ROYAL HASKONING

HASKONING NEDERLAND B.V. WATER
IHS INSTITUTE FOR HOUSING AND URBAN DEVELOPMENT STUDIES
DELOITTE&TOUCHE CENTRAL EUROPE

Feasibility Study Šabac

Waste Water Treatment Project

European Agency for Reconstruction

31 December 2007

Final Report

9R5927/CvS/R2006_06/R001

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ABBREVIATIONS

AC	Asbestos Cement
ATV DVWK	German Association for Water, Wastewater and Waste
BOT	Built-Operate-Transfer
BOD	Biochemical oxygen demand
CBA	Cost Benefit Analyses
CSO	Combined Sewer Overflow
COD	Chemical Oxygen Demand
CWWTP	Central WasteWater Treatment Plant
DI	Ductile iron pipe
DTD-Canal	Danube-Tisa-Danube Canal
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EPA	Environmental Protection Agency
EU	European Union (from 1992)
EUR	European Euro
FIDIC	International Federation of Consulting Engineers
GRP	Glass-reinforced-plastic pipe
LEAP	Local Environmental Action Plan
MBR	Membrane Bio-Reactor
MLSS	Mixed Liquor Suspended Solids
NEAP	National Environmental Action Plan
NES	National Environmental Strategy
NIVA	Norwegian Institute for water research
O&M	Operation and Maintenance
PE	Population equivalent
PIP	Project Implementation Plan
PPP	Polluter-pays principle
PRAG	Practical Guide to Contract Procedures financed from the general budget of the EC in the context of external actions
PUC	Public Utility Company
PVC	PolyVinyl Choride
SCADA	Supervisory control and data acquisition
SBR	Sequencing batch reactor
SPS	Sewage Pumping Stations
SS	Suspended solids
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TOD	Total Oxygen Demand

EXECUTIVE SUMMARY

Introduction

Acting upon the request of Šabac municipality, the European Agency for Reconstruction (EAR) commissioned MIASP in July 2007 to conduct a Feasibility Study to consider the possibility of co-funding the Project for Waste Water Treatment and Sewage Collection. The project area covers the Municipality of Šabac, including its urban and rural settlements, located at the north-west part of Serbia and administratively belongs to the Mačva District.

The Municipality of Šabac had, since 2005, presented as a priority for financial support an infrastructure project including extension and upgrading of the existing sewer system and construction of corresponding wastewater treatment facilities, which would mitigate the adverse effects of the pollution of the River Sava.

The project aims at the construction of:

1. The sewage pumping station Glavna to be located close the existing wastewater outlet. This SPS will pump wastewater to the future WWTP through a new transport line;
2. A force main from the SPS Glavna to the WWTP;
3. A new wastewater treatment plant (WWTP).

The total population of the municipality of Šabac according to official 2002 population estimate was 128,000 inhabitants. The total surface amounts to 795 km2, which makes around 0.9% of the total surface of the Republic of Serbia.

The overall objective of the project is to protect and improve water quality of the River Sava since the collected and transported industrial and communal wastewater is not treated prior to discharge into the river.

The feasibility study supported defining the project and the operational and institutional arrangements required to secure financing. The study supported the full preparation of the project to the level at which financing can be extended for its implementation.

Scope of the Feasibility Study

- A basis for financial project appraisal by the EAR;
- Compose a plan for the institutional, organisational and financial setting of the waste water and sewage collection system in Šabac municipality;
- Compose a plan for the construction and operation of the new waste water treatment plant, main gravity sewer and a pumping station in accordance with Serbia's and EU's legal, regulatory and environmental legislation.

Scope of the water utilities project

- Diversion of the wastewater flow originating from the suburban areas, away from the Town centre through a by-pass interceptor sewer, ending at the future wastewater treatment plant (WWTP) site;
- Construction of a sewage pumping station (SPS) named Glavna to be located at the existing wastewater outlet;
- Construction of the main sewers to reach the surrounding villages and built up areas around the Town centre will connect an additional 23,000 inhabitants to the system;
- Construction of a new WWTP for the design organic loading of 126.000 population equivalents (PE), domestic wastewater collected in Šabac and surrounding suburbs and other settlements, and the industrial wastewater subject to prescribed preliminary treatment prior to discharge into the sewer system.

Conclusions and Recommendations

General

1. The project was originally oriented towards the construction of the Waste water treatment plant (WWTP) Šabac, only. However, in order to achieve overall project objectives and improve level of communal services, it was deemed necessary to also consider and include the scope with the extension of the sewerage system, and construction of a sewage pumping station.
2. The project is in line with the relevant EU directives and also compliant with the requirements set out in the national legislation and regulations.

Extension of the sanitary sewerage collection system

1. The proposed extension of the sanitary sewerage collection system would significantly improve standard of service – in wastewater collection, and would substitute current practice relying on individual septic tanks that represent potential source of pollution of both underground and surface waters, and serious health hazard.
2. The system is continuously being extended, and during 2005 and 2006 the main gravity sewer along the Cerski Canal was constructed, enabling the connection to the system of a number of suburbs;
3. Current operational practice of the system is such that, especially during periods of high water levels in the Sava River, the system comes under backwater effect, resulting in flooding of the zones with lower altitudes. For that reason, an auxiliary outlet has been constructed, with a pump that discharges wastewater and storm water runoff to the Sava, even for high water levels in the river.
4. A force main from the SPS Glavna to the WWTP location of nominal diameter DN800 will convey all wastewater collected in the town area, plus collected storm water runoff equivalent to the maximum wastewater dry-weather flow.

5. The plans for the extension of the sewerage service area to the suburbs neighbouring the urban area that have been developed and gradually implemented, will connect an additional 23,000 inhabitants to the system.

Construction of a sewage pumping station (SPS), Glavna

1. The Sewerage pumping station (SPS) Glavna is to be located at the existing wastewater outlet.
2. The SPS will pump wastewater to the future WWTP through a new transport pipeline.
3. It will also be designed to cater for a possible combination of wet weather flow and high levels of the River Sava, when the surface water level exceeds the invert level of the wastewater outlet pipe;

Construction of the WWTP Sabac

1. The planned WWTP Sabac would treat the complete communal wastewaters from the urban area and neighbouring suburbs, plus pre-treated industrial effluents in accordance with the set design criteria.
2. The WWTP shall be located close the outlet of the so-called Cerski Canal into the River Sava on a reserved site with an area of 5,6 ha.
3. Substantial preparatory works have already been carried out at the WWTP sites including protective embankment in the WWTP zone as well as backfilling of some 100.000 m^3 of gravel in order to improve foundation conditions. In brief, the treatment processes to be employed at the WWTP shall include the following: grit removal, primary clarifiers, biological aeration, final clarifiers, and sludge treatment: primary and secondary thickeners, anaerobic stabilization and dewatering. Construction of a new WWTP – Phase I with a hydraulic capacity $Q_{max\ day}$ = 420 l/s and $Q_{max\ h}$ = 650 l/s and for the design organic loading of 126.000 population equivalents (PE).
4. The future WWTP is supposed to provide adequate treatment of domestic wastewater collected in Šabac and surrounding suburbs and other settlements, as well as the industrial wastewater subject to prescribed preliminary treatment prior to discharge into the sewer system. The Consultant recommended five different WWTP alternative technical solutions for treating wastewater.
5. A separate wastewater treatment plant shall provide treatment of wastewater originating from the Town's major chemical industry complex Zorka.
6. Although the project period is divided into two phases, the WWTP will be built to cater for the demand of the Town of Šabac and its suburbs for the projected period of up to 2041 (**Phase I** – subject of this study). The **Phase II** of the WWTP can be only considered as a very long term perspective that can be implemented only if much more intensive urban and industrial developments take place in Šabac.
7. The location and concept of the WWTP are in accordance with the local General and Detail Urban Master Plans, and the WWTP design was approved by the Republican review committee and the corresponding building permit has been issued.
8. The set design criteria are in accordance with the EU wastewater treatment directive, and generally compatible with the requirements set by the competent national authority.

