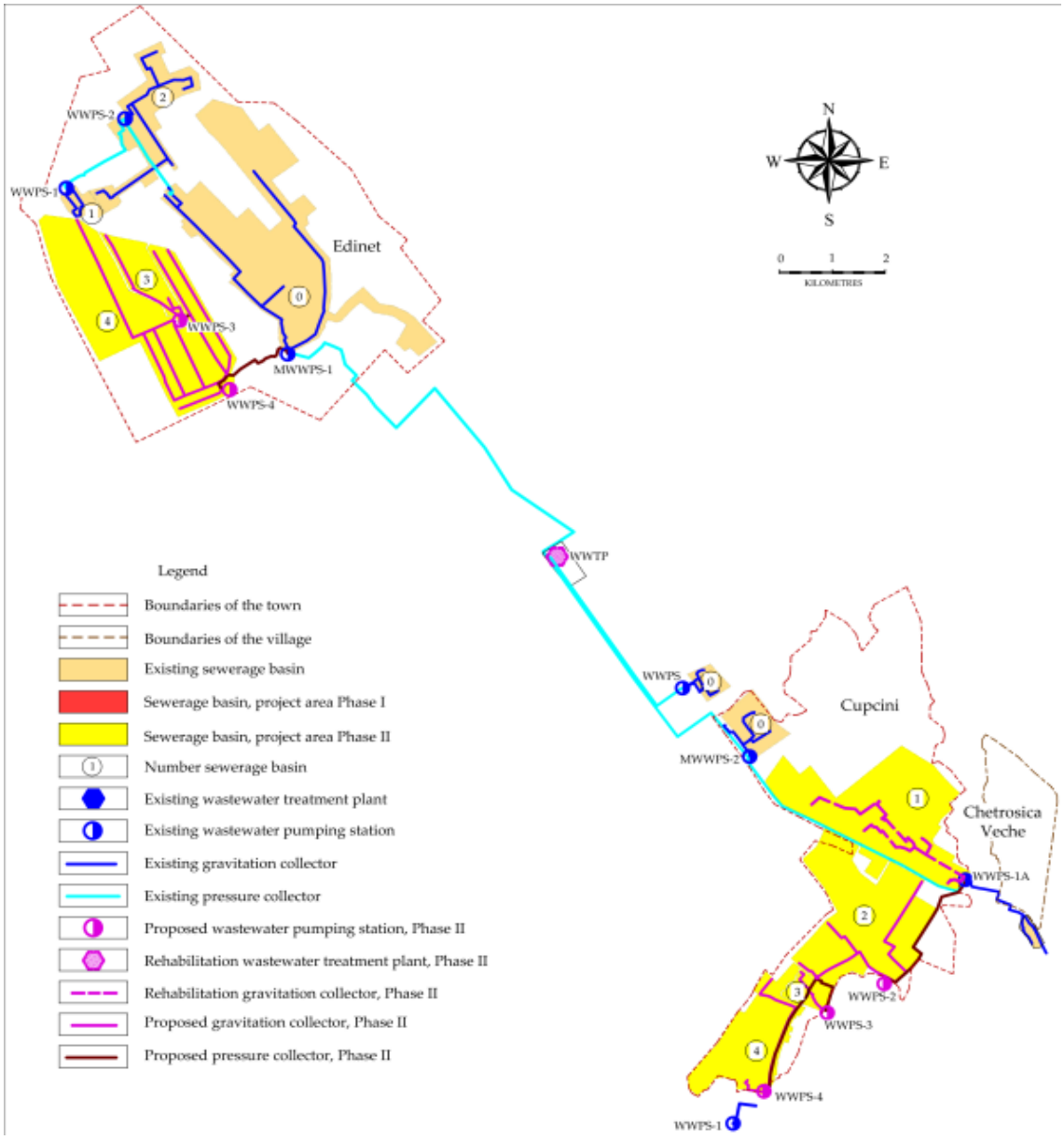
Priority Investment Plan (PIP) includes investment cost estimates for Phase 1 and Phase 2 measures. Schemes of existing and proposed water supply system and wastewater systems in the towns of Edinet and Cupcini proposed are presented in the Figures 8-1 and 8-2.

Figure 8-1: Scheme of existing and proposed water supply system in the towns of Edinet and Cupcini



Source: GIZ/MLPS

Figure 8-2: Scheme of existing and proposed wastewater system in the towns of Edinet and Cupcini



Source: GIZ/MLPS

An Environmental and Social Assessment (ESA) was prepared in order to facilitate the implementation of the Project and to ensure that the envisaged Project objectives will comply with Moldova's environmental and social legislation, as well as procedures and policies and international and EU conventions. In addition, this ESA addresses the environmental and social impacts, mitigation measures and management issues associated with the proposed objectives of the project.

According to the new law on environmental assessment (Law No. 86/29.05.2014 on Environmental Impact Assessment which is in force from beginning January 4, 2015) none of the WSS objectives of the Project is subject to full scale EIA on the national level.

For acquiring the environmental and construction permission it is required to prepare the documents for the State Ecological Expertise (SEE). This needs to be done in the detailed design stage of the Project.

The environmental impacts of the proposed FS have been assessed in this Environmental and Social Assessment. The results of analysing the environmental impacts and mitigation measures are presented below “Environmental Impacts and Mitigation measures”. Potential environmental impacts arising from the designed project along with a set of the mitigation measures to reduce the impacts to acceptable levels is provided.

The analysis reveals that the environmental impacts associated with the implementation of the Project are site specific, small scale and mostly limited to the construction stage. Therefore, the overall conclusion of the assessment is that provided the mitigation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of location, design, construction or operation of the various objectives of the Project. There should in fact be positive benefits through major improvements in quality of life and individual and public health once the scheme is in operation. The implementation of the Project will stimulate economic growth and generate new job opportunities.

Individual and public health standards will improve as a result of the project.

8.2 Introduction

This document presents the Environmental and Social Assessment (ESA) for the Phase 1 of feasibility study (the Project). The Environmental and Social Assessment is part of the feasibility study (FS).

8.2.1 Objective of the Environmental and Social Assessment

The objective of the ESA is to facilitate the implementation and to ensure that the envisaged Project objectives will comply with Moldova’s environmental and social legislation, procedures and policies and international and EU conventions. In addition, the ESA Report addresses the environmental and social impacts, mitigation measures and management issues associated with the proposed objectives of the Project.

8.2.2 Methodology

The methodology used for the preparation of this Environmental and Social Assessment was based upon the review of the documents that were so far prepared in the lead up to this FS, particularly the Regional Sector Programme in the WSS sector for the North Development Region (NDR) and the documents prepared in the PPC (Possible Project Concept) stage of the Project Development Pathway.

In addition the existing Moldovan environmental and social legislation and the pertinent safeguard requirements of International Financing Agencies (IFA) were respected.

8.2.3 Study area

The Project Area of Influence (PAI) comprises the territory of the town of Edinet. The area that is foreseen for water supply rehabilitation and extension is shown in the figure in chapter 8.4 Project Description and Location.

8.3 Legislation and legal approval procedure

According to the new law on environmental assessment (Law No. 86/29.05.2014 on Environmental Impact Assessment which is in force from beginning January 4, 2015)

none of the WSS components of the FS is subject to EIA on large scale at national level.

For acquiring the environmental and construction permission it is required to prepare the documents for the SEE. This needs to be done in the detailed design stage of the Project.

A separate annex has been prepared on the legal approval procedure. The Annex 8 describes in detail the legal framework conditions and the SEE approval process.

8.4 Project description and location

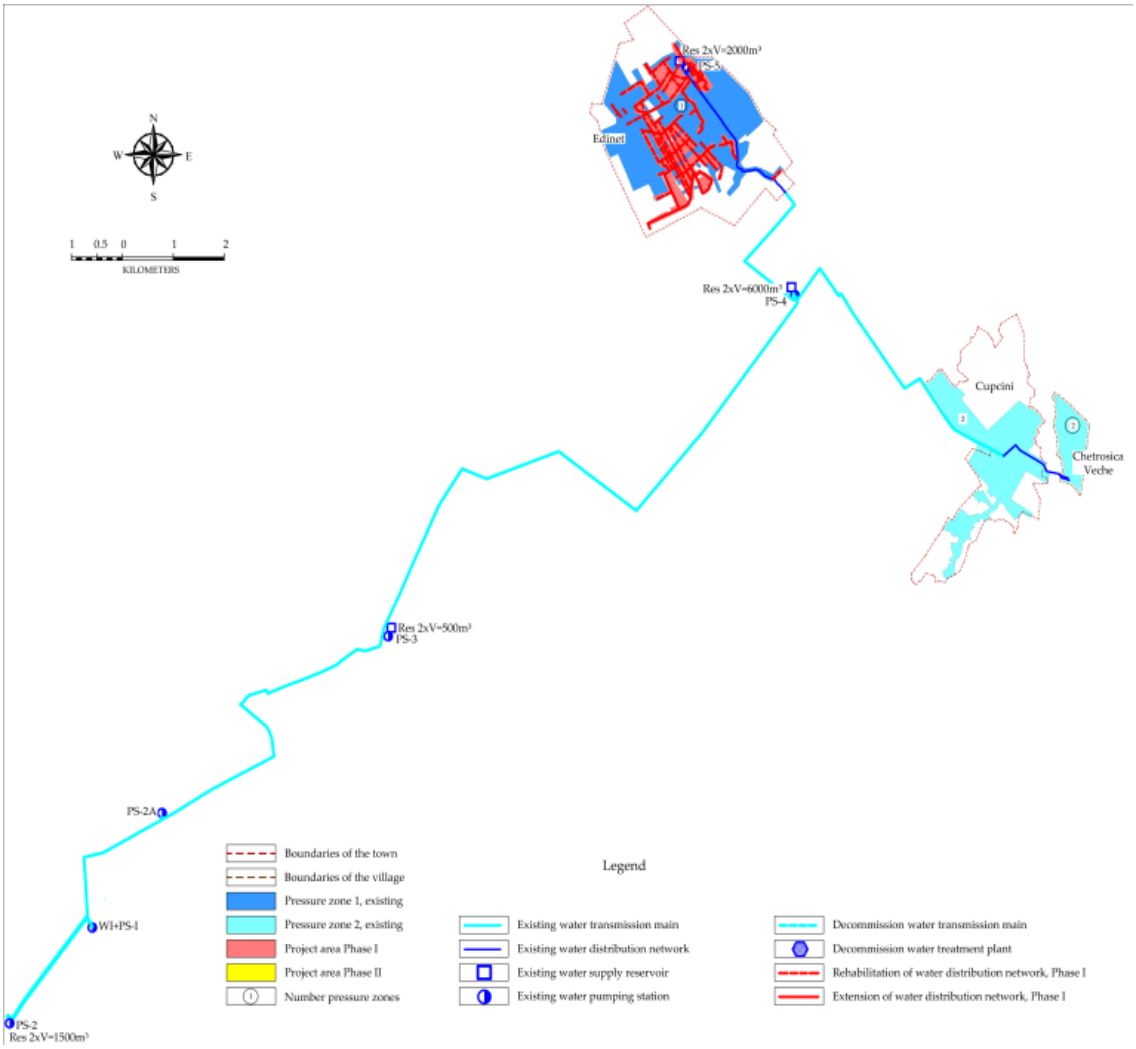
The FS involves the new construction and rehabilitation of various components in the WSS systems. It is designed to improve the service standards of the water supply system in Edinet as follows:

Water supply system:

- Rehabilitation of water distribution network in Edinet town – 22,435 m;
- Extension of water distribution network in Edinet town – 4,520 m.

Scheme of existing and proposed water supply system in the town of Edinet (Phase 1) is presented in the Figure 8-3.

Figure 8-3: Scheme of existing and proposed water supply system in the town of Edinet[50]



Source: GIZ/MLPS

8.5 Project implementation stages

With regard to potential environmental impacts it needs to be distinguished between the construction stage and the operational stage of the new WSS system. In the following the required activities for these stages are described under Environmental considerations.

8.5.1 Construction stage

In the Water Supply System the following main elements are planned.

Water Supply Sector:

- Rehabilitation of water distribution network in Edinet town – 22,435 m;
- Extension of water distribution network in Edinet town – 4,520 m.

[50] Phase 1

The new pipes for installing water supply system will be polyethylene. Pipes of smaller diameter will be laid for rehabilitation and extension of the distribution network in Edinet town. The pipes will be will be laid along existing streets, lanes or other linear structures, thus keeping the involved environmental impacts and land acquisition requirements to a minimum.

The typically depth of trench will be 1.5– 2.5m depending on topographical conditions. The width of the trench in average will vary from 0.6 m to 1.0 m depending on the pipe's outside diameter, type of soil and groundwater level. After construction part of trench will be occupied by pipe and sand layer, and trench is refilled with the excavated material, supplemented by manual and mechanical compaction.

In the wastewater system no elements are planned in the Phase 1.

Water needed for civil works comprises of potable water and construction (technical) water: potable water shall comply with the national quality standards and shall not compete with the needs of the local population. Construction water and water to be used for dust suppression measures may be taken from the Berchin Lake or other surface waters in the vicinity of construction site.

Transportation routes: construction site is accessible via the Republican Road R8 and Magistral Road M14 and other local roads.

For mitigation measures please refer to subsequent chapters.

8.5.2 Operation stage

Water supply infrastructure will require repair and maintenance activities like detection and repair of leaks. Since good quality pipes are being used breaks are very rare, and leaks will be mainly limited to joints between pipes. Repair work will be conducted in the same way the pipe was laid, after locating the leaking section.

No significant environmental impacts are associated with the operation of the new water supply system.

8.6 Environmental and social baseline conditions

8.6.1 Physical environment

Edinet Project is located in the northern part of Republic of Moldova, partially on Moldovan Plateau and on the Plain of Balti.

Most of the project area is built up area. The adjoining area is mainly under agricultural use.

The project area is mainly characterized by Quaternary deposits. Fertile chernozems (black earth) as are typical for wide parts of the country prevail in the area. Soils and ground water are reported to have suffered significantly from intensive use of chemical fertilizers, pesticides and herbicides during the Soviet Union.

The regional climate is temperate continental and usually characterized by a lengthy frost period, comparatively mild and dry winters and warm summers with relatively high rainfall level, erratic rainfall and extended droughts. Rainfall is about 550 mm annually in Edinet Rayon. Average temperatures are - 3.5°C in January and 21.4°C in July.

Winds tend to mainly come from northwest (24%) or southeast (21%).

Hydrologically the Edinet Project is located within the catchment of Prut River.

8.6.2 Biological environment

Edinet is located within Moldova's steppe zone. Due to naturally favourable conditions the region became a traditional agricultural area since the 19th century. Typical crops of the region are corn, sunflower, wheat, and sugar beet. Locally there are also orchards with apple and plum.

Due to the intensive agricultural land use the natural steppe vegetation has almost entirely disappeared in the environs of the Project area. However on some pastures and alongside edges of agricultural fields typical steppe species like Volga fescue (*Festuca valesiaca*) and various species of feathergrass such as *Stipa capillata*, *S. lessingiana*, and *S. Pulcherima* may still be found.

Due to intensive agricultural use the Project area's vicinity does not provide important reproduction habitats and migration routes of wild animals, including rare species.

Typical faunal elements of the forest-steppe zone of northern Moldova white egret (*Egretta alba*), black stork (*Ciconia nigra*), lesser spotted eagle (*Aquila pomarina*) and harrier (*Circus cyaneus*). Typical mammal species of the region are hare (*Lepus europaeus*), fox (*Vulpes vulpes*), forest polecat (*Mustela putorius*), hedgehogs (*Erinaceus europaeus*) and beech marten (*Martes foina*) may occur.

8.7 Environmental impacts and mitigation measures

In the below table the environmental impacts that are associated with the Project implementation are de-scribed together with the identified mitigation measures that need to be implemented for reducing the impacts to acceptable levels. The environmental impacts and mitigation measures are described for the 3 different phases of Project implementation, the pre-construction, construction phase and the operation phase.

Ultimately, all proposed measures for impact avoidance or mitigation that relate to construction need to be incorporated into the bidding and/or contract documents thereby becoming binding elements of the construction and construction supervision contracts.

Table 8-1: Environmental impacts and mitigation measures

Activity / Impacts	Mitigation measures	Responsibility	Location	Cost
Pre-Construction				
Possible removal of terrestrial habitat. Loss of vegetation and top soil	Construction site rehabilitation by contractor after finalization of construction activities. Vegetation planting and stabilization of site, including replacement of any native plant species that were removed during construction activities.	Construction Contractor	Construction and labour camp, storage area. Trenches for pipes	Part of construction cost
Construction				
Ambient Air and Local Dust	• Cover or damp down by water spray on the excavated mounds of soil to control dust generation; • Apply water prior to leveling or any other earth moving activity to keep the soil moist throughout the process; • Bring the material (aggregate and sand) as and when required; • Ensure speedy completion of work and proper site clearance after completion; • Damp down unsatisfied /bad condition roads to avoid dust generation while using for transport of waste/material; • Use tarpaulins to cover loose material that is transported to and from the site by truck; • Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside barricaded area; • Clean wheels and undercarriage of haul trucks prior to leaving construction site; • Don't allow access in the work area except workers to limit soil disturbance and prevent access by fencing.	Construction Company	Excavation areas for trenches	Part of construction cost
	The Contractor shall coordinate with local Traffic Police Department to minimize construction traffic impact in the following topics: • Temporary parking restrictions; • Pedestrian and cyclist diversion routes where construction prevents access; • Temporary traffic signals; • One way scheme; • Maintaining local residential access at all times; • General traffic diversion routes where roads are closed; • Sound barriers should be erected at schools and hospitals if the distance to the construction site is less than 50 m.	Contractor	Transportation routes of construction material	Part of construction cost

Activity / Impacts	Mitigation measures	Responsibility	Location	Cost
Noise Pollution	• Maintain machinery and vehicle silencer units to minimize noise; • Keep noise generating activities associated with construction activities to a minimum and within working hours; • Notify the residents close to the Project area prior to commencement of the construction phase; • Vehicles and machinery that are used intermittently should not be left in idling condition for long period of time; • Equipment used on site will be quietest reasonably available; • Haul routes for construction traffic entering and leaving the site will be selected to ensure noise levels at noise sensitive receptors are kept at a minimum.	Construction Contractor	Excavation areas for trenches in Edinet town	Part of construction cost
Impact on surface water bodies due to construction	• In case of heavy rain, protect open trenches from entry of rain water by raising earthen bunds with excavated soil; • Confine construction area including the material storage (sand and aggregate) so that runoff from upland areas will not enter the site; • Ensure that drains are not blocked with excavated soil.	Construction Contractor	Project area	Part of construction cost
Soil Contamination	• The contractors will be required to instruct and train their workforce in the storage and handling of materials and chemicals that can potentially cause soil contamination; • Solid waste generated during construction and at campsites will be properly treated and safely disposed of only in demarcated waste disposal sites; • Construction chemicals will be managed property; • Clearly labeling all dangerous products; • Fuel tanks (diesel or oil) should be placed in a concrete pool with perimeter walls that are at least 1.0 m high; • A proper floor drain should be installed on the slab of the concrete pool for safely discharging the leakages.	Construction Contractor	Construction site, Camp	Part of construction cost
Impact on Flora and Fauna	• Avoid tree cutting; • In unavoidable cases, plant two trees of same species for each tree that is cut for construction; • The trench shall not be kept open in the night/after working hours. This will avoid any safety risk to people, domesticated, stray or wild animals; • The Contractor shall ensure that the work site be kept clean, tidy and free of rubbish that would attract animals.	Construction Contractor	Construction site	Part of construction cost
Impact on Traffic	• Inform all residents and businesses about the nature and duration of any work well in advance so that they can make necessary preparations if necessary; • Provide wooden walkways/planks across trenches for pedestrians and	Construction Contractor	Construction site, Access Roads	Part of construction cost

Activity / Impacts	Mitigation measures	Responsibility	Location	Cost
	metal sheets where vehicle access is required; • Increasing workforce to complete the work in minimum time in these stretches; • Initial situation of private properties has to be re-established after construction.			
Hazardous Materials	• Comply with all national, regional and local legislation with regard to the storage, transport, use and disposal of petroleum, chemical, harmful and hazardous substances and materials; • Establish an emergency procedure for dealing with spills or releases of petroleum; • Storage of all hazardous material to be safe, tamper proof and under strict control; • Petroleum, chemical, harmful and hazardous waste throughout the site must be stored in appropriate, well maintained containers; • Any accidental chemical / fuel spills need to be corrected immediately.	Construction Contractor	Construction site Storage Area	Part of construction cost
Solid Waste	Place for disposal of waste must be demarcated. The waste may not be stored nearby drainage structures. Waste has to be immediately removed from the working sites. Waste has to be placed in secondary protective basins. Waste may only be transferred to a certified contractor. The personnel involved in the handling of hazardous and non-hazardous waste will undergo specific training in: • Waste handling; • Waste treatment; and • Waste storage.	Construction Contractor	Construction site, waste storage area, camp site	Part of construction cost
Loss of top soil	Top soil of about 0.3 m depth shall be removed and stored separately during excavation work, and after pipeline construction the same soil shall be replaced on the top.	Construction Contractor	Construction site	Part of construction cost
Erosion due to excavation/refilling	Ensure proper compaction of refilled soil. There shall not be any loose soil particles on the top; the material shall be refilled in layers and compacted properly layer by layer.	Construction Contractor	Construction site	Part of construction cost
Impact on air quality due to emissions from construction equipment/vehicles	• Ensure that all equipment & vehicles used for construction activity are in good condition and are well maintained; • Ensure that all equipment & vehicles confirm to emission and noise norms.	Construction Contractor	Construction sites in Edinet town and access roads	Part of construction cost
Socio-economic benefits from employing local peo-	To the extent possible labour force should be drawn from the local community	Construction Contractor	All construction sites	Part of construction cost

Activity / Impacts	Mitigation measures	Responsibility	Location	Cost
ple in construction work				
Safety risk – public and worker	• Follow standard and safe procedures for all activities – such as provision of shoring up deep trenches (>2 m); • Exclude public from the site – enclose construction area, provide warning and sign boards, security personnel; • Provide adequate lighting to avoid accidents; • Ensure that all workers are provided with and use appropriate Personal Protective Equipment - helmets, hand gloves, boots, masks, safety belts (while working at heights etc.); • Maintain accidents records and report regularly; • Trench construction shall be taken up in small segments, so that work (excavation, pipe laying and refilling) in each segment is completed in a day. No trenches shall be kept open in the night/after work hours.	Construction Contractor	All construction sites	Part of construction cost
Historical, archaeological chance finds during excavation	Contractor shall put in place a protocol for conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved. This should involve: • Having excavation observed by a person with archaeological field training; • Stopping work immediately to allow further investigation if any finds are suspected; • Calling in the state archaeological authority if a find is suspected, and taking any action they require to ensure its removal or protection in situ.	Construction Contractor	All construction sites	Part of construction cost
Operation Phase				
Disturbance/nuisance/ noise due to operation activity including haulage of waste, dewatered sludge	• Plan transportation routes in consultation with Municipality and Police; • Schedule transportation activities by avoiding peak traffic periods; • Use tarpaulins to cover loose material that is transported to and from the site by truck; • Educate drivers: limit speed between 20-25 Km/h and avoid use of horn in the town; • Provide prior information to local people about work.	Contractor, Police Department	Construction site, access road	Part of operation costs
Influx of insects, rodents	• Regular waste and sludge disposal	State Environmental Inspection of the Ministry of Environment and Centre of Public Health of the Minis-try of Health	WTP	Part of operation costs
Risk of delivery of unsafe water to consumers	• Conduct regular water quality monitoring; • Develop & implement water quality monitoring program for distribution	State Environmental Inspection of the	Water intake, transmission	Part of operation cost

Activity / Impacts	Mitigation measures	Responsibility	Location	Cost
	system; • Establish a water quality laboratory as part of the project, with adequate building, equipment and trained personnel.	Ministry of Envi-ronment and Centre of Public Health of the Minis-try of Health	main, distribution network	

Source: GIZ/MLPS

8.8 Social and gender assessment of WSS project in Edinet

8.8.1 Social and gender issues in Moldova and in WSS project area

The main gender characteristics for the Republic of Moldova, including for the Project area, are as follow:

- **The population of the Republic of Moldova has decreased in recent years, with Edinet rayon exhibiting the same trend**. As of 1 January 2015, the official population of the Republic of Moldova was 3,555,159 persons, with 4,382 persons less than 2012. The population decrease is determined by the negative natural growth rate and the on-going out-migration processes. The same situation is observed in Edinet rayon where the population decreased by 946 persons: from 82,535 in 2012 to 81589 persons in 2014.[51] The population of Edinet town was 25,994 in 2014, which represented 31.9% of the total population of Edinet rayon and 0.7% of the total population of the Republic of Moldova;
- **Women are predominant in both the general population and the population of the Project area**. The gender distribution of the population in the country has been practically the same for a long period of time, with small deviations: around 52% of women and 48% of men. In 2014 in the Republic of Moldova the breakdown of the population by gender was: 51.9% women and 48.1% men. In Edinet rayon, the gender distribution was the following: women – 52.7% and men – 47.3%.[52] In Edinet town the gender distribution was 46.7% for men and 53.3% for women;
- **On average, at the national level women have higher life expectancy at birth than men by 7.9 years in 2014**.[53] In 2014 the average life expectancy at birth was 67.5 years for men and 75.4 years for women. Because of the differentiated level of mortality, the average duration of life of inhabitants at birth in the urban areas is higher than in rural areas, respectively by 4.6 years for men and 3.5 years for women. In Edinet rayon, the average duration of life is higher than the average per country (men – 68.9 years, women – 76.9 years);[54]
- **In 2015, the average age of women (39.1 years) was higher than the average age of men (35.8 years).** The average age at the national level increased from 36.7 years in 2012 to 37.5 years in 2015. In Edinet rayon the average age increased from 40.2 years in 2012 to 40.5 years in 2014 while for the town the figures are 39.9 in 2012 and 40.5 in 2014. The average age by gender for the Project area is higher than the one at national level: women – 42.4 years, men – 38.4 years;[55]
- **The employment rate among women was lower** (37.4%) **compared to that for men** (42.1%) in 2014. For the North Statistical Region the employment rate for men was 41.6% while for women – 38.3%. Women with higher levels of education are more likely to participate in the labour market. Therefore, the employment rate is greater among women with higher education (54.2%), followed by those with specialised secondary education (48%) and secondary professional education (44.5%), secondary school (39%) and those with gymnasium

[51] Statistica teritoriala, 2014; Statistical databank, NBS website.