9. It is recommended that the WWTP including primary and secondary treatment should preferably be tendered on the shortest possible notice, according to one of the recommended scenarios (PRAG).

Environmental Impact Assessment

1. The EIA covers the WWTP but not the sewage connections. In the EIA the WWTP is referred to as the central WWTP for Šabac. The plant will treat all the faecal waste water (from urban and suburban population) and industrial waste water from the territory covered by the Šabac General City Plan, except the industrial waste water of 'Zorka'. Discharge takes place on the Sava River as recipient water body. The WWTP will also handle runoff water by rain.
2. The WWTP complex comprises three elements that will be considered:
   - The WWTP itself;
   - The pipeline that feds the WWTP with combined sewage and runoff water;
   - The pumping station that pumps the sewage/water through the pipeline to the WWTP.
3. The aim of this feasibility study is to assess whether the issues dealt with in the EIA are complete, followed by a more detailed check on the content of the EIA. This deals with the standard environmental issues during construction and operation of the WWTP complex.
4. To secure proper functioning of the WWTP, industrial waste water containing different types of pollutants, has to be filtrated to meet certain quality levels, before it is discharged to the city sewerage. The quality of industrial effluents is prescribed by the Rules on technical and sanitary conditions for waste water discharge. Those Rules were developed within the Šabac City Project. Pre-treatment of waste water from each industry is defined by the characteristics of industrial waste water and requirements of the Rules.
5. In line with requirements by Serbian Law, an EIA was carried out for the Central Municipal and Waste Water Treatment Plant by 'Energoprojekt-Hidroinzenjering MDD', reported in September – October 2005. This EIA has been approved by the Serbian competent authority (i.e. the Ministry for Infrastructure and Capital Investments). This Ministry issues the building permit for the WWTP, pumping station and interconnecting pipeline.
6. For the construction and operational phase an extensive HSE management plan should be made. It should elaborate on all the HSE issues, including necessary training of employees.

Financial assessment PUC Standard

1. PUC Vodovod Šabac operates at 0% net profit;
2. The generated cash flow is insufficient to finance investments; most investments are funded directly by the Municipality or are provided for with capital subsidies
3. The collection rate is high 91%; the revenue from the core activity includes also revenues from sale of the material and civil engineering works.
4. The water and waste water tariffs are projected to just cover costs during 2007. The cost coverage ratio is, however, declining as a result of costs increases higher than allowed and applied tariff adjustments
5. Fixed assets are not revaluated regularly. In an inflationary environment, as has been the case in Serbia, this leads to the understatement of the asset base in the

balance sheet, but also to the understatement of the depreciation charge and might lead to tariffs being set at below cost recovery levels.

6. The PUC does not make *provisions* for doubtful debts. Instead, uncollectible debt is written off directly, but also this happens irregularly. The PUC prepares annual plans and budgets, in conformity with guidelines provided by the Ministry of Finance. There is no multi year planning, integrated with this annual planning & budgeting cycle;
7. There is no tariff setting formula or procedure, since it is currently national policy to cap tariff increase with the estimated inflation for the next year;

Creditworthiness assessment Sabac municipality

1. The budget of Sabac municipality is balanced during the period 2004 to 2007. Part of the budget is however financed from external sources (commercial bank loans);
2. Budget capital expenditures during 2004 to 2006 have increased by 12% and the plan for 2007 is a further increase of capital expenditures by 91% compared to 2006.
3. Projections of municipal revenue and costs show that, in addition to the 2007 allocation, the municipality still would have some though limited financial room to finance sewage infrastructure from its budget during the period 2008 to 2010;
4. The Municipality of Šabac, has very ambitious investment plans, related to building of the North –Zone, and the capacity to borrow in 2007 (as reported by the Treasury) RSD 595 or €7,54 million.
5. However favourable borrowing conditions commercial banks are offering to the municipalities, the Municipality of Šabac can only finance part of this plan. They look for additional funding means by attracting investors (either foreign or domestic), donations and funds from the Republic.

Financial analysis

1. A tariff policy is proposed, consisting of the following elements:
   a. A new waste water treatment tariff to be introduced in the year 2011 amounting to RSD 18/m3 (2011 price) of drinking water consumed. It is proposed to set the waste water tariff from the start (year 2011) at the unit cost price at the same level for all customer groups. Thereafter the tariffs will only need to be adjusted for inflation.
   b. A sewage collection tariffs: Cross subsidy for the domestic and institutional tariffs will diminish from 2012 onwards, to level with the business tariffs after 2028. As from the year 2014, average tariff charged is equal to average unit cost price. As a result of this policy, the average tariff charged up to the year 2014 exceeds the full unit cost price, with the exception of the year 2010.
   c. A drinking water tariff: Proposed to gradually abolish cross subsidy starting from year 2009, to introduce equal drinking water tariffs for all customer groups by the year 2028. Increase of the current drinking water tariff with inflation is proposed only for the year 2011. After that, the average tariff will be based on the full cost unit price.
2. The tariff policy results in a real cumulative increase of the overall water and waste water tariff for domestic users of approximately 50% by the year 2011 and 80% cumulative by the year 2041.

3. However, it remains within affordability constraints. A maximum of 1.5% of average household income is forecasted to be spent on water & waste water during the years 2011 to 2013, up from 1.2% in 2007.
4. The proposed tariffs are on the average affordable for domestic users. Calculations are based on the average consumption patters and average household income. Affordability constrains may be faced by the pensioners and other low income groups.
5. On the basis of this proposed tariff policy, a financial analysis was conducted. Assuming a macro economic base case scenario the analysis results in a nominal financial internal rate of return on total invested capital (FIRR/C) of 0.3% and a financial net present value (FNPV/C) of € -8,728 thousand;
6. This financial result justifies grant funding, like EU-IPA. Using the "modified formula", a grant rate percentage of 73.7% is calculated. Assuming a maximum 75% rate, the project would be eligible for a grant amounting to € 11,724 thousand;
7. The funding gap methodology applicable to ERDF/CF financed project during the programming period 2007 – 2013 leads to a substantially lower maximum grant level of € 7,668K, assuming a maximum co-financing rate of 75%. In case the discount rate would be set at 5% in real terms (7% current) as required for ERDF/CF financed projects during the programming period 2007 - 2013, the maximum EU grant would amount to € 7,396 thousand;
8. The project is financially sustainable, since the cumulative project cash flow in each year is positive;
9. The financial rate of return on national invested capital is acceptable at a level slightly higher than the nominal discount rate of 8%. FIRR/K is 10.9% and FNPV/K is € 983 thousand;
10. The sensitivity analysis shows that a variation of +/-1% in selected key variables does not cause fluctuations higher than 5% in FNPV/C. There are therefore no critical variables requiring a further risk assessment;
11. The project is most sensitive to variations in the discount rate, in particular to lower discount rates.
12. The project creates large positive external effects. The quantitative economic analysis shows positive results, even though not all external effects could be monetized: EIRR 17.0%, ENPV of € 16,798 thousand and a B/C ratio of 1.51. The project is therefore feasible from the point of view of society.