[52] Statistica teritoriala, 2014.

[53] http://www.statistica.md/newsview.php?l=ro&id=3814&idc=168

[54] Statistica teritoriala, 2014.

[55] Ibid.

(31.5%).[56] The analysis of statistical data also shows that the female employment rate depends on various factors, including whether they have children under 16. The employment rate of women with children gradually decreases depending on the number of children: from 52.2% for women with one child up to 43.9% for women with three or more children. This rate of employed women also depends on the children' age, the biggest differences being registered to persons with children up to two years old, the employment rate being 15.3% for women compared to 53% for men;[57]

- **There are significant discrepancies in the employment of women and men in different spheres**.
  There is a larger share of women employed in the service sector (60% compared to 40% of men) but they are less in the agricultural (44%), industry (44%) and constructions (9%) sectors. Women are predominant in economic activities like hotels and restaurants (73.7%), education (81.5%), health protection (81.3%) and trade (56.6%);[58]
- **Women are mostly employed in low-paying jobs and occupy lower positions in the job hierarchy where they are employed**.[59] The statistical data shows that women are dominant in the group of specialists with higher levels of qualification (65% women and 35% men), in administrative officials (83% women and 17% men) and in workers in services and trade (77% women and 23% men). However, men constitute 56% of the total managers of all levels. The gender differences for the top leaders of economic and social units are even more pronounced. The gender ratio among employers is one woman to four men regardless of ownership of the unit they lead;[60]
- **Unemployment affects men more than women**. The unemployment rate at the country level was 3.9% in 2014, compared to 5.6% in 2012[61], the rate among unemployed men being higher (4.6%) compared to women (3.1%). In 2013, in Edinet town the unemployment rate was 6.5% compared to 3,9% at the national level;
- **At the national level, the average salary for women is 11.6% less than the average salary for men**. Discrepancies between the salaries of women and men decreased in the period 2003-2013; however, this trend has slightly reversed since then. Thus, the monthly average earnings for women amount to 88.4% of the average salary for men in 2013; in monetary terms, the discrepancy constituted 454 MDL on average (according to NBS). This gap persists because women, most often, either work in lower-paid sectors – education, healthcare or services – or occupy lower-paid positions. For Edinet rayon, the gender pay gap was 87.7%, women getting 378 MDL less than men;[62]
- **Women spend more time on unremunerated household work than men**. According to statistical data, unremunerated work in Moldova constitutes on average 3.9 hours per day per person (in urban areas – 3.8 hours, in rural areas – 4.9

[56] Statistical databank, NBS website.

[57] Statistica Moldovei, 2014. Portretul statistic al barbatilor si femeilor in Republica Moldova.

[58] Ibid.

[59] http://www.undp.md/mdg/MDG3/gender.shtml

[60] Statistica Moldovei, 2014. Portretul statistic al barbatilor si femeilor in Republica Moldova.

[61] Statistical databank, NBS website.

[62] Promote gender equality and empower women, UNDP Moldova; Statistica teritoriala 2014.

hours). Women spend on average 4.9 hours per day (in rural areas – 5.9 hours and in urban areas – 4.4 hours) and men – 2.8 hours per day (in rural areas – 3.9 hours and in urban areas – 2.7 hours);[63]

- **The average size of female pensions is less than the average size for men**. The discrepancies in the remuneration of men and women influence also the size of pensions for statutory retirement. In 2013, the average woman's pension was 16% lower than the average man's pension. Furthermore, the average pension for employees in the non-agricultural sector is higher compared to agricultural sector: in the case of women, the difference is 20.7% while for men the gap is higher – 45.7%;[64]
- **The average nominal monthly earning per employee** in Edinet in 2013 was 2862 MDL (compared to 3,765.1 MDL in the country overall), with 532 MDL more than in 2011; this constitutes 77.9% of the average salary in the country overall. According to the deprivation index of the small areas calculated in 2012, out of 35 LPAs of 2nd level, Edinet rayon is ranked 34th for the index of multiple deprivation and 24th in income deprivation specifically;[65]
- **More women than men are enrolled in the higher education system.** In 2014, from the total number of graduates from higher education institutions, women represented about 60.5% compared to 39.5% of men (statistical databank). There are gender discrepancies at the level of specialities with a significant share of women in the teaching staff (over 80%). The almost exclusive domination of primary education by women confirms that there are stereotypes according to which women are those who must educate and take care of children. The poor remuneration in education and the exodus of teachers abroad are also worth mentioning;[66]
- **Domestic violence and human trafficking have gender dimensions and remain among the largest problems for women in Moldova**. According to data from the Ministry of Internal Affairs on combating human trafficking, during 2012 the following was recorded: 151 criminal cases for human trafficking offences, with 266 identified victims out of which about 65% are women and 35% are men. The purpose of trafficking varied as following: a) 126 victims were sexually exploited (100% women); b) 126 victims were exploited in labour (37 women, 89 men); and, c) 13 victims were exploited in begging (6 women, 7 men);[67]
- **Women in Moldova are less represented in politics than men**, constituting 19.8% of the members of Parliament, 18.6% of councillors in rayonal councils, 29.9% in local councils, and 20.5% of the mayors. After the local elections in June 2015, the Edinet Rayon Council comprises 33 councillors, of whom five (15%) are women.[68] Regarding the Local Council of Edinet town, of 27 councillors two (7.4%) are women;[69]

[63] Biroul National de Statistica, Chisinau 2013. Utilizarea timpului in Republica Moldova. Sinteza

[64] Statistica Moldovei, 2014. Portretul statistic al barbatilor si femeilor in Republica Moldova

[65] In order to establish the deprivation level of the locality in a certain field, the city halls were arranged in the order of rank obtained: first rank indicates the most deprived community (the poorest, lacking certain services), rank 35 – the lowest deprivation (the wealthiest), Ministry of Economy, National Bureau of Statistics.

[66] Government decision no.933 from 31.12.2009 on approval of the National Programme on ensuring gender equality in the Republic of Moldova during the period 2009-2015

[67] CEDAW. Replies of Moldova to the list of issues

[68] Webpage of the Rayonal Council Edinet: http://edinet.md/wp-content/uploads/2015/11/1118.pdf

[69] Webpage of the Town Hall Edinet http://primariaedinet.md/?page_id=57

- Poverty in Moldova continues to affect vulnerable population categories: traditional families who depend on farming, older people, people without education and professional skills, and households consisting of several children. Although the poverty rate in Moldova decreased from 26.4% in 2008 to 12.7% in 2013, it continued to be high in rural areas (18.8%), in households with three and more children (34.6%), in households with the head aged over 65 (18%), in households where the head has low level of education (no education – 40.8%; primary/gymnasium education - 24.1%), among agricultural workers (31.3%), self-employed (21.7%) and retired persons (14.7%). The proportion of the poor population that lives in rural areas increased from 75.6% in 2006 to 84% in 2013.[70] In Edinet town, the vulnerable families constituted 22.3% (1941) of the total families in 2012 and included 1060 families with persons with disabilities, 750 families – with one parent, 125 families – with three and more children, 6 families – that have children under the tutorship;[71]
- **The high poverty level limits the access of vulnerable groups to goods and services for a decent standard of living**. Expenditure for the purchase of food and communal services' payments absorb approximately 73% of the budget of poor families, a fact which limits their access to other goods and services necessary for a decent living. According to the Household Budget Survey (2013), in the 1st quintile, only 35.5% of population have access to water supply services, only 7.33% of the population have access to a centralised sewage system, and only 7.4% of the population have access to the toilet inside their houses. The poor, in comparison with the wealthy group of population spend 20 times less for education, 11 times less for leisure activities, six times less for clothes and shoes and five times less for health services.[72]

Based on the analysis of social and gender dimensions in the Republic of Moldova and in the Project area, the conclusion is that, despite the adoption of the legal and regulatory framework on ensuring gender equality, and the relatively high ranking of Moldova in the Global Gender GAP Index 2015 (26)[73] there are still many problems faced within its practical implementation in the country, including in the Project area, including among others:

- Employment inequalities;
- Under-representation of women in decision-making positions;
- Salary and pension disparity between women and men;
- Engagement of women in unremunerated household work etc.

Poverty in Moldova still affects the most vulnerable groups of population (families who depend on farming, older people, people without education and professional skills, households consisting of three and more children) and limits their access to goods and services, like water supply and wastewater, centralised heating systems, education and health. Given this situation, social and gender mainstreaming is an essential compo-

[70] Raport privind saracia in Republica Moldova, 2014.

[71] Ministry of Economy, Deprivation Index for Small Areas, 2012 http://www.mec.gov.md/ro/content/indicatori-social-economici-pe-localitati; National Bureau of Statistics

[72] Raport privind saracia in Republica Moldova, 2014.

[73] World Economic Forum. The Gender Global GAP report, 2015 http://reports.weforum.org/global-gender-gap-report-2015/economies/#economy=MDA

nent of the implementation of WSS project in Edinet town. The methodological approach and the description of the pilot gender study (performed for the town of Straseni and considered to apply also for the FS of Edinet) are presented in Annex 8.2.

9 Procurement strategy and implementation plan

9.1 General

The following chapter describes all actions for the procurement of services and works for a successful and efficient project implementation including an envisaged time schedule. The project measures for Edinet in Phase 1 comprise capital investments and technical assistance that need to be procured and implemented.

The works and services to be procured for the implementation of Phase 1 measures are as follows:

Technical assistance components:

- Design and Engineering for Phase 1 investments;
- Corporate Development Program;
- Stakeholder Participation Program;
- Water Supply Network Analysis and Water Loss Reduction Programme;
- Medium to Long-term Sanitation Study.

Capital investments and goods:

- Rehabilitation of the existing water distribution network in the town of Edinet (22,435 m);
- Extension of the water distribution network in the town of Edinet (4,520 m);
- Equipment for operational performance improvement (water supply and wastewater).

9.2 Procurement plan

In line with Moldova's policies and rules, the required public sector services and works contracts shall be awarded on the basis of open competitive tendering, which should assure a maximum of competition and transparency.

The fundamental requirements of open competitive tendering are:

- Be open to all qualified and interested bidders;
- Be advertised locally (and internationally, when required);
- Have objective qualification criteria;
- Have neutral and clear technical specifications;
- Have clear and objective evaluation criteria;
- Be awarded to the least-cost provider, without contract negotiations.

9.2.1 Procurement strategy

It is proposed to arrange procurement into four different contracts:

- Design & engineering contract;
- Works contract;

- Supply contract;
- Technical assistance.

9.2.1.1 Design & engineering contract / technical assistance

Design and engineering is proposed to be procured separately from the remaining technical assistance tasks (Corporate Development Programme, Stakeholder Participation Programme, Water Supply Network Analysis and Water Loss Reduction Programme, Medium to Long-term Sanitation Study) as the requirements for the consulting company are different.

9.2.1.2 Capital investment and goods

The strategy is to keep contract values at a size to attract international contractors as well as local contractors. Due to the similarity of the works (mainly network rehabilitation and extension; investment amount of chlorination equipment will be too small to be procured in a separate contract) and the relatively small total investment value it is proposed to combine all capital investment measures in one contract. The Conditions of Contracts for the works contracts should be based on “FIDIC Conditions of Contract for Construction for Building and Engineering Works Designed by the Employer (FIDIC Red Book)”.

Although the contract value will be relatively small, the equipment for operation and maintenance improvement is proposed to be procured under a supply contract (shopping).

The summary of cost breakdown per contract and the procurement plan below, lists the different contracts to be procured during the entire project including, project component, costs and financing, type of contract and the procurement method.

Table 9-1: Summary cost breakdown per contract

N°	Component	Total project costs	Design & engineering	Construction works	Supply of equipment	Technical assistance
1	Water supply					
1.1	Rehabilitation of the water distribution network in the town of Edinet	1,506,615		1,506,615		
1.2	Extension of the water distribution network in the town of Edinet	381,120		381,120		
2	Equipment and tools for operational performance improvement (water supply and wastewater)	200,000			200,000	
3	Technical assistance					
3.1	Design, engineering, and supervision for Phase 1 investments (12% of investment costs)	250,528	250,528			
3.2	Technical assistance (Corporate Development Stakeholder Participation Programme, Water Supply Network analysis and Water Loss Reduction Programme, Medium to Long-term Sanitation Study)	300,000				300,000
4	Contingencies (10% of 1+2+3)	263,826	25,053	188,774	20,000	30,000
GT	**Total Costs per contract**	**2,902,090**	**275,581**	**2,076,509**	**220,000**	**330,000**

Source: GIZ/MLPS

Table 9-2: Procurement plan

N°	Description	Estimated contract value[74], EUR	Contract type	Procurement method
1	Design, engineering, and supervision for Phase 1 investments	275,581	Consulting services	Competitive
2	Construction works: Rehabilitation and extension of the water supply system in the town of Edinet.	2,076,508	Works	Open
3	Supply of equipment for operational performance improvement	220,000	Supply of goods	shopping
4	Technical assistance for: Corporate Development Programme, Stakeholder Participation Programme Water Supply Network analysis and Water Loss Reduction Programme, Medium to Long-term Sanitation Study	330,000	Consulting services	Competitive
GT	**Total amount**	**2,902,090**		

Source: GIZ/MLPS

9.3 Project implementation plan

9.3.1 Key steps of project implementation

Key steps in project implementation will be the following:

9.3.1.1 Concluding of funding arrangements

In order to conclude on the funding arrangements the following will be necessary:

- Agreement of all relevant stakeholders (i.e. local authorities, ministries, relevant funding institutions) on project volume, funding sources, financing plan;
- Conclusion of funding agreements as basis for project start.

9.3.1.2 Setting-up of project implementation structures

In order to establish a sound and efficient project steering and project management a proper project implementation structure shall be established by the client of the project (the Employer). The client will either[75] be the LPA Edinet, which is the owner of the assets or the ME 'Apa-Canal' Edinet, which manages and operates these assets. Further, relevant stakeholders shall be involved in the project implementation structure in order to have coordinated decisions and processes.

The project implementation shall be managed by a Project Manager (PM), appointed by the Employer. The main tasks of a project implementation structure are:

- Establish adequate conditions for operation, location, and endowment.
- Selection of a qualified staff;
- Develop implementation plan for the project;
- Tendering process for services and works contracts;

[74] Including Contingencies

[75] Depending on the funding arrangement (donor and type of contract)

- Monitor the implementation of the service and works contracts;
- Organise in due time all required licenses, permits and conclusions;
- Financial management and reporting;
- Maintain records for all the documents and communications;
- Monitor of disbursements and reporting to the funding institution.

9.3.1.3 Procurement and implementation of consulting services

The first key activity directly related with project implementation will be the timely and successful procurement of the required consulting services for detailed design and construction supervision of the identified rehabilitation works, supplies and their installation.

The steps about procurement and implementation of the Consulting Services (the Engineer) will be:

- Issuing the Request for Proposal;
- Technical and financial evaluation of the received proposals;
- Recommendation for consultant selection;
- Contract award for consulting services;
- Implementation of consulting Services.

9.3.1.4 Procurement and implementation of works and supplies contracts

In cooperation with the Engineer the Employer (project implementation structure) will hold responsible for the procurement process for the works contracts comprising following steps:

- Invitation for tendering and issuing of tender documents;
- Tender period;
- Receiving of bids;
- Bid evaluation and preparation of evaluation report;
- Contract award for work contracts;
- Implementation of works contract;
- Defects liability period.

9.3.1.5 Project monitoring and evaluation

Project monitoring during implementation of the project and internal as well as external evaluation at the end of the project implementation period shall be carried out:

- Monitoring is an instrument for systematic collection of data on specific indicators to provide the management and the main stakeholder relevant information on the project progress and the achievement of objectives;
- Evaluation is the systematic and objective assessment of the on-going or completed project, its design, implementation and results. The aim is to determine the relevance and fulfillment of objectives, development efficiency, effectiveness, impact and sustainability.

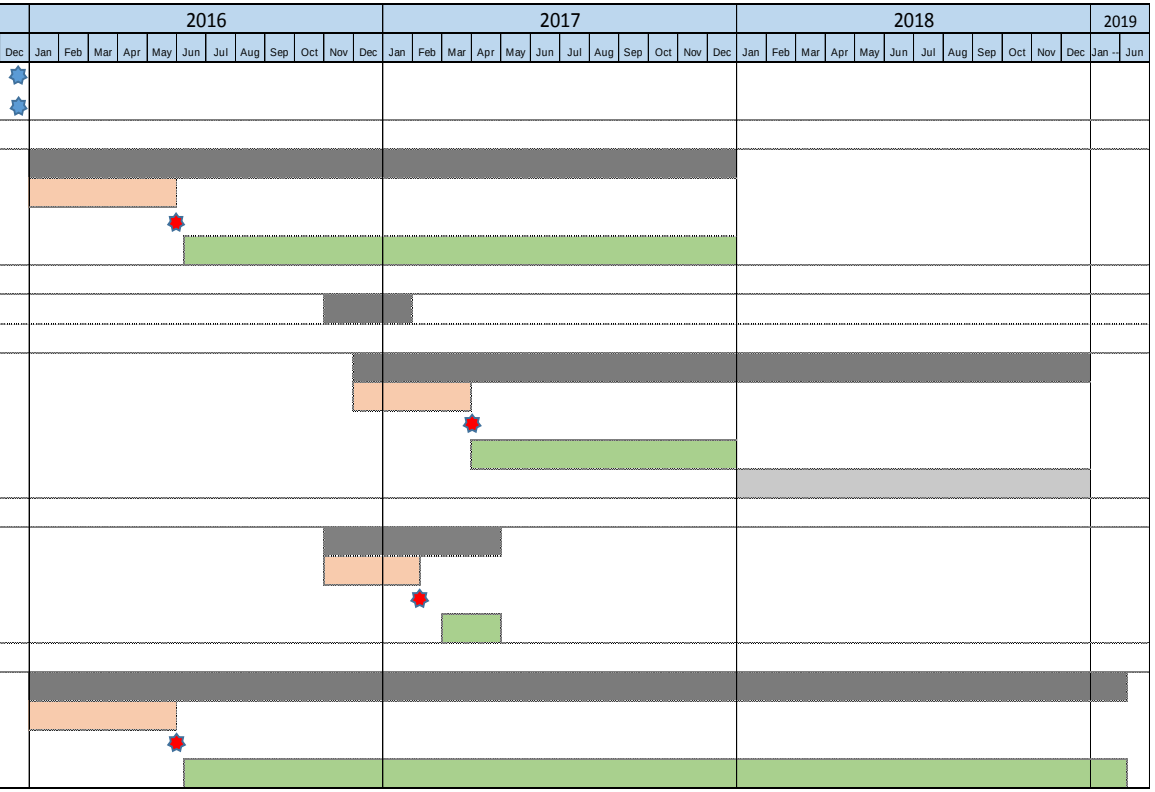
For both instruments the setting of targets and indicators as well as the methodology and administration of data collection need to be organised.

9.3.2 Project implementation plan

All key data for the above mentioned implementation steps are based on having the funding arrangement concluded by end of 2015. The table below gives the project implementation plan for the proposed measures.

Table 9-3: Project implementation plan

No	Item	start date	end date
1	Concluding of funding arrangements*	31.12.2015	
2	Setting-up of project implementation structures	31.12.2015	
3	Design and engineering	01.01.2016	01.12.2017
3.1	Procurement of consulting services	01.01.2016	30.05.2016
3.2	Contract award for consulting services	30.05.2016	
3.3	Implementation of consulting services	09.06.2016	01.12.2017
4	Obtaining required conclusions and permits	01.11.2016	30.01.2017
5	Works contracts	01.12.2016	31.12.2018
5.1	Procurement of works	01.12.2016	31.03.2017
5.2	Contract award for works contracts	31.03.2017	
5.3	Implementation of works contract	31.03.2017	31.12.2017
5.4	Defects liability period	01.01.2018	31.12.2018
6	Supply contracts	01.11.2016	30.04.2017
6.1	Procurement of equipment and tools	01.11.2016	31.01.2017
6.2	Contract award for supply contracts	31.01.2017	
6.3	Delivery of goods	01.03.2017	30.04.2017
7	Other technical assistance components	01.01.2016	09.06.2019
7.1	Procurement of consulting services	01.01.2016	30.05.2016
7.2	Contract award for consulting services	30.05.2016	
7.3	Implementation of consulting services	09.06.2016	09.06.2019



* In case the conclusion of funding arrangements and/or the setting up of the project implementation structures are delayed all following activities will be postponed accordingly

Source: GIZ/MLPS

10 Risk analysis

10.1 General

The following chapter applies and adapts the methodology for qualitative risk analysis in the new guide to cost-benefit analysis published by the European Commission[76].

According to the Guide, a qualitative risk analysis includes the following elements:

- "A list of adverse events to which the project is exposed;
- A risk matrix for each adverse event indicating:
  - The possible causes of occurrence;
  - The link with the sensitivity analysis, where applicable;
  - The negative effects generated on the project;
  - The (ranked) levels of probability of occurrence and of the severity of impact;
  - The risk level.
- An interpretation of the risk matrix including the assessment of acceptable levels of risk;
- A description of mitigation and/or prevention measures for the main risks, indicating who is responsible for the applicable measures to reduce risk exposure, when they are considered necessary[77]."

Further, the Guide continues that "according to the CBA methodology, as described in Annex III to the Implementing Regulation on application form and CBA methodology, the probabilistic risk analysis is required where the residual risk exposure is still significant. In other cases it may be carried out where appropriate, depending on project size and data availability[78]". Given that the project at hand entails "no regrets" measures in the first phase of a short-term priority investment programme (PIP), which in turn is part of a long-term investment plan, the residual risk exposure is not expected to be significant. Further, the project size, while above the threshold of a typical water and wastewater sector project in the Republic of Moldova, is below any objective measure of a major project. Therefore, a qualitative risk analysis is deemed sufficient for the present study.

10.2 Assumptions

A number of assumptions related to the project are important to its success. These assumptions serve to acknowledge the dependencies, potential points of weakness, and risks associated with the project:

- The per capita water consumption will increase, as provided in Chapter 5-4 Water demand and wastewater flow projection;
- The connection rate to the water systems will increase as a result of the investments and technical assistance;
- The operators will implement unified tariffs for the entire area of their operations;

[76] European Commission, Guide to Cost-Benefit Analysis of Investment Projects, Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.

[77] Ibid, p 69

[78] Ibid, p. 71

- As a target for the tariff strategy, we have considered that the affordability ratio should be somewhere between 3% and 3.5% of average household income.

It is also assumed that the local authorities, as owners of the assets operated by the target water utility will commit themselves to support the implementation of the Project and the Priority Investment Programme.

It is finally assumed that the sensitivity analysis covers overall changes in investment costs, operating costs and revenues, and the overall impacts of these changes on project effectiveness. Specific aspects of risk are covered in the following risk matrix.

10.3 Identification of adverse events and risks

As an input to the risk matrix, a list of adverse events to which the project is exposed needs to be developed. The following list is offered, together with a brief description of each risk:

- Political and policy risks, including:
  - Political risk from national and local elections – possibly delaying key decisions and policy changes;
  - Political risk from interference in day-to-day operations – causing both instability and delay in implementing day to day operational decisions;
  - Financial crisis at national level – limiting domestic financing sources;
  - Legal and regulatory framework – sectoral policy: delays in establishment of new tariff policy for the regional and local water companies by the National Agency for Energy Regulation (ANRE);
  - Legal and regulatory framework – sectoral policy: Lack of regulation regarding the elaboration of PAAS (Water Supply and Sanitation plans);
  - Legal and regulatory framework – sectoral policy: Lack of legal framework on ownership of land and public infrastructure at the regional level.
- Institutional risks, including:
  - Limited understanding of functioning of commercial companies – raising risk that the water utility will not make necessary improvements to improve and expand its services;
  - Operator size – operators are rather small in Moldova, making regionalisation of services difficult;
  - Institutional capacity – weak institutional capacity on the operational level in Water Supply and Sanitation (WSS), including financial weaknesses of the institutions to attract investments, manage investments, as well as provide quality services to the population;
  - Institutional capacity – ongoing and delayed decentralization process which leads to uncertainty in the WSS sector and artificial fragmentation of the areas managed by the specialized institutions;
  - Institutional capacity – financial weakness of the institutions which increases the perceived risks of making investments in WSS.
- Operational risks, including:
  - Insufficient number of customers when networks extended – raising the risks that forecasted revenues will not be realised;
  - Lack of reliable data collection and recording on the part of the operator – increasing the number of assumptions required in any study, thus raising the

uncertainty, as well as reducing the likelihood that project impacts will be properly tracked in the future;
    - Delay in obtaining the construction permits due to delay in submission or approval by the local authorities.
- Financial risks, including:
    - Low financial absorption capacity at national and local level;
    - Lack of expressed co-financing commitment from donors for priority projects;
    - Lower number of actual consumers than estimated after the investment implementation;
    - Political interference in tariff adjustments.
- Project implementation and management risks, including:
    - Insufficient technical expertise at local level that creates serious difficulties in supplementing project teams with qualified staff;
    - Insufficient project management and implementation experience at local level;
    - Construction delays;
    - Cost overruns;
    - Outdated construction standards of materials and technologies applied for design and project implementation.