Institutional analysis

1. The PUC provides services related to water supply and wastewater management. For the purpose of the project, no mayor changes are envisaged in the organisational setup of the water supply and wastewater departments of the existing PUC.
2. The Municipal Decision on sanitary-technical conditions for discharge of wastewater in the sewer system endorsed on June 14th 2007, sets conditions that have to be met before wastewater is discharged into the sewer system. The obligation of all real estate owners and tenants (legal entities and natural persons)

to connect to the public sewer system was included at the request of the Consultant.

3. It is recommended that the existing Municipal Decision of Communal Activities (MoV Official Gazette 23/2001) is amended so as to include the following:
   a. To enforce connection to the sewage system within 6 months from the construction of the sewage for both legal and physical persons;
   b. To define authorities of inspectors and penalties

4. Implementation of the project shall enable (major) industries in the Municipality of Šabac to get connected to the main collector and thus to the WWTP.
5. To ensure project sustainability, it is recommended that the municipal Decisions are amended in a way to ensure:
   a. Obligation to use the WWTP;
   b. Define conditions by which users may be connected to the sewage system and the WWTP;
   c. Define penalties and authorities of inspectors.

<u>Operational efficiency</u>

1. The PUC will remain the responsible operator of all infrastructural assets for the raw water intake, drinking water production and distribution, and collection and treatment of wastewater
2. Financial systems should be improved. There is especially a need to design and implement a management accounting system that would be linked to the management information system;
3. Furthermore, multi-year long-term financial/investment planning system and an approved and implemented tariff policy needs strengthening;
4. The billing and collection system will need to be adapted to the specific needs of the utility and to improve its efficiency;
5. A management information system needs to be designed, which is standardized and fully integrated with the financial systems;
6. Laboratory facilities both in terms of facilities and in human capacity will need strengthening.
7. Wastewater sampling at different points between treatment steps will be required for process monitoring and operation. The volume of sampling will therefore increase. A laboratory for wastewater analysis is foreseen at the site of the new WWTP.
8. Measures and a program for leakage reduction, both in terms of human resources, management and physical measures (sector metering) are required to reduce physical losses.
9. The introduction of a so-called Service Level Contract between the Municipality and the PUC is a possibility to further develop the independent position of the PUC.
10. Specific information on water losses and other consumption categories and costs for O & M and remedial maintenance can be found but are neither complete nor reliable.

Financing and investment

1. The Total investment cost for Phase I amounts to € 15.92 million;
2. The Ministry of Agriculture, Forestry and Water has committed in writing € 4.19 million for the new waste water treatment plant, provided 100% financing is secured, 1/3 of the total cost of the SPS is assumed to be financed by the Ministry.
3. EU-IPA funds are assumed to amount to 75% of eligible costs or € 10.89 million (excluding VAT, land acquisition). Actual grant size will depend on the appraisal of this feasibility study, availability of funds and the applicable grant determination mechanism
4. The Municipality of Sabac allocated in its 2007 budget RSD 67 million (€ 0.84 million) for sewerage projects.

Table 01 Overview of Investments

WWTP (incl. contingencies, incl. VAT)	Units	Tot.	2009	2010
Investigation works & design	€ m	0.35	0.18	0.18
Construction works	€ m	6.91	3.45	3.45
Electro-mechanical equipment	€ m	5.01	2.50	2.50
Additional land acquisition (1,5 ha)	€ m	-	-	-
Trial run, staff training, operation	€ m	0.30	0.15	0.15
Sewerage			-	-
Sabac main sewers	€ m	-	-	-
Sabac SPS - civil works	€ m	1.64	0.82	0.82
Sabac SPS - elctr/mechanical	€ m	0.65	0.32	0.32
Sabac SPS - pipes & fittings	€ m	-	-	-
Supervision			-	-
Supervision WWTP	€ m	0.95	0.48	0.48
Supervision sewer extension	€ m	0.11	0.05	0.05
Total	**€ m**	**15.92**	**7.96**	**7.96**

Table 02 Identified TA elements

Project	**Time frame**	**Assessed costs (€x1000)**
Sabac WW Project Detail Design SPS Glavna and main sewer Financing unidentified	February 2009 – August 2009	200
Sabac WW Project Tendering and Supervision of the scheme Financing unidentified	June 2009 – December 2011	1,064
Sabac WW Project Financial Operation and Performance Improvement Program (FOPIP) Financing unidentified	April 2009 – April 2010	250
Total		**1,514**

Table 03 Proposed financing plan Phase I

Financial year ending		Total	2009	2010
EU-IPA, grants, other	€ m	10.89	5.45	5.45
Min. Agriculture, DG Water	€ m	4.19	2.09	2.09
Municipal contribution	€ m	0.84	0.42	0.42
Loan	€ m	-	-	-
Total	€ m	15.92	7.96	7.96

Risks

The following major risks related to project preparation, implementation and operation have been identified

Risk	Category Financial, Environmental, Operational, Institutional Socio-economic Human	Probability H: High M: Moderate L: Low	Adverse effect From: 1 (Severe) To: 5 (None)	Mitigation measures (for effects 1, 2 and 3 only)
PROJECT PREPARATION				
No agreement on use of the property for pumping station and pipeline	Institutional/ Socio-economic	Low	3	Enforcement by municipality
PUC / Municipality fail to allocate funds for the project	Financial	Moderate	1	Apply for funding from sources other than national funds
Limited management capacity available	Operational/ Institutional	Low	4	Capacity enhancement programs
PROJECT IMPLEMENTATION				
Delay due to construction of pipeline	Operational	Moderate	2	Technical and organizational support
Delay of works due to winter weather conditions	Operational	Moderate	2	Technical and organizational support
Zorka _US Steel fails to treat its industrial discharge	Operational/ Institutional	Moderate	3	Close follow up with Ministry of Waters and provide support to Municipality in legal/contractual enforcement
OPERATION				
Occurrence of streams of industrial waste water.	Operational	High	1	Implement waste water management strategies. Increase control on the treatment process
Enforcement of industrial waste water treatment fails	Institutional	High	2	Enforcement by municipality
Inadequate tariff policies and payment discipline	Institutional	Moderate	2	Ensure adequate tariff policy in agreements.

Low HSE standards	Human	Moderate	1	Draw up a HSE plan and live up to it. Apply control measures
Quality standards of treated wastewater not met	Operational / environmental	Moderate	3	Provide TA support to set up appropriate plans and measures

IZVRŠNI REZIME

Uvod

Na zahtev opštine Šabac, Evropska agencija za rekonstrukciju (EAR) je u julu 2007. godine angažovala MIASP da izradi Studiju izvodljivosti kako bi se sagledale mogućnosti sufinansiranja projekta za tretman otpadnih voda i projekta za sakupljanje otpadnih voda. Projektna oblast obuhvata opštinu Šabac uključujući njena gradska i prigradska naselja koja se nalazi u severozapadnom delu Srbije i administrativno pripada Mačvanskom okrugu.

Od 2005. godine opština Šabac, kao prioritet za finansijsku podršku, ističe projekat lokalne infrastrukture uključujući proširenje i unapredjenje postojećeg kanalizacionog sistema i izgradnju odgovarajućih postrojenja za tretman otpadnih voda što bi ublažilo negativne uticaje zagadjenja reke Save.

Cilj projekta je sledeće:

1. Crpna stanica Glavna treba da se nalazi blizu postojećeg ispusta otpadnih voda. Ona će ispumpavati otpadne vode u buduće postrojenje za tretman otpadnih voda kroz nov transportni cevovod;
2. Potisni cevovov od KCS Glavna do PPOV;
3. Novo postrojenje za prečišćavanje otpadnih voda (PPOV).

Ukupan broj stanovnika opštine Šabac, prema zvaničnoj proceni iz 2002. godine, je bio 128.000 stanovnika. Ukupna površina dostiže je 795 km^2, što čini oko 0.9% ukupne površine Republike Srbije.

Cilj ovog projekta je zaštita i poboljšanje kvaliteta vode reke Save s obzirom da se sakupljena i transportovana industrijska i komunalna voda ne prečišćavaju pre ispuštanja u reku.
Studija izvodljivosti je pomogla definisanje projekta i neophodnih operativnih i institucionalnih mera kako bi se osiguralo finansiranje. Studija je podržala sveobuhvatne pripreme projekta do nivoa na kome se može očekivati finansiranje.

Obim Studije izvodljivosti

- Osnova za finansijsku procenu projekta od strane EAR-a;
- Priprema plana za izradu finansijskog, institucionalnog i finansijskog okvira sistema za sakupljanje otpadnih voda u opštini Šabac;
- Priprema plana za izgradnju i rad novog postrojenja za prečišćavanje otpadnih voda, glavni kolektor i crpnu stanicu u skladu sa regulativama i zakonima Srbije i EZ koji se odnose na zaštitu životne sredine.

Obim projekta otpadnih voda

- Preusmeravanje toka otpadnih voda koje kreću sa periferije, daleko od centra grada kroz by-pass interceptor sewer i dolaze do lokacije budućeg postrojenja za prečišćavanje otpadnih voda;
- Izgradnja kanalizacione crpne stanice (KCS) nazvane Glavna koja treba da se nalazi na postojećem ispustu otpadnih voda;
- Izgradnjom cevovoda koji treba da stigne do okolnih sela i naselja izgradjenih oko centra grada na sistem će se povezati još 23.000 stanovnika;
- Izgradnja novog PPOV za projektovano organsko opterećenje od 126.000 ekvivalent stanovnika (ES), otpadne vode iz domaćinstava, sakupljene na teritoriji Šapca i okolnih predgradja i industrijske otpadne vode, za koje je predvidjen propisan preliminarni tretman pre ispuštanja u kanalizacioni sistem.

Zaključci i preporuke

Opšte

3. Projekat se prvobitno zasnivao samo na izgradnji postrojenja za prečišćavanje otpadnih voda (PPOV) u Šapcu. Medjutim, kako bi se postigli sveobuhvatni ciljevi projekta i unapredio nivo kvaliteta komunalnih usluga, smatralo se neophodnim da se razmotri i u obim projekta uključi proširenje kanalizacionog sistema i kanalizacione crpne stanice.
4. Projekat je u skladu sa relevantnim direktivama EZ I takodje sa standardima sadržanim u domaćem zakonodavstvu.

Proširenje sistema za sakupljanje sanitarnih otpadnih voda

6. Predloženo proširenje sistema za sakupljanje otpadnih voda bi značajno poboljšalo nivo ove usluge – sakupljanja otpadnih voda, i bila bi zamenjena sadašnja praksa oslanjanja na pojedinačne septičke jame koje predstavljaju potencijalni izvor zagadjenja podzemnih i površinskih voda i ozbiljnu opasnost za zdravlje ljudi.
7. Sistem je stalno u procesu proširenja, a tokom 2005. i 2006. godine izgradjen je glavni kolektor duž Cerskog kanala što je omogućilo povezivanje brojnih predgradja na sistem;
8. Sistem trenutno funkcioniše tako, da je naročito za vreme perioda visokog vodostaja u reci Savi, pod uticajem efekta suprotnog toka vode što izaziva plavljenje nižih područja. Zbog toga je sagradjen pomoćni ispust, sa pumpom koja ispušta otpadne vode i kišnicu u Savu, čak i kada je vodostaj ove reke već visok. sa niskom nadmorskom visinom effect
9. Potisni cevovod iz kanalizacione crpne stanice Glavna do mesta na kome se nalazi PPOV, nominalnog prečnika DN800, preneće sve otpadne vode sakupljene u gradskoj oblasti kao i sakupljenu kišnicu u količinama ekvivalentnim maksimalnom protoku otpadnih voda u suvom periodu.
10. Planovi proširenja područja koje je pokriveno uslugama sakupljanja otpadnih voda na predgradja koja se graniče sa urbanim delom, su u pripremi delimično su realizovani, a odnose se na povezivanje dodatne 23000 stanovnika na ovaj sistem.

Izgradnja kanalizacione crpne stanice (KCS), Glavna

4. Kanalizaciona crpna stanica (KCS) Glavna treba da bude locirana na postojećem ispustu otpadnih voda.
5. KCS će ispumpavati otpadne vode u buduće PPOV kroz nov transportni cevovod.
6. Takodje će biti projektovana tako da služi u slučaju moguće kombinacije padavina i visokog vodostaja reke Save kada površinski nivo vode premaši niveletu ispusne cevi za otpadne vode;

Izgradnja PPOV Šabac

10. U planiranom PPOV Šabac bi se vršio tretman svih komunalnih otpadnih voda iz urbanih područja i okolnih predgradja, a takodje i prethodno tretiranih industrijskih otpadnih voda u skladu sa postavljenim projektnim kriterijumima.
11. PPOV će se nalaziti u blizini ispusta takozvanog Cerskog kanala u reku Savu, na rezervisanoj lokaciji površine 5.6 ha.
12. Značajan deo pripremnih radova je već obavljen na lokaciji PPOV, uključujući zaštitni nasip u zoni postrojenja kao i materijal - 100.000 m^3 šljunka kako bi se poboljšalo stanje temelja. Ukratko, procesi prečišćavanja koji su predvidjeni u okviru PPOV uključivaće sledeće: uklanjanje kamenčića, primarno prečišćavanje, biološku aeraciju, finalno prečišćavanje kao i sledeće: primarne i sekundarne zgušnjavače, anaerobnu stabilaciju i odvodnjavanje taloga. Izgradnja novog PPOV – faza I sa hidrauličkim kapacitetom $Q_{max\ day}$ = 420 l/s i $Q_{max\ h}$ = 650 l/s i za projektovano organsko opterećenje od 126.000 ekvivalent stanovnika (ES).
13. Predvidjeno je da buduće PPOV omogući adekvatano prečišćavanje otpadnih voda iz domaćinstava na teritoriji Šapca, okolnih predgradja i drugih naselja, kao i industrijskih otpadnih voda za koje je propisan preliminarni tretman pre ispuštanja u kanalizacioni system. Konsultant je preporučio pet različitih alternativnih tehničkih rešenja za prečišćavanje otpadnih voda.
14. Zasebno postrojenje za prečišćavanje otpadnih voda će omogućiti prečišćavanje otpadnih voda koje dolaze iz glavnog gradskog kompleksa hemijske industrije Zorka.
15. Iako je projekat podeljen na dve faze, PPOV će biti sagradjeno da bi zadovoljilo potrebu grada Šapca i njegovih predgradja u predvidjenom periodu do 2041. godine (**Faza I** – predmet ove studije). **Faza II** PPOV se može razmatrati samo kao dugoročna perspektiva koja se može realizovati samo ako se sprovede mnogo intenzivniji urbanistički i industrijski razvoj u Šapcu.
16. Lokacija i concept PPOV su u skladu sa lokalnim Generalnim i Detaljnim urbanističkim master planom, a projekat PPOV je odobren od strane Republičke revizione komisije i izdata je odgovarajuća dozvola za gradnju.
17. Postavljeni projektni kriterijumi su u skladu sa Direktivom EZ o tretmanu otpadnih voda i su postavile kompetentne domaće vlasti.
18. Preporučuje se da se za PPOV, uključujući primarni i sekundarni tretman, raspiše tender sa najkraćim mogućim rokom, u skladu sa jednom od preporučenih mogućnosti (Red FIDIC book).