10.3.1 Risk matrix

The risk matrix is presented in the following tables.

Key:

Probability of occurrence: A. Very unlikely (0–10% probability); B. Unlikely (10–33% probability); C. About as likely as not (33–66% probability); D. Likely (66–90% probability); E. Very likely (90–100% probability).

Severity of impact: I – No relevant effect on social welfare, even without remedial actions.; II – Minor loss of the social welfare generated by the project, minimally affecting the project long run effects- However, remedial or corrective actions are needed.; III – Moderate: social welfare loss generated by the project, mostly financial damage, even in the medium-long run. Remedial actions may correct the problem.; IV – Critical: High social welfare loss generated by the project; the occurrence of the risk causes a loss of the primary function(s) of the project. Remedial actions, even large in scope, are not enough to avoid serious damage; V Catastrophic: Project failure that may result in serious or even total loss of the project functions.

Table 10-1: Risk matrix, political and policy risks

Adverse event	Variable	Causes	Effect	Timing (short, medium, long-term)	Effect on cash flows	Probability	Severity	Risk level	Prevention and/or mitigation measures	Residual risk
Delay in key decisions and policy changes	n/a	National and/or local elections	Reduced project efficiency	Medium	Delay in establishing positive cash flow	D	III	High	Intensify work within partner systems to ensure policy decisions are taken in a timely manner and followed by subsequent regimes	High, but cannot be modelled
Instability and delay in implementing day to day operational decisions	Operating costs	Political interference in day-to-day operations	Reduced project efficiency	Medium	Negative	C	III	Moderate	Corporate development programme as part of technical assistance	Low to moderate
Limited availability of domestic financing sources	n/a	Financial crisis at national level	Delay in project start	Short	Delay in establishing positive cash flow and benefits to public	E	IV	Very high	Policy recommendations at national level to consolidate funding sources. Supporting unified policy to external donors	Moderate
Unclear tariff regime	Operating revenues	Delays in establishment of new tariff policy for the regional and local water companies	Reduced project efficiency and financial stability of operator	Medium	Negative	C	III	Moderate	Policy recommendations at national level; Corporate development programme as part of technical assistance	Low to moderate
Planning uncertainty	n/a	Lack of regulation regarding the elaboration of PAAS (Water Supply and Sanitation plans)	Reduced project efficiency; project not meeting local needs	Medium to long-term	Negative	C	III	Moderate	Regional sector programmes; intensive cooperation with local partners to identify needs; Corporate development programme as part of technical as-	Low

Adverse event	Variable	Causes	Effect	Timing (short, medium, long-term)	Effect on cash flows	Probability	Severity	Risk level	Prevention and/or mitigation measures	Residual risk
									sistance	
Uncertainty in ownership of assets at regional operator	n/a	Lack of legal framework on ownership of land and public infrastructure at the regional level	Reduced project efficiency and financial stability of operator	Medium to long-term	Negative	B	III	Moderate	Corporate development programme as part of technical assistance; Road map for establishment of regional operator	Low

Table 10-2: Risk matrix, institutional risks

Adverse event	Variable	Causes	Effect	Timing (short, medium, long-term)	Effect on cash flows	Probability	Severity	Risk level	Prevention and/or mitigation measures	Residual risk
AC will not make necessary improvements to improve and expand its services	Operating revenues	Limited understanding of functioning of commercial companies	Reduced operator efficiency; delays in provision of improved services	Medium to long-term	Negative	C	III	Moderate	Corporate development programme as part of technical assistance; Road map for establishment of regional operator	Low to moderate
Regionalisation of services will not be achieved	Operating revenues	Small existing operators; lack of national level policy guidance	Reduced operator efficiency; delays in provision of improved services	Medium to long-term	Negative	C	III	Moderate	Corporate development programme as part of technical assistance; Road map for establishment of regional operator;	Low to moderate

Adverse event	Variable	Causes	Effect	Timing (short, medium, long-term)	Effect on cash flows	Probability	Severity	Risk level	Prevention and/or mitigation measures	Residual risk
									National level policy advise	
Expansion of higher quality services is delayed	n/a	Weak institutional capacity on the operational level in WSS, including financial weaknesses of the institutions to attract investments, manage investments, as well as provide quality services to the population	Delay in project start	Short	Delay in establishing positive cash flow and benefits to public	E	IV	Very high	Policy recommendations at national level to consolidate funding sources. Supporting unified policy to external donors	Moderate
Unclear tariff regime ongoing and delayed decentralization process which leads to uncertainty in WSS sector and artificial fragmentation of the areas managed by the specialized institutions	Operating revenues	Delays in establishment of new tariff policy for the regional and local water companies ongoing and delayed decentralization process which leads to uncertainty in WSS sector and artificial fragmentation of the areas managed	Reduced project efficiency and financial stability of operator	Medium	Negative	C	III	Moderate	Policy recommendations at national level; Corporate development programme as part of technical assistance	Low to moderate

Adverse event	Variable	Causes	Effect	Timing (short, medium, long-term)	Effect on cash flows	Probability	Severity	Risk level	Prevention and/or mitigation measures	Residual risk
		by the specialized institutions								
Planning uncertainty financial weakness of the institutions which increases the perceived risks of making investments in WSS	n/a	financial weakness of the institutions which increases the perceived risks of making investments in WSS	Reduced project efficiency; project not meeting needs	Medium and long-term	Negative	C	III	Moderate	Regional sector programmes; intensive cooperation with local partners to identify needs; Corporate development programme as part of technical assistance	Low
Uncertainty in ownership of assets at regional operator	n/a	Lack of legal framework on ownership of land and public infrastructure at the regional level	Delays in implementation; depreciation not calculated in tariff	Short to medium-term	Negative	B	III	Moderate	Corporate development programme as part of technical assistance	Low

Table 10-3: Risk matrix, financial risks

Adverse event	Variable	Causes	Effect	Timing (short, medium, long-term)	Effect on cash flows	Probability	Severity	Risk level	Prevention and/or mitigation measures	Residual risk
Delay in project implementation	n/a	Low financial absorption capacity at national and local level	Delay in project start	Short to medium	Delay in establishing positive cash flow	D	II	Moderate	Capacity development within partner systems	Moderate
Delay in project approval and implementation	n/a	Lack of expressed co-financing commitment from donors for priority projects	Delay in project start	Short to medium	Delay in establishing positive cash flow	C	III	Moderate	Corporate development programme as part of technical assistance	Low to moderate
Project indicators and cash flow forecast not met	Operating revenues	Lower number of actual consumers than estimated after the investment implementation	Reduced project efficiency and financial stability of operator	Medium	Negative	D	III	High	Corporate development programme – revenue enhancement activities, as part of technical assistance; public information campaign	Moderate
Unclear tariff regime	Operating revenues	Political interference in tariff adjustments	Reduced project efficiency and financial stability of operator	Short to medium	Negative	C	III	Moderate	Policy recommendations at national level; Corporate development programme as part of technical assistance	Low to moderate

Table 10-4: Risk matrix, project implementation and management risks

Adverse event	Variable	Causes	Effect	Timing (short, medium, long-term)	Effect on cash flows	Probability	Severity	Risk level	Prevention and/or mitigation measures	Residual risk
Difficulties in supplementing project teams with qualified staff	n/a	Insufficient technical expertise at local level	Reduced project efficiency	Medium	Delay in establishing positive cash flow	C	III	High	Corporate development programme as part of technical assistance; establishment of Project Implementation Unit (PIU)	Moderate
Difficulties in supplementing project teams with qualified staff	n/a	Insufficient project management and implementation experience at local level	Reduced project efficiency	Medium	Delay in establishing positive cash flow	C	III	High	Corporate development programme as part of technical assistance; establishment of PIU	Moderate
Construction delays	n/a	Insufficient project management and implementation experience at local level	Reduced project efficiency	Short to medium	Delay in benefits to public	C	II	Moderate	Corporate development programme and technical supervision as part of technical assistance; assistance to PIU	Moderate
Cost overruns in excess of contingencies	n/a	Insufficient project management and implementation experience at local level	Reduced project efficiency	Short to medium	Negative	C	III	Moderate	Corporate development programme and technical supervision as part of technical assistance; assistance to PIU	Low to moderate
Project targets not met	n/a	Outdated construction standards of materials and technologies applied for design and project implementation	Project not meeting local needs	Medium to long-term	Delay in benefits to public	C	III	Moderate	Lobbying within partner systems; Technical supervision as part of technical assistance; assistance to PIU	Moderate

Table 10-5: Risk level

Severity/Probability	I - none	II – minor	III – moderate	IV - critical	V - catastrophic
A. Very unlikely (0-10% probability)	Low	Low	Low	Low	Moderate
B. Unlikely (10–33% probability)	Low	Low	Moderate	Moderate	High
C. About as likely as not (33–66% probability)	Low	Low	Moderate	High	High
D. Likely (66–90% probability)	Low	Moderate	High	Very high	Very high
E. Very likely (90–100% probability)	Moderate	High	Very high	Very high	Very high

10.3.2 Interpretation of risk matrix

Adverse events for which the residual risk is higher than “moderate” should be modeled in a probabilistic risk analysis. It is assumed that all risk resulting from the adverse events will be mitigated down to at least “moderate” level through the measures indicated, with the exception of the political risk from elections and the winding up of various governments. This risk, in turn, cannot be adequately modeled in a probabilistic risk analysis.

The main mitigation measures are related to lobbying within partner systems (work with line ministries), establishment and assistance to a Project Implementation Unit, and technical assistance to the WSS operator through a corporate development programme. The corporate development programme is described in 5.7.5 – Technical Assistance.

Annexes

Annex 3	Legal and regulatory framework
Annex 4	General information on consumers
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Annex 3

Legal and regulatory framework

Annex 3: Legal and regulatory framework

International regulations:

- Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991), ratified by Parliament Decision No. 1546-XII dated 23 June, 1993. It was applied in construction impact assessment of a larger number of facilities, including Giurgiulesti terminal on Prut - Danube Rivers;
- Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992), ratified by Republic of Moldova Parliament Decision no. 1546 -XII dated 23 June 1993. Institutional cooperation entities in transboundary watercourses management were established based on bilateral cooperation agreements with Ukraine (11.23.1994) and Romania (08.28.2010);
- Convention on the Transboundary Effects of Industrial Accidents (Helsinki, 1992), ratified by Parliament Decision no. 1546-XII dated 23 June, 1993;
- Convention on cooperation and protection and sustainable use of the Danube River (Sofia, 1994) created the general legal instrument for cooperation in transboundary watercourse management in Danube River basin. The Convention was ratified by Republic of Moldova Parliament Decision no. 323-XIV of 17 March 1999, respectively that is a part of the management committee of Danube river basin;
- Convention on Access to Environmental Information, Public Participation in Environmental Decision-making and Access to Justice in environmental matters (The Aarhus Convention) was signed on 25 June 1998 and entered into force on 30 October 2001. The Aarhus Convention was ratified by Republic of Moldova Parliament Decision o. n46-XIV dated 07 April 1999 and the National Action Plan for implementing the Aarhus Convention in Moldova was approved by Government Decision no. 471 dated 28 June 2011;
- The Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes EEC UNO / WHO-EURO, adopted in London on 17 June 1999 entered into force on 4 August 2005. Republic of Moldova ratified the Protocol on Water and Health based on Law No. 207 dated 29 July 2005.

National Regulations:

- Law on local public administration no. 436 dated 12.28.2006, published in Monitorul Oficial, Republic of Moldova no. 32-35 dated 03.09.2007;
- Law on administrative decentralisation no. 435-XVI dated 12.28.2006, published in Monitorul Oficial, Republic of Moldova no. 29-31/91 dated 03.02.2007;
- Law on Local Public Finances No. 397-XV of 10.16.2003, published in Monitorul Oficial of Republic of Moldova no. 248/253 dated 10.16.2003;
- Law on public utility services no. 1402-XV of 10.24.2002, published in Monitorul Oficial, Republic of Moldova no.14-17/49 dated 02.07.2003;
- Law on Water Supply and Sanitation Public Services no. 303 dated 13 December 2013, published in Monitorul Oficial, Republic of Moldova no. 60-65 dated 03.14.2014;

- Water Law no. 272 of 23 December 2011, published in Monitorul Oficial al Republicii Moldova no. 81 dated 04.26.2012;
- Law on drinking water no. 272-XIVof 02.10.1999, published in Monitorul Oficial, Republic of Moldova no. 39-41 dated 22 April 1999;
- Law on state supervision of public health no. 10-XVI dated 02.03.2009, published in Monitorul Oficial, Republic of Moldova No. 67/183 dated 04.03.2009;
- Law on Public - Private Partnership no. 179-XVI of 07.10.2008, published in Monitorul Oficial, Republic of Moldova no. 165-166/605 dated 09.02.2008;
- Law on Concessions no. 534-XIII of 07.13.95, published in Monitorul Oficial, Republis of Moldova no. 67/752 dated 11.30.1995;
- Law on protection areas and protection strips of river waters and water basins no. 440-XIII of 27 Aprilie 1995, published in Monitorul Oficial, Republic of Moldova no. 43/482 dated 08.03.1995;
- Law on irrigation water users associations no. 171 of 07.09.2010, published in Monitorul Oficial, Republic of Moldova no. 160-162 dated 09.07.2010;
- Civil Code of Republic of Moldova no. 1107-XV of 6 June 2002, published in Monitorul Oficial, Republic of Moldova no. 82-86 dated 06.22.2002;
- Law on entrepreneurship and enterprises no. 845-XII of 01.03.1992, published in Monitorul Oficial, Republic of Moldova no. 2 dated 02.28.1994;
- Law on Joint Stock Companies no.1134-XIII of 04.02.1997, published in Monitorul Oficial, Republic of Moldova no. 38-39 dated 06.12.1997;
- Law on Limited Liability Companies no. 135 of 06.14.2007, published in Monitorul Oficial, Republic of Moldova no. 127-130 dated 08.17.2007;
- The law on state registration of legal entities and individual entrepreneurs no. 220-XVI of 10.19.2007, published in Monitorul Oficial, Republic of Moldova no. 184-187 dated 11.30.2007;
- Government Decision of Republic of Moldova no. 685 dated September 4 2013 on the National Strategy for Regional Development for the period 2013-2015, published in Monitorul Oficial, Republic of Moldova no. 198-204 dated 09.13.2013;
- Government Decision of Republic of Moldova on approval of Water Supply and Sanitation Strategy (2014-2028) no. 199 dated 20 March 2014, published in Monitorul Oficial, Republicof Moldova no. 72-77 dated 03.28.2014;
- Government Decision of Republic of Moldova no. 802 dated 10.09.2013 for approving the Regulation on conditions for waste water discharge into water bodies, published in Monitorul Oficial, Republic of Moldova no. 243-247 dated 11.01.2013;
- Government Decision of Republic of Moldova no. 950 of 25 November 2013 approving the Regulation on requirements for collection, treatment and discharge of wastewater into the sewerage system and / or water bodies for urban and rural areas, published in Monitorul Oficial, Republic of Moldova no. 284-289 dated 12.06.2013;

- Government Decision of Republic of Moldova no. 387 of 06.06.1994 on the approval of the Model Regulation for Municipal enterprises, published in Monitorul Oficial, Republic of Moldova no. 2 dated 09.02.1994;
- Government Decision of Republic of Moldova no. 1006 of 09.13.2004 on the approval of the Regulation on public utility service concession, published in Monitorul Oficial, Republic of Moldova no. 171 dated 09.17.2004;
- Government Decision of Republic of Moldova no. 656 of 05.27.2002 on the approval of the Regulation Framework on the use of municipal water supply and sewerage system, published in Monitorul Oficial, Republic of Moldova no. 71-73 dated 06.06.2002;
- Government Decision of Republic of Moldova no. 1228 dated 11.13.2007 approving the Regulation on the acquisition, designing, installation, reception and operation of the equipment for recording water consumption, published in Monitorul Oficial, Republic of Moldova no. 180-183 dated 11.23.2007;
- Government Decision of Republic of Moldova no. 1188 dated in 11.02.2004 on the Action Plan related to the operation of the 'Soroca - Balti' water main and the water supply of some areas of the country, published in Monitorul Oficial, Republic of Moldova no. 199-204 of 11.05.2004;
- Government Decision of Republic of Moldova no. 619 dated 08.16.1994 on the regulation of links in the field of water management and rational use of water resources in Republic of Moldova, published in Monitorul Oficial, Republic of Moldova no. 3 dated 09.08.1994;
- Decision of the National Agency for Energy Regulation no. 741 of 12.18.2014 on approving the Methodology for determination, approval and application of tariffs for public water supply, sanitation and wastewater treatment services, published in Monitorul Oficial, Republic of Moldova no. 33-38 dated 02.13.2015;
- Decision of the Ministry of Regional Development, Construction, Housing and Communal Services on the approval of the Strategy for modernization and development of municipal water supply and sewerage systems no. 7/1 dated 05.14.99, published in Monitorul Oficial, Republic of Moldova no. 130-133/238 of 11.25.1999;
- Order of the Ministry of Environment and Ministry of Health on approving the list of target indicators for implementation of the Protocol on Water and Health no. 91 / 704 of 20 October 2010.

Standards for the design and construction of infrastructure in the field of water supply and sanitation are:

- Construction Standard of Moldova / CSM L.01.07: 2005 The structure of the bill of quantity in construction;
- CSM A.07.03: 2014 Procedure on development, notification and approval of special technical conditions regarding project documentation of building projects (this one is valid);
- CSM G.03.01: 2012 Small capacity wastewater treatment plants;
- Practice Code / PC G.03.02-2006 Design and installation of water supply and sewerage systems made of polymer materials;

- PC G.03.06-2011 Design and installation of sewage underground pipes made of glass fiber reinforced plastics;
- SNiP 2.04.01-85 Internal water supply and sewerage systems;
- SNiP 2.04.02-84 Water supply. External networks and installations;
- SNiP 2.04.03-85 Sewerage. External networks and installations;
- SNiP 3.05.04-85 Water supply and sewerage external networks and installations;
- GOST 12.3.006-75* Safety standards system. Operation of the water supply and sewage facilities and networks. General safety requirements;
- Guideline to SNiP 2.04.02 Design of installations for surface water catchment;
- Guideline to SNiP 2.04.02-84 Design of installations for water treatment;
- Guideline to SNiP 2.04.03-85 Design of installations for wastewater treatment;
- Guideline to SNiP 2.04.02-84 Guideline on the volume and content of the project documentation for external water supply and sewerage systems;
- Guideline to SNiP 3.05.04-85 Guideline on laying and installation of cast iron, concrete and asbestos-cement pipelines of water supply and sewerage systems.

Annex 4

General information on consumers

Annex 4: General information on consumers

Table 4-1: General information about public institutions in the town of Edinet

No.	Public institution name	No. of pupils/children/ /places/beds	Employee's number	Connected to water supply system	Connected to centralized sewer system
1.	Theoretical Lyceum „Mihai Eminescu"	525	62	yes	yes
2.	Theoretical Lyceum "Suhomlinschi"	435	56	yes	yes
3.	Theoretical Lyceum „Pan Halippa"	300	39	no	yes
4.	Theoretical Lyceum „Dimitrie Cantemir"	269	36	yes	no
5.	Gymnasium Edinet	435	56	yes	yes
6.	Kindergarten no. 1	157	29	yes	yes
7.	Kindergarten no. 2	270	64	yes	yes
8.	Kindergarten no. 3	135	26	yes	yes
9.	Kindergarten no. 4	160	32	yes	yes
10.	Public Health Centre			yes	yes
11.	Centre of Family Physicians			yes	yes
12.	Raion Hospital			yes	yes

Source: LPA Edinet, ME 'Apa-Canal' Edinet

Table 4-2: General information about public institutions in the town of Cupcini

No.	Public institution name	No. of pupils/children/ places/beds	Employee's number	Connected to water supply system	Connected to centralized sewer system
1.	Theoretical Lyceum „Sofia Kovalevschi"	270	38	yes	yes
2.	Theoretical Lyceum „Mihail Sadoveanu"	327	39	no	yes
3.	Gymnasium Cupcini	107	26	yes	yes
4.	Technologic school Cupcini	500	113	yes	yes
5.	Kindergarten no. 1	90	22	no	yes
6.	Kindergarten no. 2	80	15	yes	no
7.	Kindergarten no. 3	140	30	Nu	yes
8.	Kindergarten no. 4	38	15	yes	no
9.	Cupcini Hospital			yes	yes

Source: LPA Edinet, ME 'Apa-Canal' Edinet

Table 4-3: General information about business entities in the town of Edinet

No.	Business entity	Employee's number	Field	Type of property	Drinking water flow rate (m^3/year)	Collected wastewater flow rate (m^3/year)
1.	Ltd. Caroservice	23	commerce	private	516	516
2.	Ltd. Fourchette-M	55	commerce	private	1,405	1,405
3.	Ltd. Salin Impex	9	commerce	private	226	128
4.	Ltd. Mobisistem	15	commerce	private	228	228
5.	Ltd. Bemol Retail	12	commerce	private	797	-
6.	Ltd. Irin profit	5	commerce	private	-	400
7.	I.E Lesnic Galina	5	commerce	private	-	204
8.	Ltd.SRL Neoservice	14	commerce	private	708	840
9.	Ltd.SRL Vlados com	85	commerce	private	442	919
10.	Ltd.SRL Arisa farm	18	commerce	private	-	720
11.	RED Nord Vest	54	commerce	private	250	-
12.	JSC Volan	40	commerce	private	1,464	1,464
13.	Ltd. Vladen Stil	12	commerce	private	200	200
14.	Ltd. Gloria Qvarc	77	commerce	private	-	780
15.	Ltd. Maximos Pan	67	commerce	private	-	616
16.	JSC Banca de Economii	67	commerce	private	495	495
17.	Banca Sociala	20	commerce	private	200	200
18.	JSC Moldtelecom	55	commerce	private	200	200
19.	I.E. Dolghii	10	commerce	private	307	307
20.	Ltd. Catarvai	4	commerce	private	200	200
21.	HP Martorii lui Ehova	5	commerce	private	-	200
22.	Ltd. Danlex MVM	10	commerce	private	-	200
23.	I.E. Bagrii	5	commerce	private	330	-
24.	R.H. Scutaru Victor	7	commerce	private	537	-
25.	Ltd. Vahenat	9	commerce	private	327	327
26.	Ltd. Sitind	7	commerce	private	-	680
27.	Biserica Penticostala	3	commerce	private	395	-
28.	Ltd. Expertauto Nord	3	commerce	private	330	-

Source: LPA Edinet, ME 'Apa-Canal' Edinet

Table 4-4: General information about business entities in the town of Cupcini

No.	Business entity	Employee's number	Field	Type of property	Drinking water flow rate (m^3/year)	Collected wastewater flow rate (m^3/year)
1.	JSC NaturBravo		commerce	private	155,920	132,533
2.	JSC InLac	130	commerce	private	9,352	8,226
3.	Ltd. Astra	100	commerce	private	-	1,200
4.	Ltd. Floreana Fashion	350	commerce	private	1,218	1,218
5.	Ltd. Gigacom	18	commerce	private	265	-
6.	FFE Moldova Zahar	100	commerce	private	-	342
7.	Ltd. Nic-ol	65	commerce	private	918	325
8.	Ltd. Megastoc prim	20	commerce	private	1,955	-
9.	Roman-Catholic parish	4	commerce	private	235	-