Procena uticaja na životnu sredinu

7. PUŽS obuhvata PPOV, ali ne i povezivanje na kanalizacioni sistem. U PUŽS se PPOV pominje kao centralno postrojenje za prečišćavanje otpadnih voda za Šabac. Ovo postrojenje će prečišćavati sve kanalizacione otpadne vode (iz urbanih i ostalih naselja) i industrijske otpadne vode sa teritorije koja je obuhvaćena Generalnim planom grada Šapca, osim industrijskih otpadnih voda fabrike "Zorka". Ispuštanje se vrši u reku Savu kao recipijentno vodeno telo. PPOV će takodje uključiti i kišnicu.
8. Kompleks PPOV obuhvata sledeća tri elementa koja će biti razmotrena:
   - Postrojenje za prečišćavanje otpadnih voda;
   - Cevovod kojim se kanalizacione vode zajedno sa kišnicom transportuju do PPOV;
   - Crpna stanica koja ispumpava otpadne vode kroz cevovod do PPOV-a.
9. Cilj ove studije izvodljivosti je da proceni da li su pitanja razmatrana u PUŽS potpuna, nakon čega sledi detaljnija provera sadržaja PUŽS. Ova procena se bavi standardnim pitanjima zaštite životne sredine za vreme izgradnje i rada kompleksa postrojenja za prečišćavanje otpadnih voda.
10. Da bi se osigurao pravilan rad PPOV-a, industrijske otpadne vode koje sadrže različite vrste zagadjivača moraju biti filtrirane kako bi imale odredjeni nivo kvaliteta pre nego što budu ispuštene u gradsku kanalizaciju. Ta pravila su ustanovljena u okviru Projekta grada Šapca. Preliminarni tretman otpadnih voda iz svakog industrijskog objekta definiše se karakteristikama industrijskih otpadnih voda i zahtevima pomenutih pravilima.
11. U skladu sa uslovima relevantnog domaćeg zakona, PUŽS je sprovedena za potrebe Centralnog opštinskog postrojenja za prečišćavanje otpadnih voda, od strane firme "Energoprojekt- Hidroinzenjering MDD', kako je saopšteno u periodu septembar-oktobar 2005. godine. Ovu Studiju o proceni uicaja na životnu sredinu odobrili su nadležni državni organi (tj. Ministarstvo za infrastrukturu i kapitalne investicije). Ovo ministarstvo izdaje dozvolu za gradnju PPOV-a, crpne stanice i cevovoda za povezivanje.
12. Za potrebe izgradnje i operativne faze treba pripremiti ekstenzivan menadžment plan zaštite zdravlja ljudi i njihove radne sredine. U okviru ovog plana treba da budu razmotrena sva pitanja u vezi sa zaštitom zdravlja ljudi i njihove radne sredine, uključujući neophodnu obuku zaposlenih.

Finansijska procena JKP-a Standard

8. JKP Vodovod Šabac posluje sa 0% neto profita;
9. Ostvareni novčani tok je nedovoljan za finansiranje investicija; Većinu investicija direktno finansira opština ili su sredstva obezbedjena kapitalnim subvencijama.
10. Stopa naplate je visika - 91%; prihodi iz osnovnih aktivnosti uključuju i prihode od prodaje materijala i gradjevinskih radova.
11. Tarife za vodu i kanalizaciju su odredjene tako da samo pokriju troškove tokom 2007. godine. Medjutim stopa pokrivenosti troškova opada kao rezultat povećanja cena iznad dozvoljene granice i primenjenih tarifnih uskladjivanja.
12. Ne vrši se redovna procena osnovnih sredstava. U uslovima inflacije, kao što je slučaj u Srbiji, to vodi ka potcenjivanju osnovice za obračun amortizacije u bilansu stanja kao i potcenjivanju troškova amortizacije i može dovesti do odredjivanja tarifa ispod nivoa pokrivenosti troškova.
13. JKP ne pravi rezervisanja za sporna potraživanja. Umesto toga, nenaplaćeni dug se direktno otpisuje, ali se i to dešava neredovno. JKP priprema godišnje planove i

budžete u skladu sa uputstvima Ministarstva finansija. Ne postoji višegodišnje planiranje integrisano sa ovakivim godišnjim planiranjem i budžetskim ciklusom;

14. Ne postoji pravilo niti postupak odredjivanja tarifa s obzirom da je trenutno na snazi nacionalna politika da se povećanje tarifa uskladi sa predvidjenom stopom inflacije u narednoj godini;

Procena kreditne sposobnosti opštine Šabac

6. U periodu od 2004. do 2007. godine budžet opštine Šabac je bio uravnotežen. Medjutim, deo tog budžeta se finansira iz spoljnih izvora (krediti komercijalnih banaka);
7. Kapitalni budžetski rashodi u periodu od 2004. do 2006. godine povećani su za 12%, a za 2007. godinu planiran je dalji porast kapitalnih rashoda za 91% u poredjenju sa 2006. godinom.
8. Projekcije opštinskih prihoda i troškova pokazuju da bi, pored sredstava dodeljenih u 2007. godini, u periodu od 2008. do 2010. godine opština ipak imala ograničena finansijska sredstva za ulaganje u pomenutu infrastrukturu;
9. Opština Šabac ima vrlo ambiciozne investicione planove koji se odnose na izgradnju Severne zone i sposobnost da uzmu pozajmicu od 595 RSD ili 7.54 miliona evra u 2007. godini (kako je saopštio Trezor).
10. Bez obzira na povoljne uslove kreditiranja koje komercijalne banke nude opštinama, opština Šabac može da finansira samo deo ovog plana. Oni moraju da nadju dodatne izvore finansiranja što znači da moraju da privuku investitore (domaće ili strane), donacije i republička sredstva.

Finansijska analiza

2. Predložena politika odredjivanja cena, koja se sastoji od sledećih elemenata:
   d. Uvesti novu tarifu za prečišćavanje otpadnih voda 2011. godine, koja bi iznosila 18 RSD po m3 potrošene vode (cena u 2011. godini). Predloženo je da se cena za prečišćavanje otpadnih voda od početka (2011. godine) odredi kao jedinična cena na istom nivou za sve grupe potrošača. Stoga bi cene morale da se usklade samo zbog inflacije.
   e. Tarife za kanalizaciju: Subvencije za tarife za domaćinstva i institucije smanjivaće se od 2012. godine nadalje, da bi se posle 2028. godine izjednačile sa tarifama za industriju-privredu. Od 2014. godine, prosečna cena za ove usluge jednaka je prosečnoj jediničnoj ceni. Kao rezultat ovakve politike odredjivanja cena, prosečna cena koja se naplaćuje do 2014. godine prelazi punu jediničnu cenu, sa izuzetkom 2010. godine.
   f. Tarifa za vodu: Predloženo je da se od 2009. godine postepeno ukida subvencija, da se uvedu jednake cene za pijaću vodu za sve potrošačke grupe do 2028. godine. Povećanje trenutne cene za pijaću vodu u skladu sa inflacijom predloženo je samo za 2011. godinu. Posle toga, prosečna cena će se zasnivati na punoj jediničnoj ceni.
13. Politika odredjivanja cena za posledicu ima realno kumulativno povećanje sveobuhvatne cene vode i kanalizacije za domaće potrošače od oko 50% do 2011. godine i 80% kumulativno do 2014. godine.