Source: LPA Cupcini, ME 'Apa-Canal' Edinet

Annex 5

Investment Programme

Annex 5: Investment Programme

Annex 5.1: Water Demand Projection

N°	Parameter	Unit	2014*	2015	2016	2017	2018**	2019	2020	2021***	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
1	**Population in the project area served with water**																																	
1.1	Total population serviced	N°	20,946	20,946	20,946	20,946	21,696	21,696	21,696	24,859	25,111	25,362	25,614	25,866	26,118	26,370	26,622	26,875	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127
1.2	In urban settlements	N°	20,946	20,946	20,946	20,946	21,696	21,696	21,696	24,859	25,111	25,362	25,614	25,866	26,118	26,370	26,622	26,875	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127	27,127
1.3	In rural settlements	N°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	**Volume of water sold in total and disaggr. for different consumers**																																	
2.1	Total volume sold	m^3/y	444,747	472,817	500,888	528,958	576,966	606,041	635,116	761,011	802,368	844,402	887,114	930,503	974,571	1,019,317	1,064,741	1,110,844	1,157,627	1,182,766	1,207,905	1,233,044	1,258,183	1,283,321	1,308,460	1,333,599	1,358,738	1,383,877	1,409,016	1,434,155	1,459,293	1,484,432	1,509,571	1,534,710
2.2	Domestic customers	m^3/y	239,250	258,661	278,073	297,484	328,237	348,343	368,449	445,195	472,973	501,220	529,934	559,117	588,769	618,889	649,479	680,538	712,066	737,205	762,344	787,483	812,622	837,761	862,899	888,038	913,177	938,316	963,455	988,594	1,013,732	1,038,871	1,064,010	1,089,149
2.3	Industrial customers	m^3/y	192,813	197,487	202,160	206,834	219,078	223,918	228,759	267,652	275,965	284,391	292,931	301,583	310,349	319,229	328,221	337,328	346,547	346,547	346,547	346,547	346,547	346,547	346,547	346,547	346,547	346,547	346,547	346,547	346,547	346,547	346,547	346,547
2.4	Institutional customers	m^3/y	12,684	16,670	20,655	24,641	29,651	33,779	37,908	48,164	53,429	58,791	64,249	69,803	75,452	81,198	87,041	92,979	99,014	99,014	99,014	99,014	99,014	99,014	99,014	99,014	99,014	99,014	99,014	99,014	99,014	99,014	99,014	99,014
3	**Total water sold disaggr. for urban and rural areas**																																	
3.1	Urban Settlements	m^3/y	444,747	472,817	500,888	528,958	576,966	606,041	635,116	761,011	802,368	844,402	887,114	930,503	974,571	1,019,317	1,064,741	1,110,844	1,157,627	1,182,766	1,207,905	1,233,044	1,258,183	1,283,321	1,308,460	1,333,599	1,358,738	1,383,877	1,409,016	1,434,155	1,459,293	1,484,432	1,509,571	1,534,710
3.2	Rural settlements	m^3/y	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	**Non-Revenue Water (NRW) volume dissagregated for total NRW, apparent losses, and real losses**																																	
4.1	Total NRW	m^3/y	1,066,243	1,133,539	945,813	799,703	705,180	647,837	604,135	622,645	634,709	645,719	655,693	664,645	672,591	679,544	685,518	690,525	694,576	684,759	674,544	663,947	652,981	641,661	629,999	618,009	605,703	593,090	580,183	566,991	553,525	539,794	525,806	511,570
4.2	Apparent losses	m^3/y	380,823	404,859	339,527	288,778	256,429	229,878	211,705	207,548	209,574	211,101	212,136	212,686	212,758	212,358	211,490	210,160	208,373	202,315	196,088	189,699	183,153	176,457	169,615	162,634	155,518	148,273	140,902	133,410	125,801	118,080	110,250	102,314
4.3	Real losses (physical losses)	m^3/y	685,420	728,681	606,287	510,925	448,751	417,959	392,429	415,097	425,135	434,619	443,557	451,959	459,833	467,187	474,029	480,365	486,203	482,444	478,456	474,248	469,828	465,204	460,384	455,375	450,184	444,818	439,281	433,582	427,724	421,714	415,556	409,256
5	**The water demand figures considering the demand variation factors**																																	
5.1	Yearly water demand/production	m^3/y	1,510,990	1,606,357	1,446,701	1,328,661	1,282,146	1,253,878	1,239,251	1,383,657	1,437,077	1,490,122	1,542,807	1,595,148	1,647,162	1,698,861	1,750,259	1,801,369	1,852,204	1,867,525	1,882,449	1,896,990	1,911,163	1,924,982	1,938,460	1,951,609	1,964,441	1,976,967	1,989,199	2,001,146	2,012,819	2,024,226	2,035,377	2,046,280
5.2	Average daily water demand	m^3/d	4,140	4,401	3,964	3,640	3,513	3,435	3,395	3,791	3,937	4,083	4,227	4,370	4,513	4,654	4,795	4,935	5,075	5,117	5,157	5,197	5,236	5,274	5,311	5,347	5,382	5,416	5,450	5,483	5,515	5,546	5,576	5,606
5.3	Maximum daily water demand	m^3/d	4,262	4,531	4,101	3,785	3,671	3,601	3,569	3,999	4,157	4,314	4,470	4,625	4,780	4,934	5,087	5,240	5,392	5,441	5,488	5,535	5,581	5,626	5,669	5,712	5,754	5,795	5,836	5,876	5,914	5,953	5,990	6,027
5.4	Average hourly water demand	m^3/h	172	183	165	152	146	143	141	158	164	170	176	182	188	194	200	206	211	213	215	217	218	220	221	223	224	226	227	228	230	231	232	234
5.5	Max. hourly water demand	m^3/h	216	229	214	203	202	202	203	232	242	252	262	272	282	293	303	313	324	328	332	336	340	344	348	352	356	360	363	367	371	375	378	382

Annex 5.2: Wastewater Flow and Load Projection

N°	Parameter	Unit	2014*	2015	2016	2017	2018**	2019	2020	2021***	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
1	**Population in the project area served with sewerage**																																	
1.1	Total population serviced	N°	12,501	12,501	12,501	12,501	12,501	12,501	12,501	16,959	17,723	18,503	19,300	20,112	20,940	21,785	22,645	23,522	24,414	24,505	24,595	24,686	24,776	24,866	24,957	25,047	25,138	25,228	25,319	25,409	25,499	25,590	25,680	25,771
1.2	In urban settlements	N°	12,501	12,501	12,501	12,501	12,501	12,501	12,501	16,959	17,723	18,503	19,300	20,112	20,940	21,785	22,645	23,522	24,414	24,505	24,595	24,686	24,776	24,866	24,957	25,047	25,138	25,228	25,319	25,409	25,499	25,590	25,680	25,771
1.3	In rural settlements	N°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	**Volume of wastewater charged in total and disaggr. for different customers**																																	
2.1	Total volume of wastewater gen,	m^3/y	329,531	347,725	365,918	384,112	402,306	420,499	438,693	619,798	673,525	730,110	789,622	852,130	917,705	986,417	1,058,336	1,133,531	1,212,073	1,239,807	1,267,713	1,295,791	1,324,040	1,352,460	1,381,052	1,409,816	1,438,751	1,467,858	1,497,136	1,526,586	1,556,207	1,586,000	1,615,964	1,646,100
2.2	by domestic customers	m^3/y	134,305	146,164	158,022	169,881	181,739	193,598	205,456	294,802	324,901	356,758	390,421	425,933	463,341	502,691	544,028	587,397	632,844	658,433	684,193	710,125	736,229	762,504	788,951	815,569	842,359	869,321	896,454	923,758	951,234	978,882	1,006,701	1,034,692
2.3	by industrial customers	m^3/y	182,704	186,970	191,236	195,502	199,768	204,034	208,300	288,360	307,404	327,254	347,924	369,433	391,796	415,029	439,150	464,173	490,117	491,932	493,748	495,563	497,378	499,193	501,009	502,824	504,639	506,454	508,270	510,085	511,900	513,715	515,531	517,346
2.4	by Institutional customers	m^3/y	12,522	14,591	16,660	18,730	20,799	22,868	24,937	36,636	41,221	46,098	51,277	56,764	62,568	68,697	75,159	81,961	89,112	89,442	89,772	90,102	90,432	90,762	91,092	91,423	91,753	92,083	92,413	92,743	93,073	93,403	93,733	94,063
3	**Total wastewater charged disaggr, for urban and rural areas**																																	
3.1	in urban Settlements	m^3/y	329,531	347,725	365,918	384,112	402,306	420,499	438,693	619,798	673,525	730,110	789,622	852,130	917,705	986,417	1,058,336	1,133,531	1,212,073	1,239,807	1,267,713	1,295,791	1,324,040	1,352,460	1,381,052	1,409,816	1,438,751	1,467,858	1,497,136	1,526,586	1,556,207	1,586,000	1,615,964	1,646,100
3.2	in rural settlements	m^3/y	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	**The sewer infiltration water based on the determined infiltration rate**																																	
4.1	**Sewer Infiltration water**	m^3/y	164,766	169,516	173,811	177,652	181,038	147,175	109,673	92,970	101,029	109,517	118,443	127,820	137,656	147,963	158,750	170,030	181,811	185,971	190,157	194,369	198,606	202,869	207,158	211,472	215,813	220,179	224,570	228,988	233,431	237,900	242,395	246,915
5	**The wastewater generation figures considering the variation factors**																																	
5.1	Avg, wastewater flow (dry weather)	m^3/y	494,297	517,240	539,730	561,764	583,343	567,674	548,366	712,767	774,554	839,627	908,065	979,950	1,055,361	1,134,380	1,217,086	1,303,561	1,393,884	1,425,778	1,457,870	1,490,159	1,522,645	1,555,329	1,588,210	1,621,288	1,654,563	1,688,036	1,721,706	1,755,573	1,789,638	1,823,900	1,858,359	1,893,015
5.2	Max, daily dry weather flow (Qdmax)	m^3/d	1,445	1,512	1,579	1,644	1,708	1,670	1,623	2,123	2,307	2,500	2,704	2,918	3,143	3,378	3,624	3,882	4,151	4,246	4,341	4,438	4,534	4,632	4,730	4,828	4,927	5,027	5,127	5,228	5,329	5,432	5,534	5,637
5.3	Max, hourly dry weather flow (QDWF)	m^3/h	93	98	103	107	112	112	112	151	164	178	192	207	223	240	257	276	295	301	308	315	322	329	336	343	350	357	364	371	378	386	393	400
5.4	Max, hourly Storm Water Flow (QSWF)	m^3/h	121	127	133	139	145	145	145	196	213	231	250	269	290	312	335	358	383	392	401	410	419	428	437	446	455	464	473	483	492	501	511	520
6	**Population equivalents in total and disaggr, for different customers**																																	
6.1	Total population equivalent	PE_{60}	14,507	14,572	14,637	14,702	14,767	14,832	14,897	20,298	21,305	22,339	23,401	24,491	25,609	26,755	27,929	29,133	30,365	30,478	30,590	30,703	30,815	30,928	31,040	31,153	31,265	31,377	31,490	31,602	31,715	31,827	31,940	32,052
6.2	by domestic customers	PE_{60}	12,501	12,501	12,501	12,501	12,501	12,501	12,501	16,959	17,723	18,503	19,300	20,112	20,940	21,785	22,645	23,522	24,414	24,505	24,595	24,686	24,776	24,866	24,957	25,047	25,138	25,228	25,319	25,409	25,499	25,590	25,680	25,771
6.3	by Industrial and instit, customers	PE_{60}	2,006	2,071	2,136	2,201	2,266	2,331	2,396	3,339	3,582	3,836	4,101	4,379	4,668	4,970	5,284	5,611	5,951	5,973	5,995	6,017	6,039	6,061	6,083	6,105	6,127	6,149	6,171	6,193	6,215	6,238	6,260	6,282
7	**Pollution load – BOD in total and disaggr, for different customers**																																	
7.1	The total BOD_5 load	kg/d	870	874	878	882	886	890	894	1,218	1,278	1,340	1,404	1,469	1,537	1,605	1,676	1,748	1,822	1,829	1,835	1,842	1,849	1,856	1,862	1,869	1,876	1,883	1,889	1,896	1,903	1,910	1,916	1,923
7.2	by domestic customers	kg/d	750	750	750	750	750	750	750	1,018	1,063	1,110	1,158	1,207	1,256	1,307	1,359	1,411	1,465	1,470	1,476	1,481	1,487	1,492	1,497	1,503	1,508	1,514	1,519	1,525	1,530	1,535	1,541	1,546
7.3	by industrial and instit, customers	kg/d	120	124	128	132	136	140	144	200	215	230	246	263	280	298	317	337	357	358	360	361	362	364	365	366	368	369	370	372	373	374	376	377

Annex 5.3: Development of connection rates water supply

N°	Settlement	2014*	2015	2016	2017	2018**	2019	2020	2021***	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
1	Edinet	80%	80%	80%	80%	84%	84%	84%	93%	94%	95%	95%	96%	97%	98%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
2	Cupcini	72%	72%	72%	72%	72%	72%	72%	88%	90%	91%	92%	94%	95%	96%	97%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
TOT	**Total**	**77%**	**77%**	**77%**	**77%**	**80%**	**80%**	**80%**	**92%**	**93%**	**93%**	**94%**	**95%**	**96%**	**97%**	**98%**	**99%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Annex 5.4: Development of connected population water supply

N°	Settlement	2014*	2015	2016	2017	2018**	2019	2020	2021***	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
1	Edinet	14,507	14,507	14,507	14,507	15,257	15,257	15,257	16,971	17,108	17,246	17,384	17,521	17,659	17,797	17,935	18,073	18,211	18,211	18,211	18,211	18,211	18,211	18,211	18,211	18,211	18,211	18,211	18,211	18,211	18,211	18,211	18,211
2	Cupcini	6,439	6,439	6,439	6,439	6,439	6,439	6,439	7,888	8,002	8,116	8,231	8,345	8,459	8,573	8,688	8,802	8,916	8,916	8,916	8,916	8,916	8,916	8,916	8,916	8,916	8,916	8,916	8,916	8,916	8,916	8,916	8,916
TOT	**Total**	**20,946**	**20,946**	**20,946**	**20,946**	**21,696**	**21,696**	**21,696**	**24,859**	**25,111**	**25,362**	**25,614**	**25,866**	**26,118**	**26,370**	**26,622**	**26,875**	**27,127**	**27,127**	**27,127**	**27,127**	**27,127**	**27,127**	**27,127**	**27,127**	**27,127**	**27,127**	**27,127**	**27,127**	**27,127**	**27,127**	**27,127**	**27,127**

Annex 5.5: Development of connection rates wastewater

N°	Settlement	2014*	2015	2016	2017	2018**	2019	2020	2021***	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
1	Edinet	46	46	46	46	46	46	46	57	60	64	67	71	75	78	82	86	90	90	91	91	91	92	92	92	93	93	93	94	94	94	95	95
2	Cupcini	47	47	47	47	47	47	47	74	76	77	79	81	83	84	86	88	90	90	91	91	91	92	92	92	93	93	93	94	94	94	95	95
TOT	**Total**	**46**	**46**	**46**	**46**	**46**	**46**	**46**	**63**	**65**	**68**	**71**	**74**	**77**	**80**	**83**	**87**	**90**	**90**	**91**	**91**	**91**	**92**	**92**	**92**	**93**	**93**	**93**	**94**	**94**	**94**	**95**	**95**

Annex 5.6: Development of connected population wastewater

N°	Settlement	2014*	2015	2016	2017	2018**	2019	2020	2021***	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
1	Edinet	8,293	8,293	8,293	8,293	8,293	8,293	8,293	10,376	10,986	11,611	12,249	12,903	13,571	14,254	14,951	15,663	16,390	16,451	16,511	16,572	16,633	16,693	16,754	16,815	16,876	16,936	16,997	17,058	17,118	17,179	17,240	17,300
2	Cupcini	4,208	4,208	4,208	4,208	4,208	4,208	4,208	6,582	6,737	6,893	7,050	7,209	7,369	7,531	7,694	7,859	8,024	8,054	8,084	8,114	8,143	8,173	8,203	8,232	8,262	8,292	8,322	8,351	8,381	8,411	8,440	8,470
TOT	**Total**	**12,501**	**12,501**	**12,501**	**12,501**	**12,501**	**12,501**	**12,501**	**16,959**	**17,723**	**18,503**	**19,300**	**20,112**	**20,940**	**21,785**	**22,645**	**23,522**	**24,414**	**24,505**	**24,595**	**24,686**	**24,776**	**24,866**	**24,957**	**25,047**	**25,138**	**25,228**	**25,319**	**25,409**	**25,499**	**25,590**	**25,680**	**25,771**

Annex 6

Financial and economic analysis

Annex 6: Financial and economic analysis

Table 6-1: Macroeconomic forecast

Indicator	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Real Wage Increase	1.50%	3.00%	4.60%	4.30%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Base Case	1.50%	3.00%	4.60%	4.30%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Pessimistic	0.75%	1.50%	2.30%	2.15%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Optimistic	3.50%	5.00%	6.60%	6.30%	5.00%	5.00%	5.00%	6.00%	6.00%	6.00%	6.00%	5.00%	5.00%	5.00%	5.00%
Real GDP growth	-2.00%	1.50%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Base Case	-2.00%	1.50%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Pessimistic	-2.00%	0.75%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Optimistic	-2.00%	3.00%	4.50%	5.00%	5.00%	5.00%	5.00%	6.00%	6.00%	6.00%	6.00%	5.00%	5.00%	5.00%	5.00%
Costs of electricity	0.0%	37.0%	1.0%	1.0%	1.0%	1.0%	1.0%	3.0%	3.0%	3.0%	3.0%	3.0%	2.5%	2.5%	2.5%
Base Case	0.0%	37.0%	1.0%	1.0%	1.0%	1.0%	1.0%	3.0%	3.0%	3.0%	3.0%	3.0%	2.5%	2.5%	2.5%
Pessimistic	0.0%	37.0%	2.3%	2.4%	2.3%	2.4%	2.4%	6.0%	6.0%	6.0%	6.0%	6.0%	5.0%	5.0%	5.0%
Optimistic	0.0%	37.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%

Indicator	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Real Wage Increase	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Base Case	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Pessimistic	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
Optimistic	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Real GDP growth	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Base Case	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Pessimistic	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
Optimistic	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Costs of electricity	2.5%	2.5%	5.0%	5.0%	5.0%	5.0%	5.0%	4.0%	4.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%
Base Case	2.5%	2.5%	5.0%	5.0%	5.0%	5.0%	5.0%	4.0%	4.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%
Pessimistic	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	4.0%	4.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%
Optimistic	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%

Table 6-2: Investment costs for water supply

			TOTAL	1	2	3	4	5
Equipment and tools		MDL M	4.16	0.42	2.08	1.66		
Pipelines		MDL M	39.23	3.92	19.61	15.69		
Water towers								
Reservoirs								
Pumping stations								
Water treatment plant								
TOTAL Construction and installation costs		**MDL M**	**43.38**	**4.34**	**21.69**	**17.35**	**0.00**	**0.00**
Design and engineering		MDL M	5.21	0.52	2.60	2.08	0.00	0.00
Technical assistance		MDL M	6.23	0.62	3.12	2.49	0.00	0.00
Contingencies		MDL M	5.48	0.55	2.74	2.19	0.00	0.00
TOTAL Investment Costs		**MDL M**	**60.31**	**6.03**	**30.15**	**24.12**	**0.00**	**0.00**

Table 6-3: Depreciation rates for water supply

		years	%
1	Pipelines	50	2.0%
2	Water towers	16	6.3%
3	Reservoirs	20	5.0%
4	Pumping stations	20	5.0%
5	Equipment and tools	10	10.0%
6	Water treatment plant	35	2.9%
7	Land acquisition	99999999	0.0%
8	Technical assistance	50	2.0%
9	Contingency	50	2.0%

Table 6-4: Summary of investment costs for water supply

			TOTAL	1	2	3	4	5	6
1	Pipelines	MDL M	39.2	3.9	19.6	15.7	0.0	0.0	0.0
2	Water towers	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	Reservoirs	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	Pumping stations	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Equipment and tools	MDL M	4.2	0.4	2.1	1.7	0.0	0.0	0.0
6	Water treatment plant	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	Land acquisition	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	Technical assistance	MDL M	11.4	1.1	5.7	4.6	0.0	0.0	0.0
9	Contingency	MDL M	5.5	0.5	2.7	2.2	0.0	0.0	0.0
	TOTAL	MDL M	60.3	6.0	30.2	24.1	0.0	0.0	0.0

Table 6-5: Depreciation for water supply

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Pipelines	MDL M		0.1	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
2	Water towers	MDL M		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	Reservoirs	MDL M		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	Pumping stations	MDL M		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Equipment and tools	MDL M		0.0	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
6	Water treatment plant	MDL M		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	Land acquisition	MDL M		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	Technical assistance	MDL M		0.0	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
9	Contingency	MDL M		0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	TOTAL Depreciation costs	MDL M	**0.0**	**0.2**	**1.0**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Pipelines	MDL M	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
2	Water towers	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	Reservoirs	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	Pumping stations	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Equipment and tools	MDL M	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
6	Water treatment plant	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	Land acquisition	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	Technical assistance	MDL M	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
9	Contingency	MDL M	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	TOTAL Depreciation costs	MDL M	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**

Table 6-6: Gross value of new assets for water supply

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Pipelines	MDL M	3.9	23.5	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2
4	Pumping stations	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Equipment and tools	MDL M	0.4	2.5	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
8	Technical assistance	MDL M	1.1	6.9	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4
9	Contingency	MDL M	0.5	3.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
	TOTAL	MDL M	**6.0**	**36.2**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Pipelines	MDL M	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2
4	Pumping stations	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Equipment and tools	MDL M	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
8	Technical assistance	MDL M	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4
9	Contingency	MDL M	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
	TOTAL	MDL M	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**	**60.3**

Table 6-7: Net assets for water supply

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Pipelines	MDL M	3.9	23.5	38.7	37.9	37.1	36.3	35.5	34.8	34.0	33.2	32.4	31.6	30.8	30.0	29.3
5	Equipment and tools	MDL M	0.4	2.5	3.9	3.4	3.0	2.6	2.2	1.8	1.4	1.0	0.5	0.1	0.0	0.0	0.0
8	Technical assistance	MDL M	1.1	6.8	11.2	10.9	10.6	10.3	10.0	9.6	9.3	9.0	8.7	8.4	8.1	7.7	7.4
9	Contingency	MDL M	0.5	3.3	5.4	5.2	5.1	4.9	4.8	4.6	4.5	4.3	4.2	4.0	3.9	3.7	3.6
	TOTAL	MDL M	**6.0**	**36.0**	**59.1**	**57.5**	**55.8**	**54.1**	**52.5**	**50.8**	**49.1**	**47.5**	**45.8**	**44.1**	**42.7**	**41.5**	**40.2**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Pipelines	MDL M	28.5	27.7	26.9	26.1	25.3	24.6	23.8	23.0	22.2	21.4	20.6	19.8	19.1	18.3	17.5
5	Equipment and tools	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	Technical assistance	MDL M	7.1	6.8	6.5	6.2	5.8	5.5	5.2	4.9	4.6	4.3	3.9	3.6	3.3	3.0	2.7
9	Contingency	MDL M	3.4	3.3	3.1	2.9	2.8	2.6	2.5	2.3	2.2	2.0	1.9	1.7	1.6	1.4	1.3
	TOTAL	MDL M	**39.0**	**37.7**	**36.5**	**35.2**	**34.0**	**32.7**	**31.5**	**30.2**	**29.0**	**27.7**	**26.5**	**25.2**	**24.0**	**22.7**	**21.5**

Table 6-8: Depreciation costs for water supply

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Pipelines	MDL M		0.1	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
5	Equipment and tools	MDL M		0.0	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.1	0.0	0.0
8	Technical assistance	MDL M		0.0	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
9	Contingency	MDL M		0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	TOTAL	**MDL M**		**0.2**	**1.0**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.4**	**1.3**	**1.3**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Pipelines	MDL M	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
5	Equipment and tools	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	Technical assistance	MDL M	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
9	Contingency	MDL M	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	TOTAL	**MDL M**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**

Table 6-9: Variable costs – summary

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Water supply																
1	Electricity for pumping	MDL M	4.14	5.11	4.74	4.62	4.56	4.56	4.39	4.68	4.98	5.30	5.62	5.96	6.29	6.62	6.96
2	Water treatment costs	MDL M	0.51	0.46	0.42	0.41	0.40	0.39	0.38	0.39	0.40	0.42	0.43	0.44	0.45	0.47	0.48
	TOTAL variable costs for water	MDL M	4.654	5.572	5.164	5.029	4.963	4.951	4.763	5.068	5.384	5.712	6.052	6.405	6.740	7.086	7.443
	Wastewater																
1	Electricity for pumping	MDL M	0.370	0.529	0.556	0.583	0.573	0.559	0.842	0.915	0.993	1.077	1.165	1.259	1.352	1.451	1.554
2	Wastewater treatment costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TOTAL variable costs for water	MDL M	0.370	0.529	0.556	0.583	0.573	0.559	0.842	0.915	0.993	1.077	1.165	1.259	1.352	1.451	1.554

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Water supply																
1	Electricity for pumping	MDL M	7.32	7.56	8.01	8.47	8.96	9.48	10.02	10.49	10.98	11.50	12.03	12.59	13.04	13.51	13.99
2	Water treatment costs	MDL M	0.49	0.49	0.50	0.50	0.51	0.51	0.51	0.52	0.52	0.52	0.53	0.53	0.53	0.54	0.54
	TOTAL variable costs for water	MDL M	7.811	8.060	8.505	8.974	9.468	9.988	10.535	11.010	11.505	12.021	12.558	13.117	13.574	14.044	14.529
	Wastewater																
1	Electricity for pumping	MDL M	1.664	1.742	1.869	2.004	2.147	2.301	2.465	2.614	2.772	2.938	3.113	3.298	3.460	3.629	3.804
2	Wastewater treatment costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TOTAL variable costs for water	MDL M	1.664	1.742	1.869	2.004	2.147	2.301	2.465	2.614	2.772	2.938	3.113	3.298	3.460	3.629	3.804