14. Medjutim, cena ostaje u granicama platežne sposobnosti. Maksimalno 1.5% prosečnog prihoda po domaćinstvu predvidjeno je za plaćanje cene vode i kanalizacije u periodu od 2011. do 2013. godine, u odnosu na 1.2% u 2007. godini.
15. Predložene cene se zasnivaju na prosečnoj platežnoj sposobnosti domaćinstava. Proračuni se temelje na prosečnoj potrošnji i prosečnom prihodu domaćinstva. Za penzionere i druge grupe potrošača sa niskim prihodima ove cene mogu biti u granicama platežne sposobnosti.
16. Na osnovu ove predložene politike odredjivanja cena, uradjena je finansijska analiza. Imajući u vidu makroekonomski osnovni scenarion, analiza za rezultat ima nominalnu finansijsku internu stopu povraćaja na ukupan uloženi kapital (FIRR/K) od 0.3% I finansijsku neto sadašnju vrednost (FNSV/K) od -8.728.000 evra;
17. Ovaj finansijski rezultat opravdava finansiranje donacijama, kao što su sredstva EZ-IPA. Koristeći "modifikovanu formulu", izračunat je procenat donacije od 73.7%. Ako je stopa maksimalno 75%, projekat bi bio kvalifikovan za dobijanje donacije od 11.724.000 evra;
18. Metoda nedostatka sredstava za finansiranje koja se može primeniti na projekat finansiran sredstvima ERDF/CF za vreme perioda programiranja od 2007. do 2013. godine, vodi ka značajno nižeg maksimalnog iznosa donacije od 7.668.evra, pod pretpostavkom da je maksimalna sufinansirajuća stopa 75%. Ako bi diskontna stopa bila 5% u realnim uslovima (trenutno 7%), što je uslov kod projekata finansiranih sredstvima ERDF/CF u periodu od 2007. do 2013., maksimalni iznos donacije EZ bi bio 7.396.000 evra;
19. Projekat je finansijski održiv s obzirom da je kumulativni novčani tok projekta u svakoj godini pozitivan;
20. Finansijska stopa povraćaja na nacionalni uloženi kapital prihvatljiva je na nivou malo većem od nominalne diskontne stope od 8%. FIRR/K je 10.9%, a FNSV/K je 983.000 evra;
21. Analiza osetljivosti pokazuje da variranje od +/-1% u izabranim ključnim varijablama ne utiče na fluktuacije veće od 5% u FNSV/K. Stoga nema kritinih varijabli koje zahtevaju dalju analizu rizika;
22. Ovaj projekat je najosetljiviji na varijacije u diskontnoj stopi, naročito na niže diskontne stope.
23. Projekat kreaira značajne pozitivne spoljne efekte. Kvantitativna ekonomska analiza pokazuje pozitivne rezultate iako svi spoljni efekti ne mogu da se izraze novcem: EIRR 17.0%, ENSV od 16.798.000 evra i odnos korist/troškovi je 1.51. Stoga je projekat izvodljiv sa društvenog stanovišta.

<u>Institucionalna analiza</u>

6. JKP pruža usluge koje se odnose na vodosnabdevanje i vodoprivredu. Za svrhe projekta, nisu predvidjene nikakve velike promene u organizacionoj strukturi sektora vodosnabdevanja i vodoprivrede u posojećem JKP-u.
7. Opštinska odluka o sanitarno-tehničkim uslovima za ispuštanje otpadnih voda u kanalizacioni sistem, doneta 14, juna 2007.godine, postavlja uslove koji se moraju

ispuniti pre ispuštanja otpadnih voda u kanalizacioni sistem. Obaveza svih vlasnika nekretnina i stanara (prvana i fizička lica) da se povežu na javni kanalizacioni system, sadržana je u zahtevu Konsultanta.

8. Preporučuje se da postojeća opštinska odluka o komunalnim aktivnostima (MV, Službeni list br. 23/2001) bude izmenjena kako bi uključivala sledeće:

   c. Da se sprovede priključivanje pravnih i fizičkih lica na kanalizacioni sistem u roku od 6 meseci nakon izgradnje kanalizacionog sistema;
   d. Da se odrede nadležni organi i kazne.

9. Implementacija projekta će omogućiti (glavnim) industrijskim preduzećima u opštini Šabac da se priključe na glavni kolektor, a samim tim na PPOV.

10. Da bi se osigurala održivost projekta, preporučuje se da se relevantne opštinske odluke izmene tako da omoguće sledeće:

    a. Obavezno korišćenje PPOV-a;
    b. Definisanje uslova pod kojima korisnici mogu biti povezani na kanalizacioni sistem i PPOV;
    c. Odredjivanje kazni i nadležnih organa.

<u>Operativna efikasnost</u>

11. JKP će i dalje upravljati celokupnom infrastrukturom koja obuhvata zahvat sirove vode, proizvodnju i distribuciju pijaće vode i sakupljanje i prečišćavanje otpadnih voda;
12. Finansijske sisteme bi trebalo unaprediti. Postoji i potreba za osmišljavanjem i primenom upravljačkog obračunskog sistema koji bi bio povezan sa upravljačkim informacionim sistemom;
13. Takodje, sistem dugoročnog višegodišnjeg finansijskog/investicionog planiranja kao i odobrena i sprovedena plotika odredjivanja cena moraju biti pobaljšani;
14. Sistem za obračun i naplatu će morati da bude prilagodjen posebnim potrebama komunalnog preduzeća, a njegova efikasnost treba da bude poboljšana;
15. Treba pripremiti upravljački informacioni sistem koji je standardizovan i u potpunosti integrisan sa finansijskim sistemom;
16. Biće unapredjeni laboratorijski objekti u smislu samih objekata i znanja i rada zaposlenih.
17. Uzorkovanje otpadnih voda na različitim tačkama procesa prečišćavanja biće neophodno radi nadgledanja i funkcionisanja procesa. Obim uzorkovanja će se stoga povećati. Laboratorija za analizu otpadnih voda predvidjena je na lokaciji novog PPOV-a.
18. Mere i program za smanjenje curenja, u smislu ljudskog kapitala, upravljanja i fizičkih mera (sektorsko merenje), neophodni su za smanjenje fizičkih gubitaka.
19. Primena takozvanih ugovora o nivou usluga izmedju opštine i JKP-a predstavlja mogućnost za dalji razvoj nezavisne pozicije JKP-a.
20. Specifične informacije o gubicima vode i drugim potrošačkim kategorijama, troškovima rada i održavanja i revitalizacionom održavanju postoje, ali su nepotpune ili nepouzdane.

Finansiranje i investicije

5. Ukupni troškovi investiranja za Fazu I iznose 15.920.000 evra;
6. Ministarstvo poljoprivrede, šumarstva i vodoprivrede izdvojilo je pismenim putem 4.190.000 evra za novo PPOV. Pod uslovom da je finansiranje osigurano100%, pretpostavlja se da će 1/3 ukupnih troškova kanalizacione crpne stanice finansirati ovo Ministarstvo.
7. Pretpostavlja se da će sredstva EZ-IPA iznositi 75% opravdanih troškova ili 10.890.000 evra (uključujući PDV, otkup zemlje). Pravi iznos donacije će zavisiti od ocene ove studije izvodljivosti, dostupnosti sredstava i od mehanizma odredjivanja mogućih donacija.
8. Opština Šabac je u svom budžetu za 2007. godinu izdvojila 67 miliona dinara (0.84 miliona evra) za projekte kanalizacije.