Table 6-10: Fixed costs

	Water		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1	Maintenance - old assets	MDL M	0.00	0.00	0.00	2.00	2.04	2.08	2.12	2.16	2.21	2.25	2.30	2.34	2.39	2.44	2.49
2	Maintenance - new assets	MDL M	0.00	0.06	0.36	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
3	Salaries and related costs	MDL M	3.13	3.22	3.37	2.51	2.61	2.72	2.83	2.94	3.06	3.18	3.30	3.44	3.57	3.72	3.87
4	Fuel	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	General and administrative expenditures	MDL M	1.11	1.13	1.18	1.02	1.06	1.11	1.15	1.20	1.25	1.30	1.35	1.40	1.46	1.52	1.58
6	Other costs	MDL M	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
	TOTAL fixed costs for water	MDL M	5.202	5.373	5.868	7.097	7.279	7.467	7.661	7.863	8.071	8.288	8.512	8.744	8.984	9.233	9.491
	Wastewater																
1	Maintenance - old assets	MDL M	0.00	0.00	0.00	0.50	0.51	0.52	0.53	0.54	0.55	0.56	0.57	0.59	0.60	0.61	0.62
2	Maintenance - new assets	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Salaries and related costs	MDL M	1.94	2.00	2.09	1.17	1.22	1.27	1.51	1.57	1.63	1.69	1.76	1.83	1.91	1.98	2.06
4	Fuel	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	General and administrative expenditures	MDL M	0.78	0.79	0.82	0.72	0.75	0.78	0.81	0.84	0.87	0.91	0.94	0.98	1.02	1.06	1.11
6	Other costs	MDL M	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	TOTAL fixed costs for wastewater	MDL M	3.360	3.430	3.553	3.038	3.124	3.212	3.493	3.596	3.703	3.814	3.930	4.050	4.174	4.303	4.437

	Water		**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	Maintenance - old assets	MDL M	2.54	2.59	2.64	2.69	2.75	2.80	2.84	2.89	2.93	2.97	3.02	3.06	3.11	3.15	3.20
2	Maintenance - new assets	MDL M	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
3	Salaries and related costs	MDL M	4.02	4.18	4.35	4.52	4.70	4.89	5.04	5.19	5.35	5.51	5.67	5.84	6.02	6.20	6.38
4	Fuel	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	General and administrative expenditures	MDL M	1.64	1.70	1.77	1.84	1.92	1.99	2.05	2.12	2.18	2.24	2.31	2.38	2.45	2.53	2.60
6	Other costs	MDL M	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
	TOTAL fixed costs for water	MDL M	9.759	10.036	10.323	10.621	10.929	11.249	11.498	11.753	12.015	12.285	12.562	12.847	13.140	13.440	13.749
	Wastewater																
1	Maintenance - old assets	MDL M	0.63	0.65	0.66	0.67	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.77	0.78	0.79	0.80
2	Maintenance - new assets	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Salaries and related costs	MDL M	2.14	2.23	2.32	2.41	2.51	2.61	2.69	2.77	2.85	2.94	3.02	3.12	3.21	3.31	3.40
4	Fuel	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	General and administrative expenditures	MDL M	1.15	1.20	1.24	1.29	1.34	1.40	1.44	1.48	1.53	1.57	1.62	1.67	1.72	1.77	1.82
6	Other costs	MDL M	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	TOTAL fixed costs for wastewater	MDL M	4.576	4.721	4.870	5.026	5.188	5.356	5.486	5.621	5.759	5.902	6.048	6.199	6.354	6.513	6.677

Table 6-11: Total costs

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Variable costs	MDL M	5.02	6.10	5.72	5.61	5.54	5.51	5.60	5.98	6.38	6.79	7.22	7.66	8.09	8.54	9.00
2	Fixed costs	MDL M	8.56	8.80	9.42	10.14	10.40	10.68	11.15	11.46	11.77	12.10	12.44	12.79	13.16	13.54	13.93
3	Depreciation	MDL M	1.30	1.47	2.30	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.68	2.55	2.55
	TOTAL costs	MDL M	14.886	16.370	17.442	18.716	18.907	19.157	19.727	20.410	21.120	21.859	22.627	23.425	23.928	24.626	25.478

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Variable costs	MDL M	9.47	9.80	10.37	10.98	11.62	12.29	13.00	13.62	14.28	14.96	15.67	16.42	17.03	17.67	18.33
2	Fixed costs	MDL M	14.33	14.76	15.19	15.65	16.12	16.60	16.98	17.37	17.77	18.19	18.61	19.05	19.49	19.95	20.43
3	Depreciation	MDL M	2.55	2.55	2.55	2.55	2.55	2.55	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
	TOTAL costs	MDL M	26.361	27.111	28.120	29.177	30.285	31.446	31.237	32.251	33.304	34.398	35.534	36.714	37.780	38.879	40.013

Table 6-12: Calculation of the water and wastewater tariff

	Water Supply		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1	Variable and fixed costs	MDL M	9.58	9.86	10.94	11.03	12.13	12.24	12.42	12.42	12.93	13.46	14.00	14.56	15.15	15.72	16.32	16.93
2	Depreciation	MDL M	0.67	0.67	0.83	1.67	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.04	1.92	1.92
3	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Reserve for irregular receivables	MDL M	0.00	0.53	0.53	0.51	0.51	0.44	0.37	0.37	0.38	0.39	0.41	0.42	0.44	0.44	0.46	0.47
5	Sale of water	m3	444,747	472,817	500,888	528,958	576,966	606,041	635,116	649,750	682,946	716,540	750,532	784,924	819,714	854,902	890,489	926,475
6	Tariff without depreciation	MDL M/m3	21.54	21.96	22.91	21.82	21.89	20.92	20.13	19.69	19.49	19.33	19.20	19.09	19.01	18.91	18.84	18.79
7	Tariff with depreciation	MDL M/m3	23.04	23.37	24.57	24.97	25.94	24.78	23.81	23.28	22.91	22.59	22.31	22.07	21.86	21.30	20.99	20.86
8	**Proposed avarage tariff**	**MDL/m3**	**15.57**	**23.00**	**23.00**	**22.00**	**22.00**	**20.92**	**20.13**	**19.69**	**19.49**	**19.33**	**19.20**	**19.09**	**19.01**	**18.91**	**18.84**	**18.79**
	Wastewater Services																	
1	Variable and fixed costs	MDL M	3.71	3.73	3.96	4.11	3.62	3.70	3.77	4.33	4.51	4.70	4.89	5.09	5.31	5.53	5.75	5.99
2	Depreciation	MDL M	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
3	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Reserve for irregular receivables	MDL M	0.00	0.22	0.21	0.19	0.15	0.13	0.11	0.12	0.13	0.13	0.14	0.14	0.15	0.15	0.16	0.17
5	Sale of wastewater	m3	329,531	347,725	365,918	384,112	402,306	420,499	438,693	710,655	750,198	790,603	831,869	873,996	916,985	960,834	1,005,545	1,051,118
6	Tariff without depreciation	MDL M/m3	11.27	11.35	11.38	11.19	9.37	9.10	8.85	6.27	6.19	6.11	6.05	5.99	5.95	5.91	5.88	5.86
7	Tariff with depreciation	MDL M/m3	13.19	13.17	13.11	12.84	10.94	10.61	10.29	7.16	7.03	6.91	6.81	6.72	6.64	6.57	6.51	6.46
8	**Proposed avarage tariff**	**MDL/m3**	**13.17**	**13.17**	**13.00**	**12.00**	**10.94**	**10.61**	**10.29**	**7.16**	**7.03**	**6.91**	**6.81**	**6.72**	**6.64**	**6.57**	**6.51**	**6.46**
	Dynamic prime costs for water	**MDL/m3**		**24.18**														
	Dynamic prime costs for wastewater	**MDL/m3**		**6.74**														

	Water Supply		**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	Variable and fixed costs	MDL M	17.57	18.10	18.83	19.60	20.40	21.24	22.03	22.76	23.52	24.31	25.12	25.96	26.71	27.48	28.28
2	Depreciation	MDL M	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92
3	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Reserve for irregular receivables	MDL M	0.49	0.50	0.52	0.54	0.56	0.58	0.60	0.62	0.64	0.66	0.68	0.70	0.72	0.74	0.75
5	Sale of water	m3	962,859	983,769	1,004,678	1,025,587	1,046,497	1,067,406	1,088,315	1,109,224	1,130,134	1,151,043	1,171,952	1,192,862	1,213,771	1,234,680	1,255,590
6	Tariff without depreciation	MDL M/m3	18.75	18.90	19.26	19.63	20.02	20.44	20.80	21.08	21.37	21.69	22.01	22.35	22.60	22.86	23.12
7	Tariff with depreciation	MDL M/m3	20.75	20.85	21.17	21.50	21.86	22.24	22.56	22.81	23.07	23.35	23.65	23.96	24.18	24.41	24.65
8	**Proposed avarage tariff**	**MDL/m3**	**18.75**	**18.90**	**21.17**	**21.50**	**21.86**	**22.24**	**22.56**	**22.81**	**23.07**	**23.35**	**23.65**	**23.96**	**24.18**	**24.41**	**24.65**
	Wastewater Services																
1	Variable and fixed costs	MDL M	6.24	6.46	6.74	7.03	7.34	7.66	7.95	8.23	8.53	8.84	9.16	9.50	9.81	10.14	10.48
2	Depreciation	MDL M	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
3	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Reserve for irregular receivables	MDL M	0.17	0.18	0.18	0.19	0.20	0.21	0.21	0.22	0.23	0.24	0.24	0.25	0.26	0.27	0.28
5	Sale of wastewater	m3	1,097,551	1,121,511	1,145,583	1,169,767	1,194,063	1,218,471	1,242,991	1,267,624	1,292,368	1,317,225	1,342,193	1,367,274	1,392,466	1,417,771	1,443,188
6	Tariff without depreciation	MDL M/m3	5.84	5.92	6.04	6.17	6.31	6.45	6.57	6.67	6.78	6.89	7.01	7.13	7.24	7.34	7.46
7	Tariff with depreciation	MDL M/m3	6.42	6.49	6.60	6.71	6.84	6.97	7.08	7.17	7.27	7.37	7.48	7.59	7.69	7.79	7.89
8	**Proposed avarage tariff**	**MDL/m3**	**6.42**	**6.49**	**6.60**	**6.71**	**6.84**	**6.97**	**7.08**	**7.17**	**7.27**	**7.37**	**7.48**	**7.59**	**7.69**	**7.79**	**7.89**

Table 6-13: Tariff affordability

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Avarage bill for water (per person)	MDL/month	23.34	25.10	25.68	27.36	27.61	28.10	28.98	30.18	31.40	32.64	33.92	35.23	36.48	37.77	39.10
2	Avarage bill for wastewater (per person)	MDL/month	13.37	14.18	14.01	13.61	13.99	14.36	10.55	10.88	11.22	11.57	11.93	12.31	12.67	13.05	13.44
3	Avarage bill for water and wastewater (per perso	MDL/month	36.71	39.28	39.69	40.96	41.60	42.46	39.53	41.06	42.62	44.22	45.85	47.53	49.16	50.83	52.55
4	Disposable households income	MDL/month	1876.51	1932.81	2021.72	2108.65	2193.00	2280.72	2371.95	2466.82	2565.50	2668.12	2774.84	2885.84	3001.27	3121.32	3246.17
5	Tariff affordability	%	2.0%	2.0%	2.0%	1.9%	1.9%	1.9%	1.7%	1.7%	1.7%	1.7%	1.7%	1.6%	1.6%	1.6%	1.6%
6	Affordability constrains	%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Avarage bill for water (per person)	MDL/month	40.46	42.22	48.89	51.30	53.82	56.44	58.98	61.37	63.84	66.39	69.04	71.77	74.27	76.84	79.47
2	Avarage bill for wastewater (per person)	MDL/month	13.85	14.49	15.24	16.02	16.84	17.70	18.51	19.29	20.11	20.96	21.83	22.75	23.62	24.52	25.45
3	Avarage bill for water and wastewater (per perso	MDL/month	54.31	56.71	64.13	67.32	70.66	74.14	77.49	80.66	83.95	87.35	90.87	94.52	97.89	101.36	104.92
4	Disposable households income	MDL/month	3376.02	3511.06	3651.50	3797.56	3949.46	4107.44	4230.67	4357.59	4488.31	4622.96	4761.65	4904.50	5051.64	5203.19	5359.28
5	Tariff affordability	%	1.6%	1.6%	1.8%	1.8%	1.8%	1.8%	1.8%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	2.0%
6	Affordability constrains	%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%

Table 6-14: Profits and losses - with project

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Sale of water	MDL M	10.87	11.52	11.64	12.69	12.68	12.79	12.79	13.31	13.85	14.41	14.99	15.59	16.17	16.78	17.41
2	Sale of wastewater	MDL M	4.58	4.76	4.61	4.40	4.46	4.51	5.09	5.27	5.46	5.66	5.87	6.09	6.31	6.55	6.79
3	Other revenues	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	**Total revenues**	**MDL M**	**15.45**	**16.28**	**16.25**	**17.10**	**17.14**	**17.30**	**17.88**	**18.58**	**19.31**	**20.07**	**20.86**	**21.68**	**22.48**	**23.32**	**24.20**
5	Costs of water services	MDL M	10.52	11.78	12.70	14.46	14.58	14.75	14.76	15.27	15.79	16.33	16.90	17.48	17.77	18.24	18.85
	variable costs	MDL M	4.65	5.57	5.16	5.03	4.96	4.95	4.76	5.07	5.38	5.71	6.05	6.40	6.74	7.09	7.44
	fixed costs	MDL M	5.20	5.37	5.87	7.10	7.28	7.47	7.66	7.86	8.07	8.29	8.51	8.74	8.98	9.23	9.49
	depreciation	MDL M	0.67	0.83	1.67	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.04	1.92	1.92
6	Costs of wastewater services	MDL M	4.36	4.59	4.74	4.25	4.33	4.40	4.97	5.14	5.33	5.52	5.73	5.94	6.16	6.39	6.62
	variable costs	MDL M	0.37	0.53	0.56	0.58	0.57	0.56	0.84	0.92	0.99	1.08	1.17	1.26	1.35	1.45	1.55
	fixed costs	MDL M	3.36	3.43	3.55	3.04	3.12	3.21	3.49	3.60	3.70	3.81	3.93	4.05	4.17	4.30	4.44
	depreciation	MDL M	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
7	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Costs of other services and general costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	**Total costs**	**MDL M**	**14.89**	**16.37**	**17.44**	**18.72**	**18.91**	**19.16**	**19.73**	**20.41**	**21.12**	**21.86**	**22.63**	**23.43**	**23.93**	**24.63**	**25.48**
10	**Gross profit**	**MDL M**	0.57	-0.09	-1.20	-1.62	-1.77	-1.86	-1.84	-1.83	-1.81	-1.79	-1.77	-1.75	-1.45	-1.30	-1.28
11	**Income tax**	MDL M	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	**Net profit**	**MDL M**	0.50	-0.09	-1.20	-1.62	-1.77	-1.86	-1.84	-1.83	-1.81	-1.79	-1.77	-1.75	-1.45	-1.30	-1.28

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sale of water	MDL M	18.06	18.60	21.27	22.05	22.88	23.74	24.55	25.30	26.08	26.88	27.72	28.58	29.35	30.14	30.95
2	Sale of wastewater	MDL M	7.04	7.27	7.56	7.85	8.17	8.50	8.80	9.09	9.39	9.71	10.04	10.38	10.71	11.04	11.39
3	Other revenues	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	**Total revenues**	**MDL M**	**25.10**	**25.87**	**28.82**	**29.91**	**31.04**	**32.23**	**33.35**	**34.39**	**35.47**	**36.59**	**37.75**	**38.96**	**40.06**	**41.18**	**42.35**
5	Costs of water services	MDL M	19.49	20.02	20.75	21.51	22.32	23.16	23.95	24.68	25.44	26.23	27.04	27.88	28.63	29.40	30.20
	variable costs	MDL M	7.81	8.06	8.51	8.97	9.47	9.99	10.54	11.01	11.51	12.02	12.56	13.12	13.57	14.04	14.53
	fixed costs	MDL M	9.76	10.04	10.32	10.62	10.93	11.25	11.50	11.75	12.02	12.29	12.56	12.85	13.14	13.44	13.75
	depreciation	MDL M	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92
6	Costs of wastewater services	MDL M	6.87	7.10	7.37	7.66	7.97	8.29	8.58	8.87	9.16	9.47	9.79	10.13	10.45	10.77	11.11
	variable costs	MDL M	1.66	1.74	1.87	2.00	2.15	2.30	2.46	2.61	2.77	2.94	3.11	3.30	3.46	3.63	3.80
	fixed costs	MDL M	4.58	4.72	4.87	5.03	5.19	5.36	5.49	5.62	5.76	5.90	6.05	6.20	6.35	6.51	6.68
	depreciation	MDL M	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
7	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Costs of other services and general costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	**Total costs**	**MDL M**	**26.36**	**27.11**	**28.12**	**29.18**	**30.29**	**31.45**	**32.54**	**33.55**	**34.60**	**35.70**	**36.83**	**38.01**	**39.08**	**40.18**	**41.31**
10	**Gross profit**	**MDL M**	-1.26	-1.24	0.70	0.73	0.76	0.79	0.81	0.84	0.87	0.89	0.92	0.95	0.98	1.00	1.03
11	**Income tax**	MDL M	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
12	**Net profit**	**MDL M**	-1.26	-1.24	0.62	0.64	0.67	0.69	0.72	0.74	0.76	0.79	0.81	0.84	0.86	0.88	0.91

Table 6-15: Profits and losses - without project

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Sale of water	MDL M	10.87	11.52	11.64	12.25	12.90	13.45	14.14	14.98	15.86	16.78	17.75	18.76	19.76	20.79	21.87
2	Sale of wastewater	MDL M	4.58	4.76	4.61	3.91	4.00	4.10	4.45	4.61	4.78	4.96	5.15	5.34	5.55	5.76	5.98
3	Other revenues	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	**Total revenues**	**MDL M**	**15.45**	**16.28**	**16.25**	**16.16**	**16.90**	**17.55**	**18.58**	**19.59**	**20.64**	**21.74**	**22.90**	**24.10**	**25.30**	**26.55**	**27.85**
5	Costs of water services	MDL M	10.52	12.53	13.16	12.58	13.17	13.77	14.44	15.26	16.12	17.02	17.97	18.95	19.92	20.94	21.99
	variable costs	MDL M	4.65	6.55	6.98	7.42	7.87	8.32	8.84	9.50	10.20	10.93	11.69	12.49	13.27	14.08	14.92
	fixed costs	MDL M	5.20	5.31	5.51	4.49	4.64	4.78	4.94	5.09	5.26	5.43	5.61	5.80	5.99	6.19	6.40
	depreciation	MDL M	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
6	Costs of wastewater services	MDL M	4.37	4.60	4.76	3.77	3.88	4.00	4.34	4.50	4.66	4.84	5.02	5.21	5.41	5.62	5.83
	variable costs	MDL M	0.37	0.54	0.57	0.60	0.64	0.67	0.74	0.81	0.88	0.95	1.03	1.12	1.20	1.29	1.38
	fixed costs	MDL M	3.36	3.43	3.55	2.54	2.61	2.69	2.96	3.05	3.15	3.25	3.36	3.46	3.58	3.69	3.82
	depreciation	MDL M	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
7	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Costs of other services and general costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	**Total costs**	**MDL M**	**14.89**	**17.13**	**17.91**	**16.36**	**17.05**	**17.77**	**18.78**	**19.76**	**20.79**	**21.86**	**22.99**	**24.17**	**25.34**	**26.55**	**27.82**
10	**Gross profit**	**MDL M**	0.57	-0.86	-1.67	-0.20	-0.16	-0.22	-0.20	-0.17	-0.15	-0.12	-0.09	-0.06	-0.03	0.00	0.03
11	**Income tax**	MDL M	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	**Net profit**	**MDL M**	0.50	-0.86	-1.67	-0.20	-0.16	-0.22	-0.20	-0.17	-0.15	-0.12	-0.09	-0.06	-0.03	0.00	0.02

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sale of water	MDL M	22.99	23.97	26.04	27.54	29.13	30.81	32.53	34.11	35.78	37.52	39.36	41.28	42.99	44.77	46.62
2	Sale of wastewater	MDL M	6.21	6.42	6.67	6.95	7.23	7.53	7.81	8.07	8.35	8.64	8.95	9.26	9.56	9.87	10.19
3	Other revenues	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	**Total revenues**	**MDL M**	**29.20**	**30.38**	**32.72**	**34.49**	**36.36**	**38.34**	**40.33**	**42.19**	**44.13**	**46.17**	**48.30**	**50.54**	**52.55**	**54.64**	**56.81**
5	Costs of water services	MDL M	23.08	24.03	25.41	26.87	28.42	30.06	31.73	33.28	34.90	36.61	38.40	40.27	41.94	43.68	45.48
	variable costs	MDL M	15.80	16.52	17.66	18.88	20.17	21.55	23.01	24.35	25.75	27.23	28.79	30.42	31.85	33.33	34.87
	fixed costs	MDL M	6.62	6.85	7.08	7.33	7.58	7.85	8.05	8.26	8.48	8.71	8.94	9.18	9.43	9.68	9.94
	depreciation	MDL M	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
6	Costs of wastewater services	MDL M	6.06	6.26	6.51	6.78	7.05	7.35	7.62	7.88	8.15	8.43	8.73	9.04	9.33	9.63	9.95
	variable costs	MDL M	1.48	1.55	1.67	1.79	1.92	2.06	2.21	2.34	2.49	2.64	2.80	2.97	3.12	3.27	3.44
	fixed costs	MDL M	3.94	4.07	4.21	4.35	4.50	4.66	4.78	4.90	5.03	5.16	5.29	5.43	5.58	5.72	5.88
	depreciation	MDL M	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
7	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Costs of other services and general costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	**Total costs**	**MDL M**	**29.14**	**30.29**	**31.92**	**33.65**	**35.47**	**37.41**	**39.35**	**41.16**	**43.05**	**45.04**	**47.12**	**49.31**	**51.27**	**53.31**	**55.43**
10	**Gross profit**	**MDL M**	0.06	0.09	0.80	0.84	0.89	0.94	0.98	1.03	1.08	1.13	1.18	1.23	1.28	1.33	1.39
11	**Income tax**	MDL M	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
12	**Net profit**	**MDL M**	0.05	0.08	0.70	0.74	0.78	0.82	0.87	0.91	0.95	0.99	1.04	1.08	1.13	1.17	1.22

Table 6-16: Working Capital - with project

			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Current assets**	**MDL M**	**4.58**	**1.44**	**1.51**	**1.54**	**1.78**	**1.79**	**1.81**	**1.87**	**1.93**	**2.00**	**2.07**	**2.14**	**2.22**	**2.29**	**2.37**	**2.45**
1	Inventories	MDL M	0.91	0.17	0.18	0.21	0.38	0.38	0.39	0.40	0.40	0.41	0.42	0.43	0.44	0.44	0.45	0.46
2	Accounts receivable	MDL M	3.68	1.27	1.34	1.34	1.41	1.41	1.42	1.47	1.53	1.59	1.65	1.71	1.78	1.85	1.92	1.99
	Increase in current assets	MDL M		-3.14	0.07	0.03	0.24	0.01	0.02	0.06	0.06	0.07	0.07	0.07	0.08	0.07	0.08	0.08
B	**Current liabilities**	**MDL M**	**7.30**	**5.00**	**1.65**	**1.69**	**1.60**	**1.62**	**1.66**	**1.73**	**1.80**	**1.88**	**1.95**	**2.03**	**2.11**	**2.20**	**2.28**	**2.37**
1	Liabilities to suppliers	MDL M	3.01	1.12	1.22	1.24	1.29	1.31	1.33	1.38	1.43	1.49	1.55	1.62	1.68	1.75	1.81	1.88
2	Liabilities to employees	MDL M	4.29	3.89	0.43	0.45	0.30	0.31	0.33	0.36	0.37	0.39	0.40	0.42	0.43	0.45	0.47	0.49
3	Increase in current liabilities	MDL M		-2.30	-3.35	0.04	-0.10	0.03	0.03	0.08	0.07	0.07	0.08	0.08	0.08	0.08	0.09	0.09

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Current assets**	**MDL M**	**2.53**	**2.61**	**2.86**	**2.96**	**3.06**	**3.17**	**3.27**	**3.37**	**3.46**	**3.56**	**3.67**	**3.78**	**3.88**	**3.98**	**4.09**
1	Inventories	MDL M	0.47	0.48	0.49	0.50	0.51	0.52	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.60	0.61
2	Accounts receivable	MDL M	2.06	2.13	2.37	2.46	2.55	2.65	2.74	2.83	2.92	3.01	3.10	3.20	3.29	3.38	3.48
	Increase in current assets	MDL M	0.08	0.07	0.25	0.10	0.10	0.11	0.10	0.09	0.10	0.10	0.10	0.11	0.10	0.10	0.11
B	**Current liabilities**	**MDL M**	**2.46**	**2.55**	**2.65**	**2.76**	**2.87**	**2.99**	**3.10**	**3.20**	**3.31**	**3.42**	**3.53**	**3.65**	**3.76**	**3.87**	**3.99**
1	Liabilities to suppliers	MDL M	1.96	2.02	2.10	2.19	2.28	2.37	2.46	2.55	2.63	2.72	2.82	2.91	3.00	3.09	3.19
2	Liabilities to employees	MDL M	0.51	0.53	0.55	0.57	0.59	0.62	0.64	0.65	0.67	0.69	0.71	0.74	0.76	0.78	0.80
3	Increase in current liabilities	MDL M	0.09	0.08	0.10	0.11	0.11	0.12	0.11	0.10	0.11	0.11	0.11	0.12	0.11	0.11	0.12

Table 6-17: Working Capital - without project

			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Current assets**	**MDL M**	**4.58**	**1.44**	**1.51**	**1.51**	**1.49**	**1.56**	**1.61**	**1.70**	**1.79**	**1.88**	**1.97**	**2.07**	**2.18**	**2.28**	**2.39**	**2.50**
1	Inventories	MDL M	0.91	0.17	0.17	0.18	0.16	0.17	0.17	0.17	0.18	0.18	0.19	0.19	0.19	0.20	0.20	0.21
2	Accounts receivable	MDL M	3.68	1.27	1.34	1.34	1.33	1.39	1.44	1.53	1.61	1.70	1.79	1.88	1.98	2.08	2.18	2.29
	Increase in current assets	MDL M		-3.14	0.07	0.00	-0.02	0.06	0.06	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.11	0.11
B	**Current liabilities**	**MDL M**	**7.30**	**5.00**	**1.73**	**1.81**	**1.54**	**1.61**	**1.68**	**1.79**	**1.89**	**1.99**	**2.09**	**2.20**	**2.31**	**2.43**	**2.54**	**2.67**
1	Liabilities to suppliers	MDL M	3.01	1.12	1.30	1.37	1.24	1.29	1.35	1.44	1.52	1.60	1.69	1.78	1.88	1.98	2.08	2.18
2	Liabilities to employees	MDL M	4.29	3.89	0.43	0.45	0.30	0.31	0.33	0.36	0.37	0.39	0.40	0.42	0.43	0.45	0.47	0.49
3	Increase in current liabilities	MDL M		-2.30	-3.27	0.08	-0.27	0.07	0.07	0.11	0.09	0.10	0.10	0.11	0.11	0.11	0.12	0.12

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Current assets**	**MDL M**	**2.61**	**2.72**	**2.91**	**3.07**	**3.23**	**3.39**	**3.56**	**3.72**	**3.88**	**4.06**	**4.24**	**4.43**	**4.60**	**4.78**	**4.96**
1	Inventories	MDL M	0.21	0.22	0.22	0.23	0.24	0.24	0.25	0.25	0.26	0.26	0.27	0.27	0.28	0.29	0.29
2	Accounts receivable	MDL M	2.40	2.50	2.69	2.83	2.99	3.15	3.32	3.47	3.63	3.79	3.97	4.15	4.32	4.49	4.67
	Increase in current assets	MDL M	0.12	0.10	0.20	0.15	0.16	0.17	0.17	0.16	0.16	0.17	0.18	0.19	0.17	0.18	0.18
B	**Current liabilities**	**MDL M**	**2.80**	**2.91**	**3.06**	**3.23**	**3.40**	**3.58**	**3.76**	**3.93**	**4.11**	**4.29**	**4.48**	**4.68**	**4.87**	**5.06**	**5.25**
1	Liabilities to suppliers	MDL M	2.29	2.38	2.52	2.66	2.81	2.97	3.13	3.28	3.43	3.60	3.77	3.95	4.11	4.27	4.45
2	Liabilities to employees	MDL M	0.51	0.53	0.55	0.57	0.59	0.62	0.64	0.65	0.67	0.69	0.71	0.74	0.76	0.78	0.80
3	Increase in current liabilities	MDL M	0.13	0.11	0.16	0.16	0.17	0.18	0.18	0.17	0.18	0.18	0.19	0.20	0.18	0.19	0.20

Table 6-18: Balance sheet - with project

			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Assets**	**MDL M**	**33.04**	**36.77**	**63.48**	**86.45**	**84.73**	**82.99**	**81.17**	**79.40**	**77.65**	**75.91**	**74.20**	**72.51**	**70.84**	**69.48**	**68.26**	**67.07**
1	Fixed assets	MDL M	28.26	32.99	61.67	83.49	80.53	77.56	74.59	71.62	68.65	65.69	62.72	59.75	56.78	54.10	51.55	49.00
2	Current assets	MDL M	4.78	3.78	1.81	2.95	4.21	5.43	6.58	7.78	8.99	10.23	11.48	12.76	14.06	15.38	16.71	18.07
3	Inventories	MDL M	0.91	0.17	0.18	0.21	0.38	0.38	0.39	0.40	0.40	0.41	0.42	0.43	0.44	0.44	0.45	0.46
4	Short-term receivables	MDL M	3.68	1.27	1.34	1.34	1.41	1.41	1.42	1.47	1.53	1.59	1.65	1.71	1.78	1.85	1.92	1.99
5	Cash and other financial assets	MDL M	0.18	2.32	0.27	1.39	2.40	3.62	4.74	5.89	7.04	8.20	9.39	10.59	11.82	13.06	14.31	15.59
6	Other current assets	MDL M	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
B	**Liabilities**	**MDL M**	**33.04**	**36.77**	**63.48**	**86.45**	**84.73**	**82.99**	**81.17**	**79.40**	**77.65**	**75.91**	**74.20**	**72.51**	**70.84**	**69.48**	**68.26**	**67.07**
1	Equity capital	MDL M	24.62	25.12	25.03	23.83	22.21	20.44	18.59	16.75	14.92	13.11	11.32	9.55	7.81	6.36	5.05	3.77
2	Long-term liabilities	MDL M	1.12	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
3	Long-term loan	MDL M	0.00	-0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Short-term liabilities	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Short-term loan	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Current liabilities to suppliers	MDL M	3.01	1.12	1.22	1.24	1.29	1.31	1.33	1.38	1.43	1.49	1.55	1.62	1.68	1.75	1.81	1.88
7	Current liabilities	MDL M	4.29	3.89	0.43	0.45	0.30	0.31	0.33	0.36	0.37	0.39	0.40	0.42	0.43	0.45	0.47	0.49
8	Accruals	MDL M	0.00	6.03	36.18	60.31	60.31	60.31	60.31	60.31	60.31	60.31	60.31	60.31	60.31	60.31	60.31	60.31

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Assets**	**MDL M**	**65.90**	**64.74**	**65.46**	**66.21**	**66.99**	**67.80**	**68.63**	**69.47**	**70.33**	**71.23**	**72.15**	**73.11**	**74.08**	**75.08**	**76.10**
1	Fixed assets	MDL M	46.45	43.89	41.34	38.79	36.24	33.68	31.13	28.58	26.03	23.47	20.92	18.37	15.82	13.26	10.71
2	Current assets	MDL M	19.45	20.84	24.12	27.42	30.75	34.12	37.49	40.89	44.31	47.76	51.23	54.74	58.26	61.81	65.39
3	Inventories	MDL M	0.47	0.48	0.49	0.50	0.51	0.52	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.60	0.61
4	Short-term receivables	MDL M	2.06	2.13	2.37	2.46	2.55	2.65	2.74	2.83	2.92	3.01	3.10	3.20	3.29	3.38	3.48
5	Cash and other financial assets	MDL M	16.89	18.21	21.23	24.44	27.67	30.92	34.20	37.50	40.82	44.17	47.54	50.94	54.36	57.81	61.28
6	Other current assets	MDL M	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
B	**Liabilities**	**MDL M**	**65.90**	**64.74**	**65.46**	**66.21**	**66.99**	**67.80**	**68.63**	**69.47**	**70.33**	**71.23**	**72.15**	**73.11**	**74.08**	**75.08**	**76.10**
1	Equity capital	MDL M	2.51	1.27	1.89	2.53	3.20	3.89	4.60	5.34	6.10	6.89	7.70	8.54	9.39	10.28	11.19
2	Long-term liabilities	MDL M	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
3	Long-term loan	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Short-term liabilities	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Short-term loan	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Current liabilities to suppliers	MDL M	1.96	2.02	2.10	2.19	2.28	2.37	2.46	2.55	2.63	2.72	2.82	2.91	3.00	3.09	3.19
7	Current liabilities	MDL M	0.51	0.53	0.55	0.57	0.59	0.62	0.64	0.65	0.67	0.69	0.71	0.74	0.76	0.78	0.80
8	Accruals	MDL M	60.31	60.31	60.31	60.31	60.31	60.31	60.31	60.31	60.31	60.31	60.31	60.31	60.31	60.31	60.31

Table 6-19: Balance sheet - without project

			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Assets**	**MDL M**	**33.04**	**30.74**	**26.61**	**25.03**	**24.55**	**24.47**	**24.32**	**24.23**	**24.15**	**24.10**	**24.09**	**24.10**	**24.15**	**24.23**	**24.35**	**24.50**
1	Fixed assets	MDL M	28.26	26.96	25.66	24.36	23.06	21.76	20.46	19.16	17.86	16.56	15.26	13.96	12.66	11.36	10.06	8.76
2	Current assets	MDL M	4.78	3.78	0.95	0.67	1.50	2.71	3.86	5.07	6.29	7.55	8.83	10.15	11.50	12.88	14.29	15.74
3	Inventories	MDL M	0.91	0.17	0.17	0.18	0.16	0.17	0.17	0.17	0.18	0.18	0.19	0.19	0.19	0.20	0.20	0.21
4	Short-term receivables	MDL M	3.68	1.27	1.34	1.34	1.33	1.39	1.44	1.53	1.61	1.70	1.79	1.88	1.98	2.08	2.18	2.29
5	Cash and other financial assets	MDL M	0.18	2.32	-0.58	-0.87	-0.02	1.13	2.22	3.35	4.48	5.64	6.83	8.05	9.30	10.57	11.88	13.21
6	Other current assets	MDL M	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
B	**Liabilities**	**MDL M**	**33.04**	**30.74**	**26.61**	**25.03**	**24.55**	**24.47**	**24.32**	**24.23**	**24.15**	**24.10**	**24.09**	**24.10**	**24.15**	**24.23**	**24.35**	**24.50**
1	Equity capital	MDL M	24.62	25.12	24.26	22.59	22.40	22.24	22.02	21.82	21.65	21.50	21.38	21.29	21.22	21.19	21.19	21.21
2	Long-term liabilities	MDL M	1.12	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
3	Long-term loan	MDL M	0.00	-0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Short-term liabilities	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Short-term loan	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Current liabilities to suppliers	MDL M	3.01	1.12	1.30	1.37	1.24	1.29	1.35	1.44	1.52	1.60	1.69	1.78	1.88	1.98	2.08	2.18
7	Current liabilities	MDL M	4.29	3.89	0.43	0.45	0.30	0.31	0.33	0.36	0.37	0.39	0.40	0.42	0.43	0.45	0.47	0.49
8	Accruals	MDL M	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Assets**	**MDL M**	**24.68**	**24.87**	**25.73**	**26.63**	**27.59**	**28.59**	**29.64**	**30.71**	**31.83**	**33.01**	**34.24**	**35.52**	**36.83**	**38.20**	**39.61**
1	Fixed assets	MDL M	7.46	6.16	4.86	3.56	2.26	0.96	-0.34	-1.64	-2.94	-4.24	-5.54	-6.84	-8.14	-9.44	-10.74
2	Current assets	MDL M	17.22	18.71	20.87	23.07	25.33	27.63	29.98	32.35	34.77	37.25	39.78	42.36	44.97	47.63	50.35
3	Inventories	MDL M	0.21	0.22	0.22	0.23	0.24	0.24	0.25	0.25	0.26	0.26	0.27	0.27	0.28	0.29	0.29
4	Short-term receivables	MDL M	2.40	2.50	2.69	2.83	2.99	3.15	3.32	3.47	3.63	3.79	3.97	4.15	4.32	4.49	4.67
5	Cash and other financial assets	MDL M	14.58	15.97	17.93	19.98	22.08	24.21	26.39	28.60	30.86	33.16	35.51	37.91	40.35	42.83	45.36
6	Other current assets	MDL M	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
B	**Liabilities**	**MDL M**	**24.68**	**24.87**	**25.73**	**26.63**	**27.59**	**28.59**	**29.64**	**30.71**	**31.83**	**33.01**	**34.24**	**35.52**	**36.83**	**38.20**	**39.61**
1	Equity capital	MDL M	21.27	21.35	22.05	22.79	23.57	24.39	25.26	26.16	27.11	28.10	29.14	30.22	31.35	32.52	33.74
2	Long-term liabilities	MDL M	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
3	Long-term loan	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Short-term liabilities	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Short-term loan	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Current liabilities to suppliers	MDL M	2.29	2.38	2.52	2.66	2.81	2.97	3.13	3.28	3.43	3.60	3.77	3.95	4.11	4.27	4.45
7	Current liabilities	MDL M	0.51	0.53	0.55	0.57	0.59	0.62	0.64	0.65	0.67	0.69	0.71	0.74	0.76	0.78	0.80
8	Accruals	MDL M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6-20: Cash flow - with project

			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Financial inflows**	**MDL M**		**19.19**	**43.08**	**40.41**	**17.00**	**17.17**	**17.33**	**17.96**	**18.66**	**19.39**	**20.15**	**20.94**	**21.76**	**22.56**	**23.41**	**24.28**
1	Loan disbursement	MDL M		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Donor contribution (capital grant)	MDL M		4.60	22.99	18.39	0.00	0.00										
3	Own contribution	MDL M		1.43	7.16	5.73	0.00	0.00										
4	Revenues from sale	MDL M		15.45	16.28	16.25	17.10	17.14	17.30	17.88	18.58	19.31	20.07	20.86	21.68	22.48	23.32	24.20
5	Increase in current liabilities	MDL M		-2.30	-3.35	0.04	-0.10	0.03	0.03	0.08	0.07	0.07	0.08	0.08	0.08	0.08	0.09	0.09
B	**Financial outflows**	**MDL M**		**17.04**	**45.13**	**39.29**	**15.99**	**15.95**	**16.21**	**16.81**	**17.51**	**18.22**	**18.96**	**19.73**	**20.53**	**21.33**	**22.15**	**23.01**
1	Investment costs	MDL M		6.03	30.15	24.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Costs of providing services	MDL M		13.59	14.90	15.14	15.75	15.94	16.19	16.76	17.44	18.15	18.89	19.66	20.46	21.25	22.07	22.93
3	Long term loan repayment	MDL M		0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Increase in current assets	MDL M		-3.14	0.07	0.03	0.24	0.01	0.02	0.06	0.06	0.07	0.07	0.07	0.08	0.07	0.08	0.08
5	Income tax	MDL M		0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C	Net cash flow (inflow - outflow)	**MDL M**		2.14	-2.05	1.12	1.01	1.22	1.12	1.15	1.15	1.17	1.19	1.20	1.23	1.24	1.26	1.28
D	Cumulated cash	**MDL M**	0.18	2.32	0.27	1.39	2.40	3.62	4.74	5.89	7.04	8.20	9.39	10.59	11.82	13.06	14.31	15.59

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Financial inflows**	**MDL M**	**25.19**	**25.95**	**28.93**	**30.02**	**31.16**	**32.35**	**33.46**	**34.49**	**35.58**	**36.70**	**37.87**	**39.08**	**40.17**	**41.30**	**42.46**
1	Loan disbursement	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Donor contribution (capital grant)	MDL M															
3	Own contribution	MDL M															
4	Revenues from sale	MDL M	25.10	25.87	28.82	29.91	31.04	32.23	33.35	34.39	35.47	36.59	37.75	38.96	40.06	41.18	42.35
5	Increase in current liabilities	MDL M	0.09	0.08	0.10	0.11	0.11	0.12	0.11	0.10	0.11	0.11	0.11	0.12	0.11	0.11	0.12
B	**Financial outflows**	**MDL M**	**23.89**	**24.63**	**25.90**	**26.81**	**27.93**	**29.10**	**30.18**	**31.19**	**32.25**	**33.35**	**34.50**	**35.68**	**36.74**	**37.85**	**38.99**
1	Investment costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Costs of providing services	MDL M	23.81	24.56	25.57	26.62	27.73	28.89	29.98	31.00	32.05	33.15	34.28	35.46	36.53	37.63	38.76
3	Long term loan repayment	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Increase in current assets	MDL M	0.08	0.07	0.25	0.10	0.10	0.11	0.10	0.09	0.10	0.10	0.10	0.11	0.10	0.10	0.11
5	Income tax	MDL M	0.00	0.00	0.08	0.09	0.09	0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.12	0.12
C	Net cash flow (inflow - outflow)	**MDL M**	1.30	1.32	3.02	3.20	3.23	3.25	3.28	3.30	3.32	3.35	3.37	3.40	3.42	3.45	3.47
D	Cumulated cash	**MDL M**	16.89	18.21	21.23	24.44	27.67	30.92	34.20	37.50	40.82	44.17	47.54	50.94	54.36	57.81	61.28

Table 6-21: Cash flow - without project

			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Financial inflows**	**MDL M**		**13.16**	**13.00**	**16.33**	**15.89**	**16.97**	**17.62**	**18.69**	**19.68**	**20.74**	**21.85**	**23.00**	**24.22**	**25.41**	**26.67**	**27.97**
1	Loan disbursement	MDL M		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Donor contribution (capital grant)	MDL M		0.00	0.00	0.00	0.00	0.00										
3	Own contribution	MDL M		0.00	0.00	0.00	0.00	0.00										
4	Revenues from sale	MDL M		15.45	16.28	16.25	16.16	16.90	17.55	18.58	19.59	20.64	21.74	22.90	24.10	25.30	26.55	27.85
5	Increase in current liabilities	MDL M		-2.30	-3.27	0.08	-0.27	0.07	0.07	0.11	0.09	0.10	0.10	0.11	0.11	0.11	0.12	0.12
B	**Financial outflows**	**MDL M**		**11.02**	**15.90**	**16.62**	**15.04**	**15.82**	**16.52**	**17.57**	**18.55**	**19.58**	**20.66**	**21.79**	**22.97**	**24.14**	**25.36**	**26.64**
1	Investment costs	MDL M		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Costs of providing services	MDL M		13.59	15.83	16.61	15.06	15.75	16.47	17.48	18.46	19.49	20.56	21.69	22.87	24.04	25.25	26.52
3	Long term loan repayment	MDL M		0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Increase in current assets	MDL M		-3.14	0.07	0.00	-0.02	0.06	0.06	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.11	0.11
	Income tax			0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C	**Net cash flow (inflow - outflow)**	**MDL M**		2.14	-2.90	-0.29	0.85	1.15	1.09	1.13	1.14	1.16	1.19	1.22	1.25	1.28	1.31	1.34
D	**Cumulated cash**	**MDL M**	0.18	2.32	-0.58	-0.87	-0.02	1.13	2.22	3.35	4.48	5.64	6.83	8.05	9.30	10.57	11.88	13.21

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Financial inflows**	**MDL M**	**29.33**	**30.50**	**32.87**	**34.65**	**36.53**	**38.53**	**40.51**	**42.35**	**44.30**	**46.35**	**48.49**	**50.74**	**52.74**	**54.83**	**57.01**
1	Loan disbursement	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Donor contribution (capital grant)	MDL M															
3	Own contribution	MDL M															
4	Revenues from sale	MDL M	29.20	30.38	32.72	34.49	36.36	38.34	40.33	42.19	44.13	46.17	48.30	50.54	52.55	54.64	56.81
5	Increase in current liabilities	MDL M	0.13	0.11	0.16	0.16	0.17	0.18	0.18	0.17	0.18	0.18	0.19	0.20	0.18	0.19	0.20
B	**Financial outflows**	**MDL M**	**27.96**	**29.10**	**30.91**	**32.60**	**34.44**	**36.39**	**38.34**	**40.14**	**42.05**	**44.05**	**46.15**	**48.35**	**50.30**	**52.35**	**54.48**
1	Investment costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Costs of providing services	MDL M	27.84	28.99	30.62	32.35	34.17	36.11	38.05	39.86	41.75	43.74	45.82	48.01	49.97	52.01	54.13
3	Long term loan repayment	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Increase in current assets	MDL M	0.12	0.10	0.20	0.15	0.16	0.17	0.17	0.16	0.16	0.17	0.18	0.19	0.17	0.18	0.18
	Income tax		0.01	0.01	0.10	0.10	0.11	0.11	0.12	0.12	0.13	0.14	0.14	0.15	0.15	0.16	0.17
C	**Net cash flow (inflow - outflow)**	**MDL M**	1.37	1.39	1.96	2.05	2.09	2.14	2.18	2.22	2.26	2.30	2.35	2.40	2.44	2.49	2.53
D	**Cumulated cash**	**MDL M**	14.58	15.97	17.93	19.98	22.08	24.21	26.39	28.60	30.86	33.16	35.51	37.91	40.35	42.83	45.36

Table 6-22: Financial analysis on profitability of the investment

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Financial inflows**	**MDL M**	**0.00**	**-0.08**	**-0.04**	**1.11**	**0.20**	**-0.28**	**-0.73**	**-1.03**	**-1.35**	**-1.70**	**-2.07**	**-2.46**	**-2.85**	**-3.26**	**-3.69**
1	Incremental revenues from sales	MDL M	0.00	0.00	0.00	0.94	0.24	-0.24	-0.70	-1.00	-1.33	-1.67	-2.04	-2.43	-2.82	-3.23	-3.65
2	Incremental increase in current liabilities	MDL M	0.00	-0.08	-0.04	0.18	-0.04	-0.04	-0.04	-0.02	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
3	Residual value	MDL M															
B	**Financial outflows**	**MDL M**	**2.89**	**29.30**	**22.68**	**0.93**	**0.19**	**-0.26**	**-0.67**	**-0.95**	**-1.27**	**-1.60**	**-1.96**	**-2.33**	**-2.71**	**-3.10**	**-3.51**
1	Investment costs	MDL M	6.03	30.15	24.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Incremental operational costs of providing services	MDL M	0.00	-0.93	-1.47	0.69	0.18	-0.28	-0.72	-1.02	-1.34	-1.67	-2.03	-2.41	-2.78	-3.18	-3.59
3	Incremental increase in current assets	MDL M	-3.14	0.07	0.03	0.24	0.01	0.02	0.06	0.06	0.07	0.07	0.07	0.08	0.07	0.08	0.08
C	Net cash flow (inflow - outflow)	**MDL M**	-2.89	-29.37	-22.72	0.18	0.00	-0.02	-0.07	-0.07	-0.08	-0.10	-0.11	-0.13	-0.14	-0.16	-0.17
D	FNPV(C)	**MDL M**	**-41.12**														
E	FRR(C) - Financial Rate of Return of the Investment	%	**-2%**														

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Financial inflows**	**MDL M**	**-4.14**	**-4.55**	**-3.95**	**-4.64**	**-5.38**	**-6.18**	**-7.05**	**-7.86**	**-8.73**	**-9.65**	**-10.62**	**-11.66**	**-12.57**	**-13.54**	**6.90**
1	Incremental revenues from sales	MDL M	-4.10	-4.51	-3.90	-4.58	-5.32	-6.11	-6.98	-7.80	-8.66	-9.57	-10.55	-11.58	-12.50	-13.46	-14.47
2	Incremental increase in current liabilities	MDL M	-0.04	-0.03	-0.05	-0.05	-0.06	-0.06	-0.07	-0.07	-0.07	-0.07	-0.08	-0.08	-0.07	-0.08	-0.08
3	Residual value	MDL M															21.45
B	**Financial outflows**	**MDL M**	**-3.95**	**-4.36**	**-4.80**	**-5.62**	**-6.34**	**-7.11**	**-7.97**	**-8.76**	**-9.60**	**-10.49**	**-11.44**	**-12.44**	**-13.34**	**-14.28**	**-15.26**
1	Investment costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Incremental operational costs of providing services	MDL M	-4.03	-4.43	-5.05	-5.72	-6.44	-7.22	-8.07	-8.86	-9.70	-10.59	-11.54	-12.55	-13.44	-14.38	-15.37
3	Incremental increase in current assets	MDL M	0.08	0.07	0.25	0.10	0.10	0.11	0.10	0.09	0.10	0.10	0.10	0.11	0.10	0.10	0.11
C	Net cash flow (inflow - outflow)	**MDL M**	-0.19	-0.19	0.85	0.99	0.96	0.93	0.91	0.90	0.87	0.84	0.81	0.78	0.77	0.74	22.16

Table 6-23: Calculation of NPV on own capital

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Financial inflows**	**MDL M**	**4.60**	**22.92**	**18.35**	**1.11**	**0.20**	**-0.28**	**-0.73**	**-1.03**	**-1.35**	**-1.70**	**-2.07**	**-2.46**	**-2.85**	**-3.26**	**-3.69**
1	Incremental revenues from sales	MDL M	0.00	0.00	0.00	0.94	0.24	-0.24	-0.70	-1.00	-1.33	-1.67	-2.04	-2.43	-2.82	-3.23	-3.65
2	Incremental increase in current liabilities	MDL M	0.00	-0.08	-0.04	0.18	-0.04	-0.04	-0.04	-0.02	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
3	Donor contribution (capital grant)	MDL M	4.60	22.99	18.39	0.00	0.00										
4	Residual value	MDL M															
B	**Financial outflows**	**MDL M**	**2.89**	**29.30**	**22.68**	**0.93**	**0.19**	**-0.26**	**-0.67**	**-0.95**	**-1.27**	**-1.60**	**-1.96**	**-2.33**	**-2.71**	**-3.10**	**-3.51**
1	Investment costs	MDL M	6.03	30.15	24.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Incremental operational costs of providing services	MDL M	0.00	-0.93	-1.47	0.69	0.18	-0.28	-0.72	-1.02	-1.34	-1.67	-2.03	-2.41	-2.78	-3.18	-3.59
3	Incremental increase in current assets	MDL M	-3.14	0.07	0.03	0.24	0.01	0.02	0.06	0.06	0.07	0.07	0.07	0.08	0.07	0.08	0.08
C	**Net cash flow (inflow - outflow)**	**MDL M**	1.71	-6.38	-4.33	0.18	0.00	-0.02	-0.07	-0.07	-0.08	-0.10	-0.11	-0.13	-0.14	-0.16	-0.17
D	**FNPV(K) - Financial Net Present value of the Capit**	**MDL M**	**0.00**														
E	**FRR(K)- Financial Rate of Return of Capital**	%	**5%**														