Tabela 01 Pregled investicija

WWTP (incl. contingencies, incl. VAT)	Units	Tot.	2009	2010
Investigation works & design	€ m	0.35	0.18	0.18
Construction works	€ m	6.91	3.45	3.45
Electro-mechanical equipment	€ m	5.01	2.50	2.50
Additional land acquisition (1,5 ha)	€ m	-	-	-
Trial run, staff training, operation	€ m	0.30	0.15	0.15
Sewerage			-	-
Sabac main sewers	€ m	-	-	-
Sabac SPS - civil works	€ m	1.64	0.82	0.82
Sabac SPS - elctr/mechanical	€ m	0.65	0.32	0.32
Sabac SPS - pipes & fittings	€ m	-	-	-
Supervision			-	-
Supervision WWTP	€ m	0.95	0.48	0.48
Supervision sewer extension	€ m	0.11	0.05	0.05
Total	**€ m**	**15.92**	**7.96**	**7.96**

Tabela 02 Identifikovani elementi tehničke pomoći

Projekat	**Vremenski okvir**	**Procenjeni troškovi (€x1000)**
Projekat prečišćavanja otpadnih voda - Šabac Detaljni projekat KCS Glavna Glavna i glavnog kolektora Sredstva finansiraja nisu poznata	Februar 2009. – avgust 2009.	200
Projekat prečišćavanja otpadnih voda - Šabac Tender i nadzor plana Sredstva finansiraja nisu poznata	Jun 2009. – decembar 2011.	1.064
Projekat prečišćavanja otpadnih voda – Šabac Program unapredjenja finansijskog poslovanja (FOPIP) Sredstva finansiraja nisu poznata	April 2009. – april 2010.	250
Ukupno		**1,514**

Tabela 03 Predloženi plan finansiranja Faza I

Financial year ending 2010			**Total**	**2009**
EU-IPA, grants, other	€ m	10.89	5.45	5.45
Min. Agriculture, DG Water	€ m	4.19	2.09	2.09
Municipal contribution	€ m	0.84	0.42	0.42
Loan	€ m	-	-	-
Total	€ m	15.92	7.96	7.96

Rizici

Ustanovljeni su sledeći glavni rizici koji se odnose na pripremu projekta, njegovo sprovodjenje i funkcionisanje:

Rizik	**Kategorija** Finansijska, Zaštita životne sredine, Operativna, Institucionalna Društveno-ekonomska Ljudski faktor	**Verovatnoća** V: Visoka S: Srednja N: Niska	**Negativni uticaji** Od: 1 (Ozbiljni) do: 5 (Nema ih)	**Mere revitalizacije** (samo za uticaje 1, 2 i 3)
PRIPREMA PROJEKTA				
Nije postignut dogovor u vezi sa korišcenjem zemljišta za postavljanje crpnih stanica i cevovoda	Institucionalna/ Društveno-ekonomska	Niska	3	Opština treba da sprovede dogovor
JKP / Opština nije uspela da izdvoji sredstva za raelizaciju projekta	Finansijska	Srednja	1	Konkurisati za sredstva iz inostranih izvora finansiranja
Na raspolaganju je ogranicen upravljacki kapacitet	Operativna/ Institucionalna	Niska	4	Programi povećanja kapaciteta
SPROVODJENJE PROJEKTA				
Kašnjenje usled izgradnje cevovoda	Operativna	Srednja	2	Tehnička i organizaciona pomoć
Kašnjenje radova usled loših vremenskih uslova	Operativna	Srednja	2	Tehnička i organizaciona pomoć

Zorka _US Steel ne precišcavaju svoje ispuštene industrijske vode	Operativna/ Institucionalna	Srednja	3	Bliska saradnja sa Ministarstvom za vodene resurse i pružanje podrške ministarstvu u sprovodjenju zakonskih mera
FUNKCIONISANJE				
Pojava tokova industrijskih otpadnih voda	Operativna	Visoka	1	Primeniti startegiju upravljanja otpadnim vodama. Povećati kontrolu procesa prečišćavanja.
Primena procesa precišcavanja otpadnih voda nije uspela	Institucionalna	Visoka	2	Opština treba da inicira primenu
Neodgovarajuca politika odredjivanja cena i redovnost placanja	Institucionalna	Srednja	2	Obezbediti adekvatno odredjivanje cena u ugovorima.
Nizak nivo zaštite zdravlja ljudi i njihove radne sredine	Ljudski faktor	Srednja	1	Izraditi nacrt plana za zaštitu zdravlja zaposlenih i njihove radne sredine i sprovesti ga. Primeniti mere kontrole.
Nije dostignut standardni nivo kvaliteta precišcenih otpadnih voda	Operativna/ Institucionalna	Srednja	3	Pružiti tehničku pomoć u pripremi odhovarajućih planova i mera.

1 INTRODUCTION

1.1 Preliminary and background

Acting upon the request of the Municipality of Šabac, the European Agency for Reconstruction (EAR) commissioned MIASP to conduct a Feasibility Study for the Waste Water Treatment and Sewage Collection Project in July 2007, in order to be enabled to consider the possibility to provide grant funds towards the co-financing of the Project.

The project area covers the Municipality of Šabac, including its urban and rural settlements, located at the north-west part of Serbia and administratively belongs to the Mačva District.

The main objective of this project is to improve the water quality of the Sava River, improve living conditions for the people of Šabac and reduce health risks. This objective is realised by constructing a waste water treatment plant near the Sava River and ceasing of the discharge of untreated industrial and communal waste water on the Sava River.

According to relevant Serbian legislation the Sava River is classified as Class II water course at the section corresponding to the WWTP.

The current situation with untreated wastewater discharges is alarming and requires urgent action. In such circumstances it is important that the updated preliminary design has already been approved by the relevant State Authorities, in line with the relevant National regulations and set design criteria:

- Of the Republican Review Committee;
- Of the Ministry for Infrastructure and Capital Investments.

Based on the sewerage Master Plan for the municipality, the Project Area includes Šabac town and its suburbs, i.e. the area from which all wastewater is to be collected, transferred and treated at the future wastewater treatment facilities. It practically means that some 22,500 additional inhabitants of the Project Area have to be connected to the sewerage system in order to provide full service coverage.

The location and concept of the WWTP are in accordance with the local General and Detail Urban Master Plans, and the WWTP design was approved by the Republican review committee and the corresponding building permit has been issued;

Major preparatory works have already been carried out at the WWTP sites:

- Protective embankment in the WWTP zone,
- Back lifting of 100.000 m^3 of gravel to improve foundation conditions,
- Construction of the raw water pumping station,
- Erection of a hydraulic flow measuring structure

The city development led to capacity shortage of the sewerage system and flooding during high rainfall periods. To reduce the load off the system and collect water from unconnected city suburbs, construction of two main sewers (Northern and Southern rings) was undertaken.