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Financial inflows**	**MDL M**	**-4.14**	**-4.55**	**-3.95**	**-4.64**	**-5.38**	**-6.18**	**-7.05**	**-7.86**	**-8.73**	**-9.65**	**-10.62**	**-11.66**	**-12.57**	**-13.54**	**6.90**
1	Incremental revenues from sales	MDL M	-4.10	-4.51	-3.90	-4.58	-5.32	-6.11	-6.98	-7.80	-8.66	-9.57	-10.55	-11.58	-12.50	-13.46	-14.47
2	Incremental increase in current liabilities	MDL M	-0.04	-0.03	-0.05	-0.05	-0.06	-0.06	-0.07	-0.07	-0.07	-0.07	-0.08	-0.08	-0.07	-0.08	-0.08
3	Donor contribution (capital grant)	MDL M															
4	Residual value	MDL M															21.45
B	**Financial outflows**	**MDL M**	**-3.95**	**-4.36**	**-4.80**	**-5.62**	**-6.34**	**-7.11**	**-7.97**	**-8.76**	**-9.60**	**-10.49**	**-11.44**	**-12.44**	**-13.34**	**-14.28**	**-15.26**
1	Investment costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Incremental operational costs of providing services	MDL M	-4.03	-4.43	-5.05	-5.72	-6.44	-7.22	-8.07	-8.86	-9.70	-10.59	-11.54	-12.55	-13.44	-14.38	-15.37
3	Incremental increase in current assets	MDL M	0.08	0.07	0.25	0.10	0.10	0.11	0.10	0.09	0.10	0.10	0.10	0.11	0.10	0.10	0.11
C	**Net cash flow (inflow - outflow)**	**MDL M**	-0.19	-0.19	0.85	0.99	0.96	0.93	0.91	0.90	0.87	0.84	0.81	0.78	0.77	0.74	22.16

Table 6-24: Economic analysis

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Net cash flow (inflow - outflow)**	**MDL M**	**-2.89**	**-29.37**	**-22.72**	**0.18**	**0.00**	**-0.02**	**-0.07**	**-0.07**	**-0.08**	**-0.10**	**-0.11**	**-0.13**	**-0.14**	**-0.16**	**-0.17**
1	Social costs	MDL M	0.00	-0.08	-0.15	-0.19	-0.23	-0.27	-0.33	-0.35	-0.39	-0.42	-0.45	-0.49	-0.52	-0.56	-0.60
2	Shadow prices - electricity	MDL M	0.00	-0.08	-0.15	-0.19	-0.23	-0.27	-0.33	-0.35	-0.39	-0.42	-0.45	-0.49	-0.52	-0.56	-0.60
B	**Social benefits**	**MDL M**	**2.71**	**13.57**	**10.85**	**4.28**	**4.28**	**4.29**	**7.30**	**7.45**	**7.59**	**7.74**	**7.89**	**8.04**	**8.20**	**8.35**	**8.52**
1	Tax correction - VAT	MDL M	1.21	6.03	4.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Social benefits resulting from additional employment	MDL M	1.51	7.54	6.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Shadow price - business	MDL M	0.00	0.00	0.00	0.23	0.23	0.24	3.26	3.40	3.54	3.69	3.84	3.99	4.15	4.31	4.47
4	Benefits of avoiding water related disease	MDL M	0.00	0.00	0.00	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05
C	**Net cash flow (inflow - outflow)**	**MDL M**	-0.17	-15.72	-11.72	4.65	4.52	4.53	7.56	7.73	7.89	8.06	8.23	8.40	8.58	8.75	8.94
D	**ENPV**	**MDL M**	**86.46**														
E	**ERR**	%	**21%**														

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Net cash flow (inflow - outflow)**	**MDL M**	**-0.19**	**-0.19**	**0.85**	**0.99**	**0.96**	**0.93**	**0.91**	**0.90**	**0.87**	**0.84**	**0.81**	**0.78**	**0.77**	**0.74**	**22.16**
1	Social costs	MDL M	-0.64	-0.68	-0.73	-0.79	-0.86	-0.92	-1.00	-1.07	-1.14	-1.22	-1.30	-1.38	-1.46	-1.54	-1.63
2	Shadow prices - electricity	MDL M	-0.64	-0.68	-0.73	-0.79	-0.86	-0.92	-1.00	-1.07	-1.14	-1.22	-1.30	-1.38	-1.46	-1.54	-1.63
B	**Social benefits**	**MDL M**	**8.68**	**8.68**	**8.68**	**8.69**	**8.69**	**8.69**	**8.69**	**8.69**	**8.70**	**8.70**	**8.70**	**8.70**	**8.70**	**8.71**	**8.71**
1	Tax correction - VAT	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Social benefits resulting from additional employment	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Shadow price - business	MDL M	4.63	4.63	4.64	4.64	4.64	4.64	4.64	4.65	4.65	4.65	4.65	4.65	4.66	4.66	4.66
4	Benefits of avoiding water related disease	MDL M	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05
C	**Net cash flow (inflow - outflow)**	**MDL M**	9.13	9.17	10.27	10.47	10.50	10.55	10.60	10.66	10.71	10.76	10.81	10.87	10.94	10.99	32.50

Table 6-25: Sensitivity analysis

A	**Investment costs**	**%**	100%	105%	110.00%	115.00%	120.00%	125.00%
1	FNPV(C)	MDL M	-41.12	-36.14	-38.07	-39.99	-41.92	-43.85
2	FRR(C)	%	-2.14%	-1.06%	-1.10%	-1.13%	-1.16%	-1.19%
3	FNPV(K)	MDL M	0.00	-0.42	-0.84	-1.26	-1.68	-2.10
4	FRR(K)	%	5.0%	4.8%	4.7%	4.6%	4.5%	4.4%
5	Financially sustainable		True	True	True	True	True	True

B	**Real Wage Increase**		Base Case	Base Case	Pessimistic	Optimistic
			1	1	2	3
1	FNPV(C)	MDL M	-41.12	-34.22	-30.93	-37.21
2	FRR(C)	%	-2.1%	-1.02%	-0.66%	-1.29%
3	FNPV(K)	MDL M	0.00	0.00	3.29	-3.00
4	FRR(K)	%	5.0%	5.0%	6.4%	4.0%
5	Financially sustainable		True	True	True	True

C	**Real GDP growth**		Base Case	Base Case	Pessimistic	Optimistic
			1	1	2	3
1	FNPV(C)	MDL M	-41.12	-34.22	-33.03	-35.08
2	FRR(C)	%	-2.1%	-1.02%	-0.88%	-1.12%
3	FNPV(K)	MDL M	0.00	0.00	1.18	-0.87
4	FRR(K)	%	5.0%	5.0%	5.5%	4.7%
5	Financially sustainable		True	True	True	True

D	**Costs of electricity**		Base Case	Base Case	Pessimistic	Optimistic
			1	1	2	3
1	FNPV(C)	MDL M	-41.12	-34.22	-38.61	-33.24
2	FRR(C)	%	-2.1%	-1.02%	-1.54%	-0.96%
3	FNPV(K)	MDL M	0.00	0.00	-4.39	0.97
4	FRR(K)	%	5.0%	5.0%	3.5%	5.4%
5	Financially sustainable		True	True	True	True

Annex 8

Environmental impact assessment and gender aspects

Annex 8: Environmental impact assessment and gender aspects

8.1 Summary for legal framework on SEE and EIA in WSS sector

The Moldovan legal basis for environmental assessment is covered by three main laws. During the process of approximation of Moldovan legislation to the EU acquis, these laws are to be amended and/or adjusted in the near future as follow:

- Law on Environmental Protection with subsequent amendments;
- Law on Ecological Expertise with subsequent amendments;
- Law on Environmental Impact Assessment.

The Law on Environment Protection[1] represents the main legal framework for development of special normative acts and instructions in the field of environment protection in order to ensure a healthy living environment, conservation of the natural environment, ecosystem restoration etc.

The Law on Ecological Expertise[2] describes the concept of the State Ecological Expertise (SEE) which precedes decision-making on activities that may have an adverse impact on the environment. It is compulsory for all economic activities that might have negative impact on environment regardless of their destination, ownership, investments, location, source of financing, etc.

The Law on Environmental Impact Assessment[3] describes procedures and requirements for Environmental Impact Assessment (EIA) on the national level.

As result of feasibility studies, technical designs will be developed, which in the regional and local planning process in the WSS (Water Supply and Sanitation) sector will be subject to SEE and the corresponding documents shall be prepared and submitted to the responsible authorities together with the technical project documentation.

The national authority responsible for SEE in Republic of Moldova is the State Ecological Inspectorate (SIE), which is a subdivision of the Ministry of the Environment (MoE). All legal procedures on State Ecological Expertise System are described in the Chapter II of the Law on Ecological Expertise, while the organization of the SEE is detailed in the Chapter V.

In relation to the national environmental permitting procedure of various project-types and activities, there are the SEE and the EIA. The procedures, requirements and entire EIA process are detailed in the new Law on Environmental Impact Assessment.

In addition, the procedures for conducting SEE are included in the Guidelines on Performing SEE (2002). They define in detail the goals, objectives and principles of the SEE and specify the procedures for submitting project documentation, as well as reviewing procedures.

[1] Law No. 1515 of 16.06.1993 on Environment Protection, published in ”Monitorul Parlamentului” No. 10 of 01.10.1993, Art. 283, last amended by the Parliament Law No. 153 of 30.07.2015.

[2] Law No. 851 of 29.05.1996 on Ecologic Expertise and Environment Impact Assessment, published in ”Monitorul Oficial” No. 52-53 of 08.08.1996, Art. 494, last amended by the Parliament Law No. 153 of 30.07.2015.

[3] Law No. 86 of 29.05.2014 on Environment Impact Assessment, published in ”Monitorul Oficial” No. 174-177 of 04.07.2014, Art. 393. Date of entry into force: 04.01.2015.

Therefore, two project categories can be distinguished on the national level:

- Projects requiring SEE only;
- Projects requiring SEE and EIA.

In conclusion, for all selected CPV (Viable Project Concept) set-up projects as a part of the RSP (Regional Sector Program) in WSS sector, the SEE shall be conducted.

In relation to the national environmental permitting procedure of various project-types and activities, there are the SEE and the EIA. The procedures, requirements and entire EIA process for WSS project activities are detailed in the new Law on Environmental Impact Assessment.

Further, the following categories of planned activities are to be subjected of full scale EIA and for which is needed the environmental impact assessment in WSS sector.

According to the new Law No. 86 on EIA the following water supply facilities are subject to full scale EIA:

- Groundwater abstraction activities or artificial groundwater recharge schemes where the annual volume of water to be abstracted or recharged amounts to 10 million cubic metres or more;
- Deep drilling for water supply drilling (5,000 cubic metres per day and more).

And included in Annex 2:

- Installations of long-distance aqueducts (thoroughfares 5 km long and more);
- Groundwater abstraction and artificial groundwater recharge schemes (not included in Appendix no 1, with an abstraction or recharge capacity of 1 million cubic metres per year and more).

In addition waste-water treatment plants with a capacity exceeding the 150,000 population equivalent are subject to full scale EIA (Annex 1 of the New EIA Law No. 86).

Waste-water treatment plants (not included in Annex no. 1, with a capacity ranging from 50,000 to 150,000 population equivalent) are listed in Annex 2 of the new Law No. 86 and require the identification of the need for the conduct of the environmental impact assessment.

All selected VPCs in the WSS sector need only improvements of existing facilities like network repair and rehabilitation. These types of Projects do not fall into the categories that require the conduct of a full scale EIA according to national Moldovan Legislation. Consequently, this project is not subject to the new Law No. 86 and not requires an EIA evaluation.

In conclusion, the financing of programs and projects is allowed only after a positive SEE decision has been issued and following the IFI / international donor’s requirements.

8.2 Social and gender assessment in Straseni

8.2.1 Methodological approach

The main scope of the study was to assess the social and gender dimensions of the WSS project from the Centre Development Region. The objectives of the study were to

analyse the social and gender situation in Moldova and in the project zone and to develop recommendations for the action plan related to these aspects.

The **main tools** used for the assessment were both qualitative and quantitative data. A desk-based review was used to collect secondary data on various aspects on men and women features at the country as well as at the project area level. Most of the collected data[4] was based on the National Bureau of Statistics and Ministry of Economy documents; administrative data from local public administration from the first and second level, as well as studies and reports written by international organisations.

The approach applied for the current project was developed and tested in a pilot study in the town of Straseni in May 2015 where an assessment of the social and gender aspects was undertaken. Its findings were integrated in the feasibility study of the respective project. Given the scope of the proposed project ("no regrets" measures to improve service provision as part of a medium-term programme) and taking into account that social and gender needs and characteristics do not differ much from a town/project to another, the conclusions reached during the field visit in Straseni are also applied to projects of other rayons/towns of Moldova. The tools applied in the field visit to Straseni were interviews with key stakeholders and focus groups disaggregated by gender with potential beneficiaries. Based on its findings a social and gender action plan was developed.

Focus group participants were selected using the following criteria: gender dimension (men/women), education status (high/low), welfare status (low, medium to high), type of dwelling (individual/apartment), and connection to the water supply system. In the end, four focus groups discussions were conducted: 1) a focus group with women with low welfare status (women with disabilities, unemployed, retired); 2) a focus group with men with low welfare status (men with disabilities, unemployed, retired); 3) a focus group with women with medium to high welfare status; 4) a focus group with men with medium to high welfare status. In total, 28 persons (18 women and 10 men) participated in the focus group discussions.

The key stakeholders who were interviewed were selected based on groups interested in the implementation of the project. In total, seven key stakeholders were interviewed, including: the vice-mayor of Straseni, the town architect of Straseni, the person in charge of attracting investments in Straseni, the director of the district hospital, one businesswoman, the director of the district environmental inspection, and the director of the municipal enterprise, Apa-Canal Straseni.

8.2.2 Beneficiaries, needs and priorities by gender

During the focus group meetings and discussions held in Straseni, it was shown that women and men use water in different ways and for different needs. The use of water depends on the distribution of roles of men and women within households. From the table below, it can be seen that the distribution of household activities (where the water is used) between men and women in the Project area is unequal, as extrapolated from the findings from the focus group meetings.

Table 8-1: Water use by men and women

Household activities where the water is used	Men	Women	Children
Cooking		X	
Washing clothes		X	

[4] All presented data at the national level do not include the rayons from the left side of Dniester River and Bender municipality.

Household activities where the water is used	Men	Women	Children
Washing dishes		X	X
Washing children		X	
Watering crops	X	X	
Cleaning the house		X	X
Watering flowers		X	
Bathing (shower or bath)	X	X	X
Cleaning garden	X	X	
Planting garden	X	X	
Washing car	X		
Washing carpets		X	
Cleaning cesspit	X		
Cleaning animal cages	X	X	
Watering domestic animals		X	X

Thus, from the list of activities shared with the participants in focus group discussions, only a few activities are done mostly by men – washing car and, cleaning the cesspit. More than half of activities are done mostly by women, sometimes with small support from children. Those activities are the following: preparation of meals, washing clothes, washing dishes, washing children, watering flowers, cleaning the house, washing carpets, watering domestic animals. Some of the activities, like watering the crops, cleaning the garden, cleaning the animal cages, planting the garden are shared among men and women. In the households connected to the centralised water system, women are mainly those who clean the water and sanitation facilities. In the households with the outdoor sanitation facilities, roles between men and women are shared. Women usually do the daily cleaning and maintenance of the facilities and the men are responsible for the evacuation of the contents of the septic tank/collectors or of the traditional toilet.

The assessment of beneficiaries' needs and priorities by gender shows that the men and women have different needs and patterns in using the water and sanitation facilities. Therefore, these discrepancies and gaps need to be taken into consideration in the development and implementation of the Project.

The perceptions of men and women regarding the impact of the future project. Both men and women consider that as a result of Project implementation the whole population of the town will benefit. At the local level, the view is that the positive impact of the Project will result in the following:

- More business enterprises will be developed and subsequently more jobs will be created;
- The quality of water and afterwards, people's health will improve;
- The ecological situation will be improved;
- There will be more transparency in the use of water;
- The water and sanitation management will improve;
- The women will have more time to spend with their children and for their personal needs;
- Men will have more time to support their wives in household activities;
- Children will have more time for homework, reading, watching TV, playing games etc.;

- More women will use automatic washing machines and will save their time for other activities.

However, men and women consider that the implementation of the project might cause social problems and social conflicts in communities, like the following:

- Vulnerable groups of the population (pensioners, single women, households with many children, households with persons with disabilities) will still have limited access to water and sanitation system because of lack of money for an individual connection and for paying for services;
- The beneficiaries will not be willing to pay an increased tariff for WSS as they do not understand well the content of the tariff, or the factors that influence the tariff calculations;
- Many households will refuse to be connected to the sanitation system because of the need to pay more for the WSS and of lack of information regarding the positive impact of this project on their health;
- Some of the households will use in parallel the wells and will pay less for sanitation;
- The connection of some enterprises to the sanitation system will raise the cost of final products;
- The treatment plants can be located close to households and the population can suffer from bad smells;
- The streets where mostly the vulnerable groups of population live can be excluded from the project;
- Conflict of interests can arise between the city hall and the construction company, which will cause a substantial increase of the cost of the project;
- The companies will have limited interest in employing local persons during the implementation of the project;
- The staff selection for new WSS management unit could be done in a non-competitive way and qualified persons will have limited opportunities to be employed.

That is why in the elaboration and implementation project process is necessary to take into account the issues mentioned by participants and avoid or prevent the emergence of social disputes.

8.2.3 Social and Gender Action Plan

The Social and Gender Action Plan (SGAP) is based on the summary of findings during the social and gender assessment of the WSS project and provides measures that aim to increase equality in the participation of men and women during all project phases. The following activities are required for the plan:

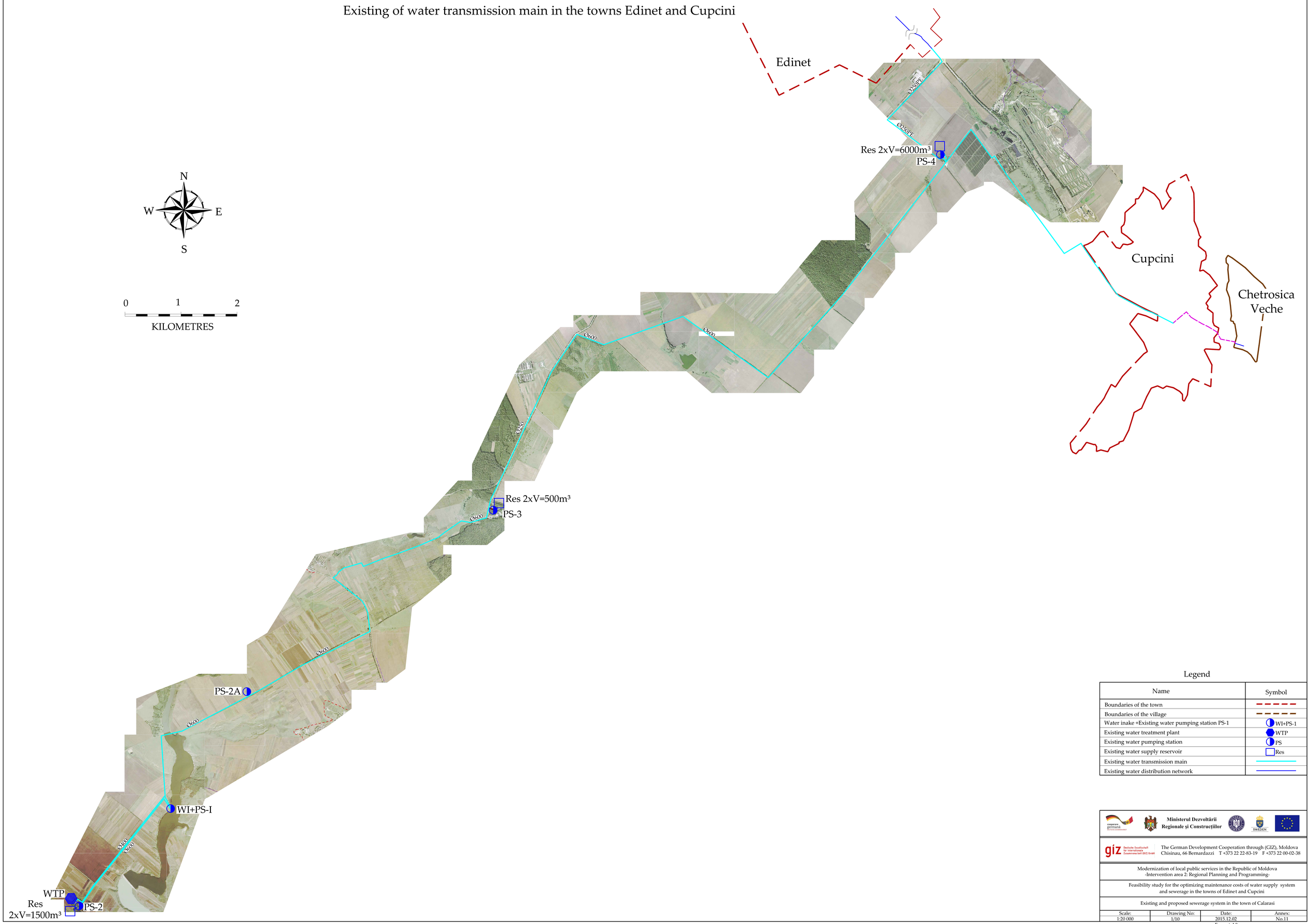
- Information of RDA staff on findings of social and gender assessment and their incorporation in the RDA plan of activities;
- Appointment of a gender focal point at the respective RDA;

- Strengthening the capacities of the RDA staff on integration of social and gender dimensions into the WSS project;
- Incorporation of the findings and recommendations of the social and gender assessment in the ToR of the company performing the detailed designs;
- Consultation of the WSS project technical design separately with women and men, according to their income, disability and age. Women will constitute at least 40% of participants at consultations. Strengthening the capacities of LPAs (rayon councils and local city halls) on the following issues: gender equity, integration of gender dimensions into the project cycle, building an accountable, affordable and qualitative WSS system and communication/information;
- Establishing monitoring committees at the local level and strengthening their capacities in social and gender issues and communication/information. At least 40% of committee members shall be women;
- Provision of information campaigns at the communities' level regarding the WSS project, including the information on SGAP that will be targeted to men/women/persons with disabilities/poor persons. 40% of participants in different communication campaigns will be women;
- Increase the access of vulnerable groups of population to WSS through their involvement at different levels of project preparation and implementation, mobilisation of community support and direct financial support;
- Change the attitudes and behaviours of population regarding the following issues: use of drinkable water for irrigation, using of permeable collectors for wastewater, sustainability of WSS services, etc. At least 40% of participants at those activities must be women.

Annex 11

Conceptual drawings

Existing of water transmission main in the towns Edinet and Cupcini



Legend

Name	Symbol
Boundaries of the town	
Boundaries of the village	
Water inake +Existing water pumping station PS-1	WI+PS-1
Existing water treatment plant	WTP
Existing water pumping station	PS
Existing water supply reservoir	Res
Existing water transmission main	
Existing water distribution network	

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Feasibility study for the optimizing maintenance costs of water supply system and sewerage in the towns of Edinet and Cupcini

Existing and proposed sewerage system in the town of Calarasi

Scale:	Drawing No:	Date:	Annex:
1:20 000	1/10	2015.12.02	No.11

Format A0

Existing water supply system in the town of Edinet

Legend

Name	Symbol
Boundaries of the town	
Water inake +Existing water pumping station PS-1	WI+PS-1
Existing water treatment plant	WTP
Existing water pumping station	PS
Existing water supply reservoir	Res
Existing water transmission main	
Existing water distribution network	

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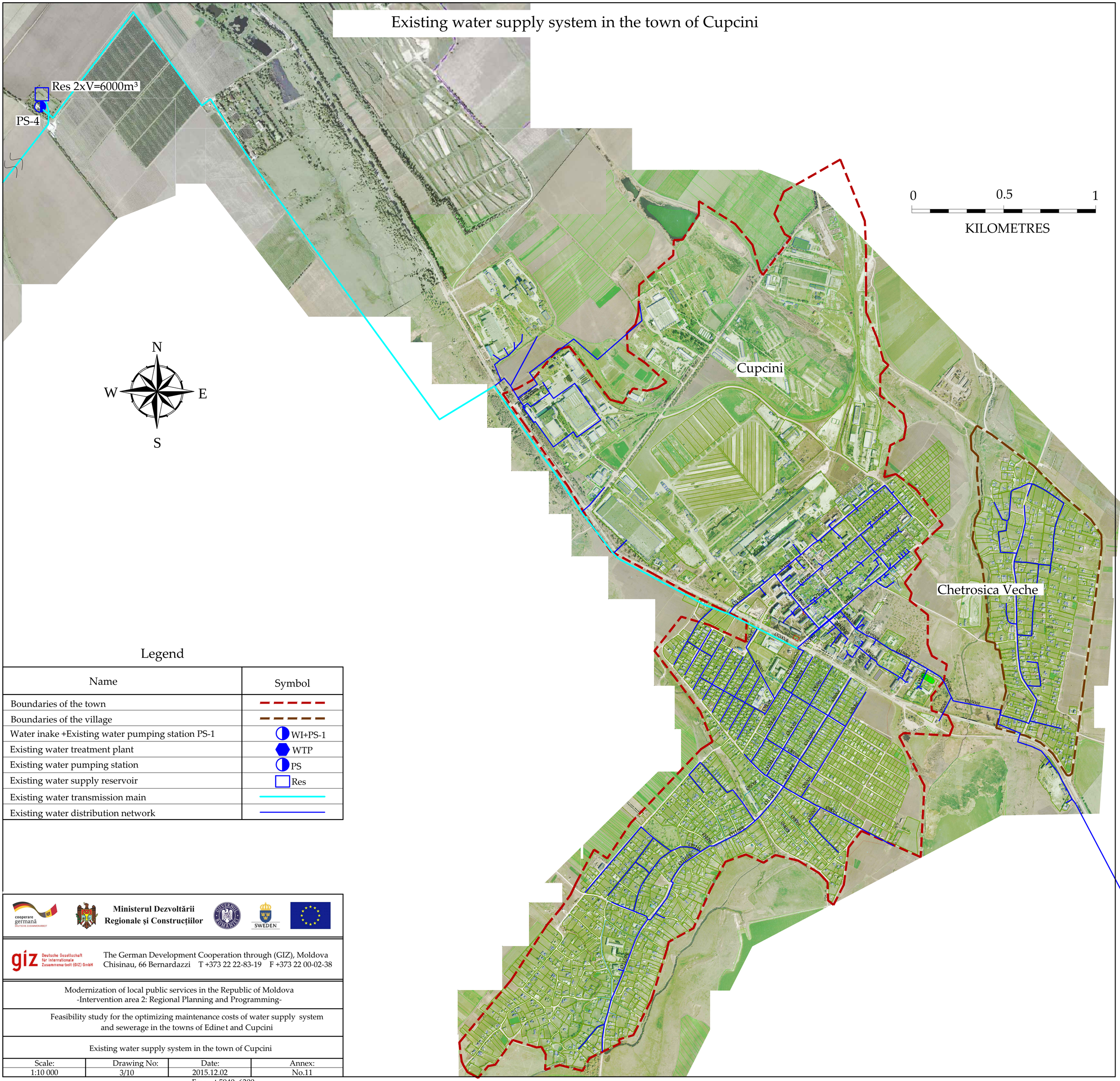
Existing water supply system in the town of Edinet

Scale:	Drawing No:	Date:	Annex:
1:10 000	2/10	2015.12.02	No.11

Format 5940x5900

Existing water supply system in the town of Cupcini



Legend

Name	Symbol
Boundaries of the town	
Boundaries of the village	
Water inake +Existing water pumping station PS-1	WI+PS-1
Existing water treatment plant	WTP
Existing water pumping station	PS
Existing water supply reservoir	Res
Existing water transmission main	
Existing water distribution network	

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Feasibility study for the optimizing maintenance costs of water supply system and sewerage in the towns of Edinet and Cupcini

Existing water supply system in the town of Cupcini

Scale:	Drawing No:	Date:	Annex:
1:10 000	3/10	2015.12.02	No.11

Format 5940x6300

Existing sewerage system in the town of Edinet

Legend

Name	Symbol
Boundaries of the town Edinet	
Existing wastewater treatment plant	WWTP
Existing wastewater pumping station	WWPS
Existing sewerage network	
Existing pressure sewerage network	

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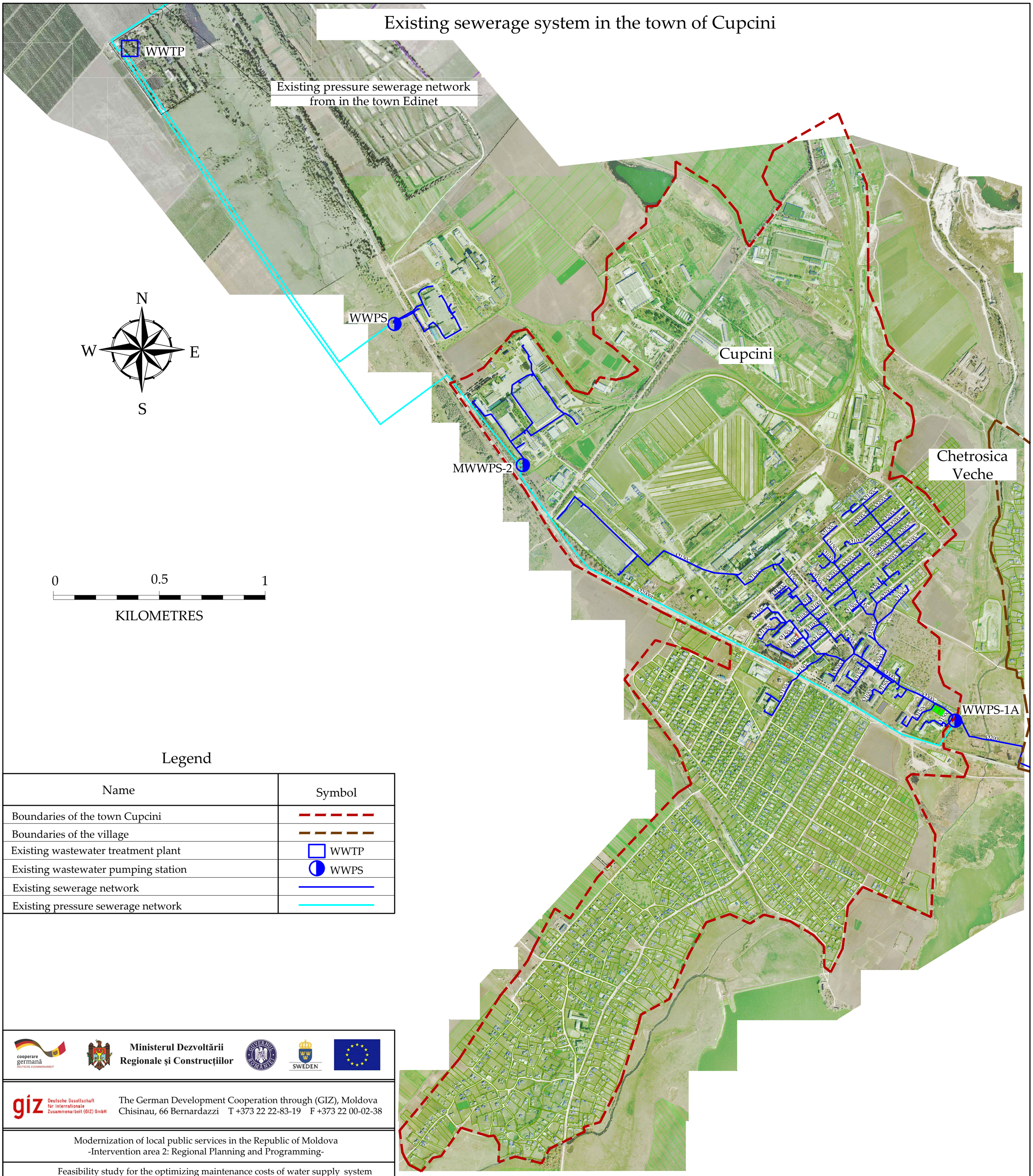
Feasibility study for the optimizing maintenance costs of water supply system and sewerage in the towns of Edinet and Cupcini

Existing sewerage system in the town of Edinet

Scale:	Drawing No:	Date:	Annex:
1:10 000	4/10	2015.12.02	No.11

Format 5940x5900

Existing sewerage system in the town of Cupcini



Legend

Name	Symbol
Boundaries of the town Cupcini	
Boundaries of the village	
Existing wastewater treatment plant	WWTP
Existing wastewater pumping station	WWPS
Existing sewerage network	
Existing pressure sewerage network	

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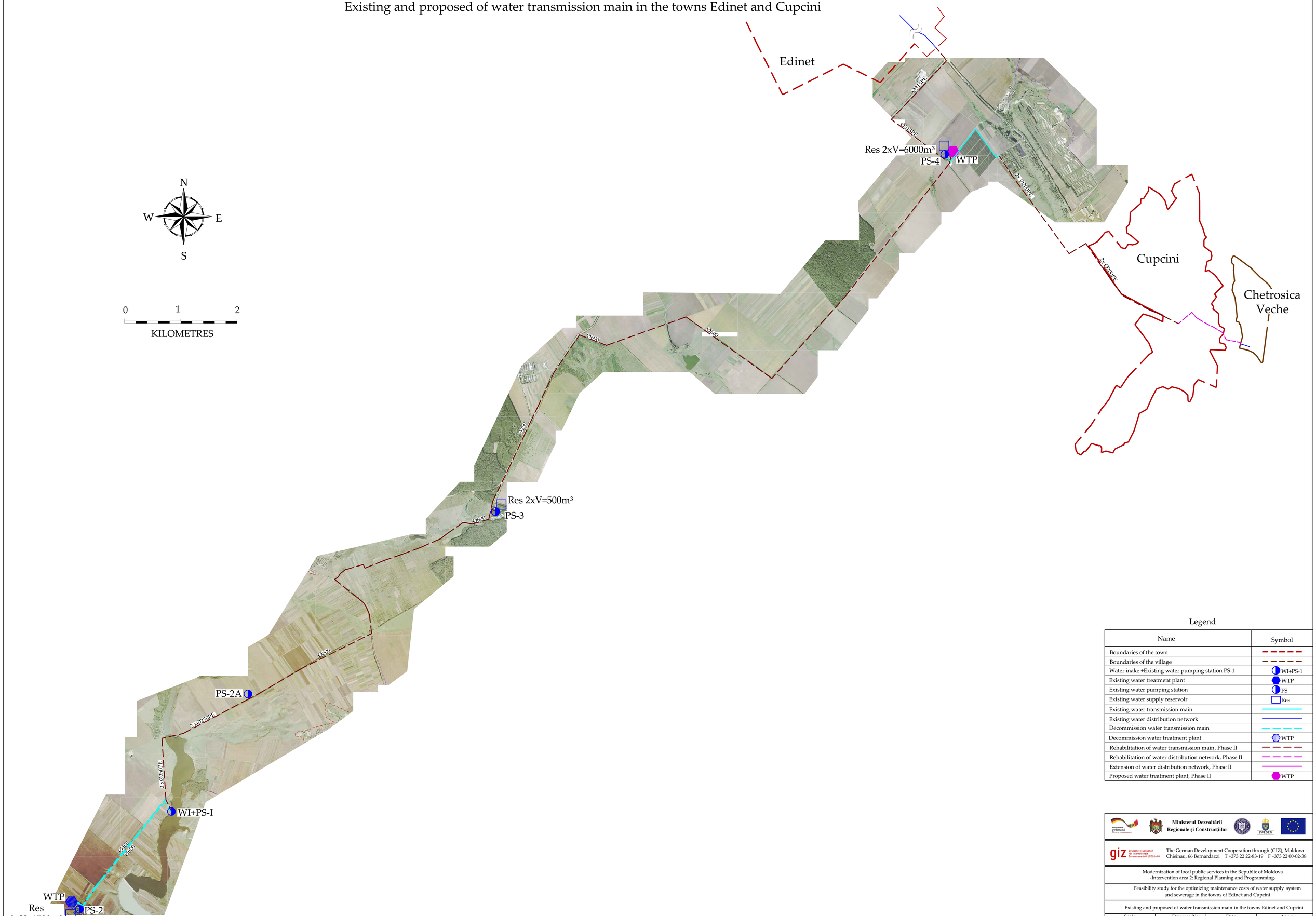
Feasibility study for the optimizing maintenance costs of water supply system and sewerage in the towns of Edinet and Cupcini

Existing sewerage system in the town of Cupcini

Scale:	Drawing No:	Date:	Annex:
1:10 000	5/10	2015.12.02	No.11

Format 5940x5100

Existing and proposed of water transmission main in the towns Edinet and Cupcini



Legend

Name	Symbol
Boundaries of the town	
Boundaries of the village	
Water inake +Existing water pumping station PS-1	WI+PS-1
Existing water treatment plant	WTP
Existing water pumping station	PS
Existing water supply reservoir	Res
Existing water transmission main	
Existing water distribution network	
Decommission water transmission main	
Decommission water treatment plant	WTP
Rehabilitation of water transmission main, Phase II	
Rehabilitation of water distribution network, Phase II	
Extension of water distribution network, Phase II	
Proposed water treatment plant, Phase II	WTP

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-Intervention area 2: Regional Planning and Programming-

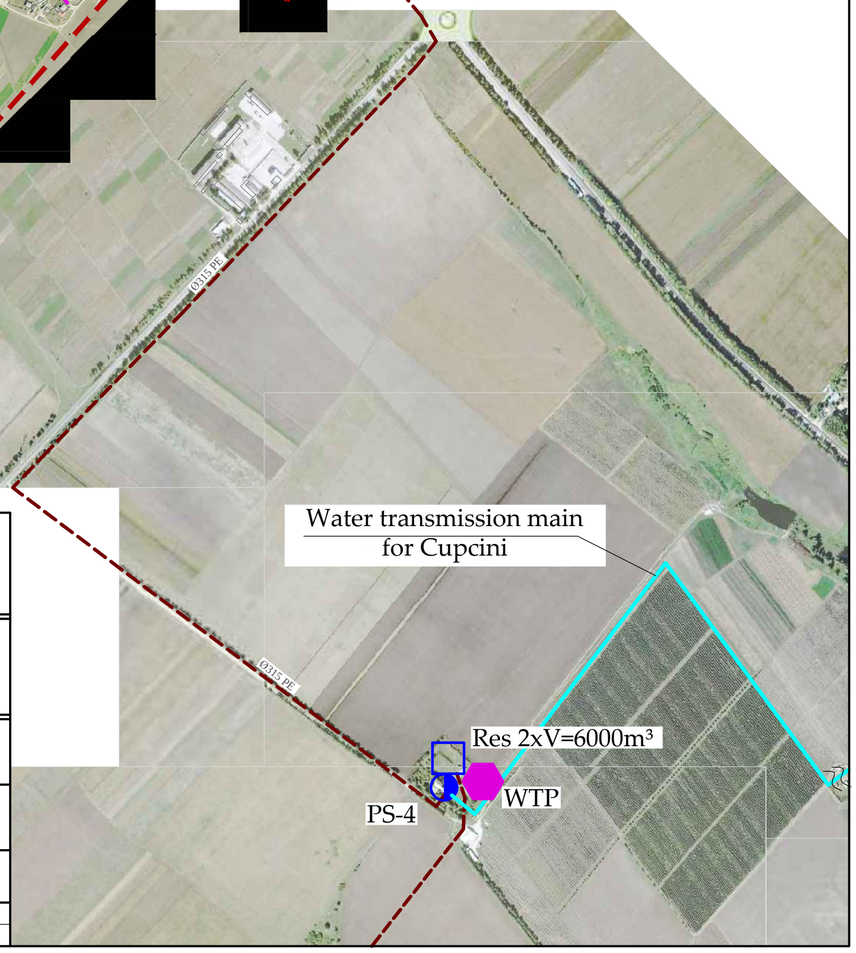
Feasibility study for the optimizing maintenance costs of water supply system and sewerage in the towns of Edinet and Cupcini

Existing and proposed of water transmission main in the towns Edinet and Cupcini

Scale:	Drawing No:	Date:	Annex:
1:20 000	6/10	2015.12.02	No.11

Format A0

Existing and proposed water supply system in the town of Edinet



Legend

Name	Symbol
Boundaries of the town	
Water inake +Existing water pumping station PS-1	WI+PS-1
Existing water treatment plant	WTP
Existing water pumping station	PS
Existing water supply reservoir	Res
Existing water transmission main	
Existing water distribution network	
Decommission water transmission main	
Decommission water treatment plant	WTP
Rehabilitation of water distribution network, Phase I	
Extension of water distribution network, Phase I	
Rehabilitation of water transmission main, Phase II	
Rehabilitation of water distribution network, Phase II	
Extension of water distribution network, Phase II	
Proposed water treatment plant, Phase II	WTP

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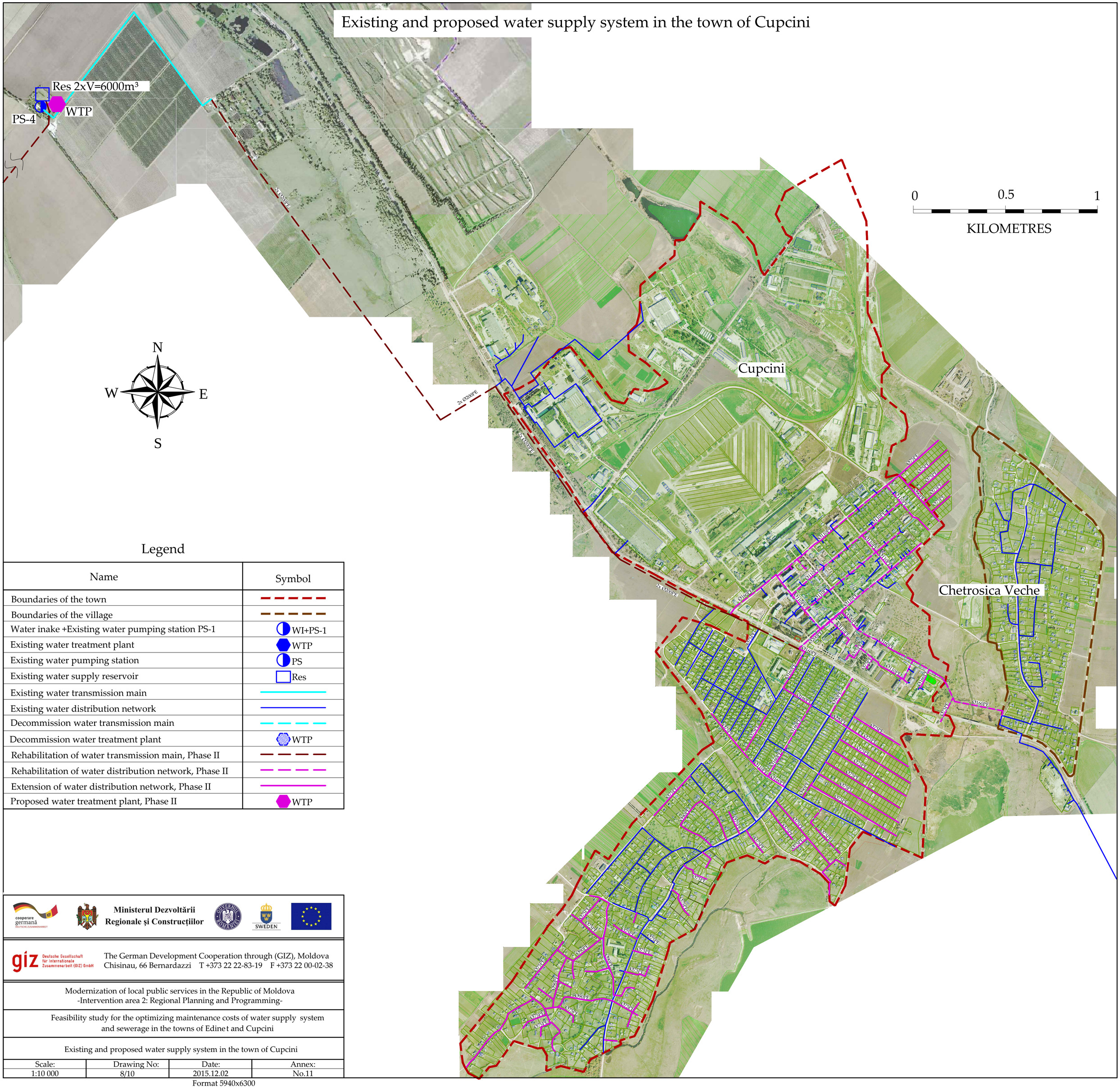
Feasibility study for the optimizing maintenance costs of water supply system and sewerage in the towns of Edinet and Cupcini

Existing and proposed water supply system in the town of Edinet

Scale:	Drawing No:	Date:	Annex:
1:10 000	7/10	2015.12.02	No.11

Format 5940x5900

Existing and proposed water supply system in the town of Cupcini



Legend

Name	Symbol
Boundaries of the town	
Boundaries of the village	
Water inake +Existing water pumping station PS-1	WI+PS-1
Existing water treatment plant	WTP
Existing water pumping station	PS
Existing water supply reservoir	Res
Existing water transmission main	
Existing water distribution network	
Decommission water transmission main	
Decommission water treatment plant	WTP
Rehabilitation of water transmission main, Phase II	
Rehabilitation of water distribution network, Phase II	
Extension of water distribution network, Phase II	
Proposed water treatment plant, Phase II	WTP

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Existing and proposed water supply system in the town of Cupcini

Scale:	Drawing No:	Date:	Annex:
1:10 000	8/10	2015.12.02	No.11

Format 5940x6300

Existing and proposed sewerage system in the town of Edinet

Legend

Name	Symbol
Boundaries of the town Edinet	
Existing wastewater treatment plant	WWTP
Existing wastewater pumping station	WWPS
Existing sewerage network	
Existing pressure sewerage network	
Point of connection	
Rehabilitation wastewater treatment plant, Phase II	WWTP
Proposed wastewater pumping station, Phase II	WWPS
Extension of sewerage network, Phase II	
Extension of pressure sewerage network, Phase II	

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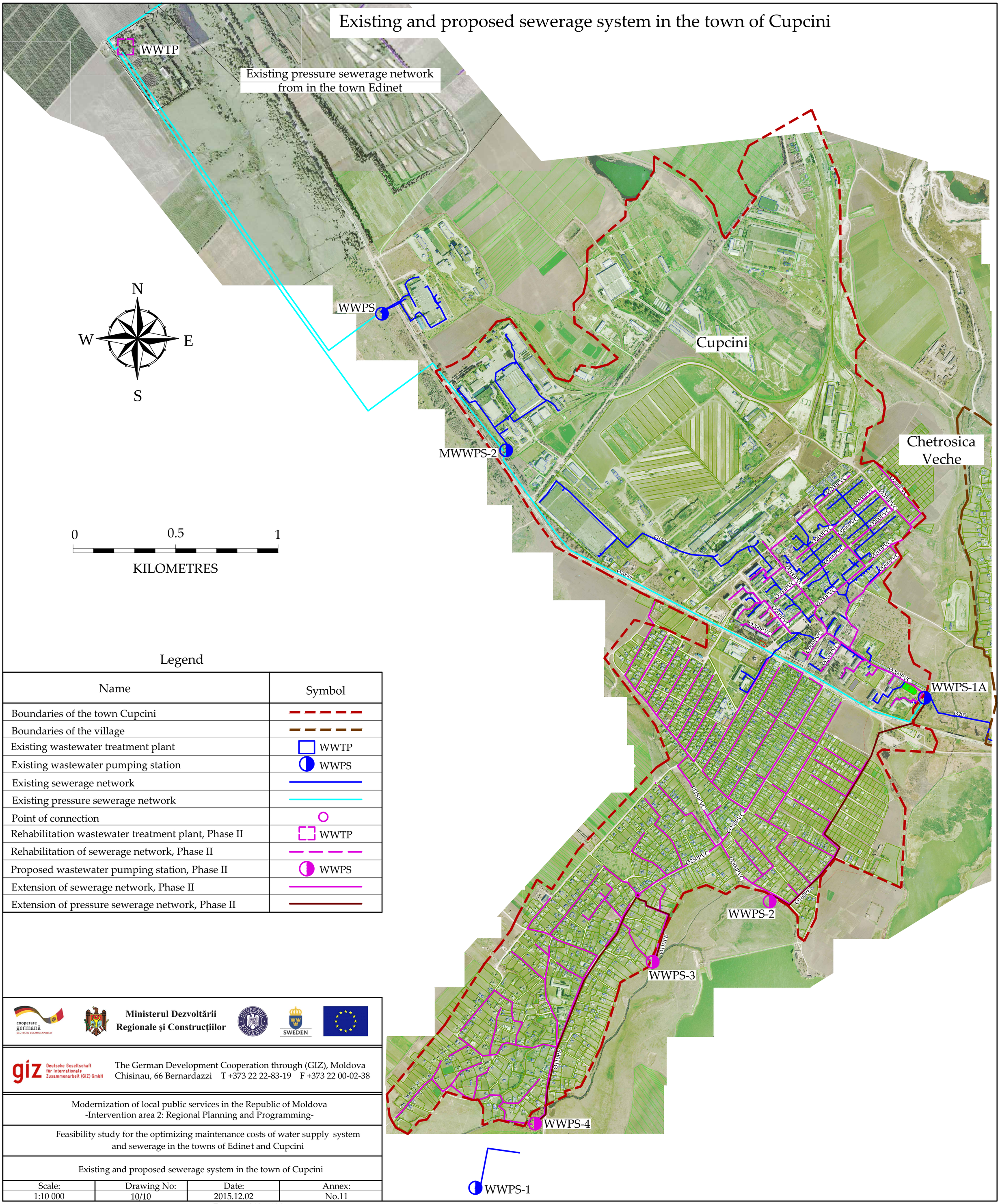
Existing and proposed sewerage system in the town of Edinet

Scale:	Drawing No:	Date:	Annex:
1:10 000	9/10	2015.12.02	No.11

Format 5940x5900

Existing and proposed sewerage system in the town of Cupcini



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Legend

Name	Symbol
Boundaries of the town Cupcini	
Boundaries of the village	
Existing wastewater treatment plant	WWTP
Existing wastewater pumping station	WWPS
Existing sewerage network	
Existing pressure sewerage network	
Point of connection	
Rehabilitation wastewater treatment plant, Phase II	WWTP
Rehabilitation of sewerage network, Phase II	
Proposed wastewater pumping station, Phase II	WWPS
Extension of sewerage network, Phase II	
Extension of pressure sewerage network, Phase II	

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Scale:	Drawing No:	Date:	Annex:
1:10 000	10/10	2015.12.02	No.11

Format 5940x5100