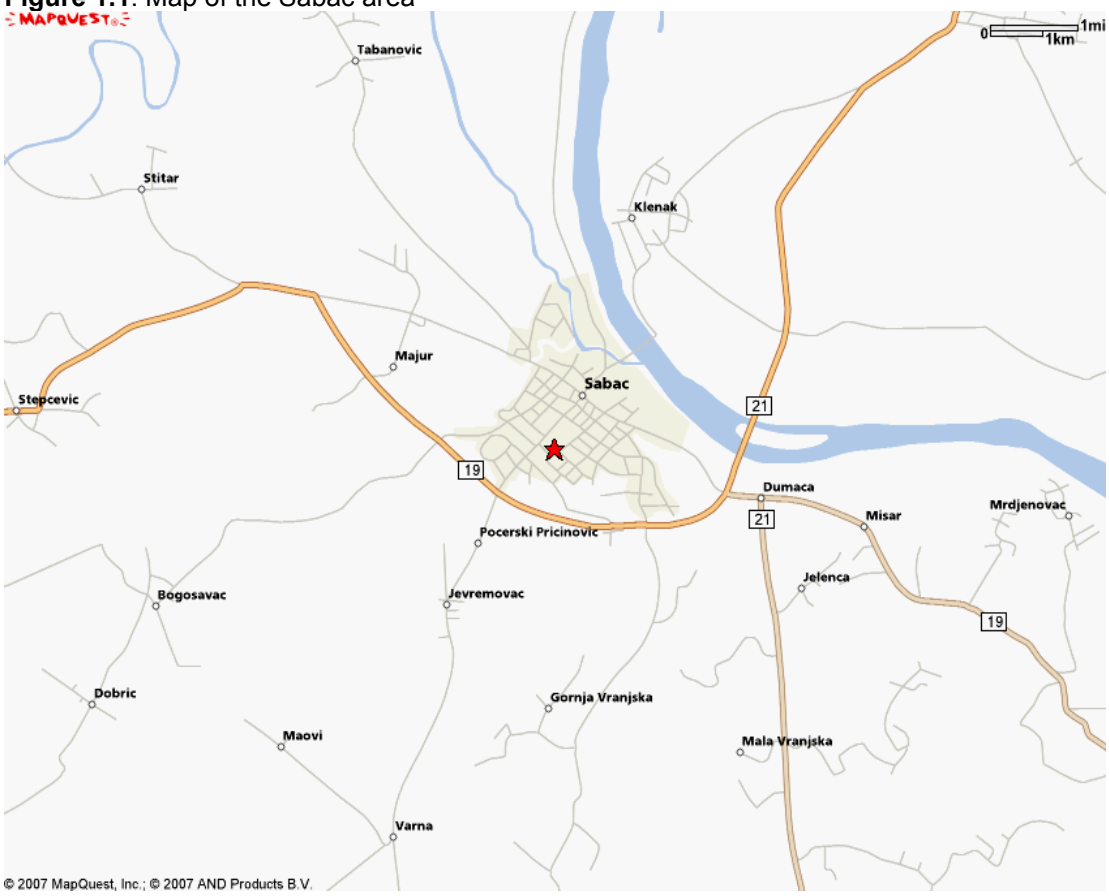
The main gravity sewers were completed in 2006 and 2007.The total length of the existing sewers is around 116 km. The system is continuously being extended, and during 2005 and 2006 the main gravity sewer along the Cerski Canal was constructed, enabling the connection to the system of a number of suburbs.

1.2 General introduction to the area

The projected site is situated along the border of the Sava River at Šabac. The WWTP is at the south side of a connected pipeline closely following the river border. And the northern end the pipeline connects to the pumping station.

The WWTP will be located in an industrial zone of Šabac, adjacent to the Cerski canal.

Figure 1.1: Map of the Šabac area



Šabac is situated upstream from Belgrade. The new WWPT will be situated at the southern tip of an industrial area which dates back several decades. It is the oldest industrial area of Šabac.

The local terrain is a depression bordered by embankments along the Sava River and Cerski boundary canal and a railway-embankment of an industrial railway. Southeast and east from the projected site two large industrial plants present, one being a steel related industry (former Zorka, now USS), the other being producer of construction materials (Zorka). Northwest of the site a chemical plant of Zorka is situated. The production of that plant has ceased.

This industrial area is not inhabited. Houses are at a minimum distance of approximately 0.8 km. The area and the projected plant site are well accessed.

Based on the Law on cultural wealth (RS Official Gazette No. 71/94) there are no registered protected immovable cultural wealth and archaeological localities in the location of the effluents filtration plant.

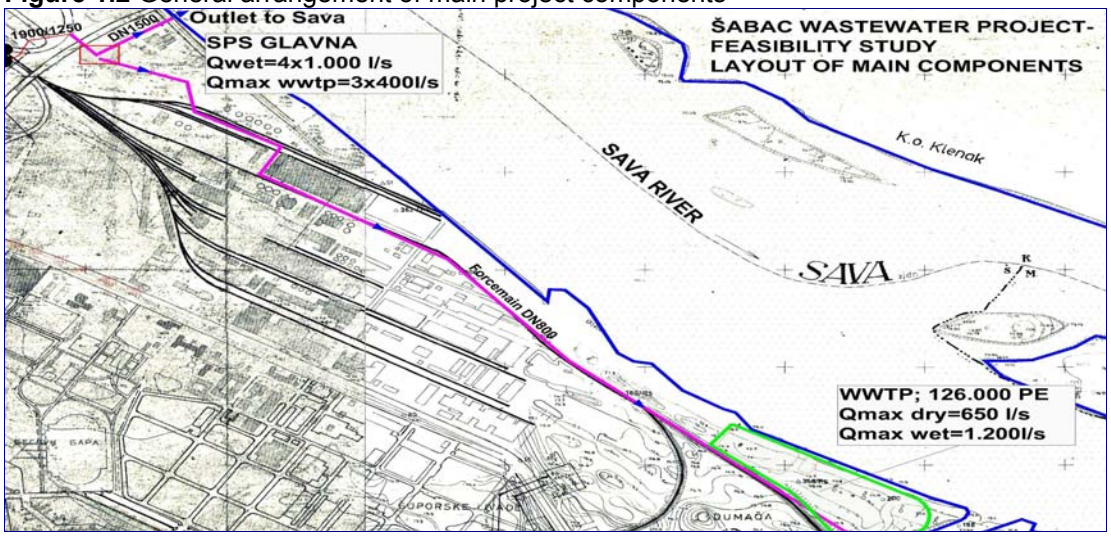
Recreational facilities, schools, medical facilities or any other public facilities are not within a range of 2 km.

1.3 Project Development Plan and Technical Assistance

The project has three main objectives:

1. The construction of the sewage pumping station Glavna to be located close to the existing wastewater outlet. This SPS will pump wastewater to the future WWTP through a new transport line. The SPS will also be designed to cater for a combination of wet weather flow and high levels of the River Sava, when that level exceeds the invert level of the wastewater outlet pipe;
2. A force main from the SPS Glavna to the WWTP location of nominal diameter DN800 that will convey all wastewater collected in the town area, plus collected storm water runoff equivalent to the maximum wastewater dry-weather flow;
3. Construction of a new wastewater treatment plant (WWTP) with a Phase I hydraulic capacity of Q max day = 420 l/s and Q max h = 650 l/s and for the design organic loading of 126.000 population equivalent (PE).

Figure 1.2 General arrangement of main project components



The WWTP is the major project component considered in this Project feasibility study.

The project is interrelated with the completion of other key components of the sewerage system, including the SPS Glavna and the force main from the SPS to the WWTP.
It is also influenced by the short and long term extension of the sewers in the suburbs of Šabac.
The commitment of the chemical industry Zorka to treat its industrial wastewater discharges at a separate treatment facility should be verified and confirmed.

Major construction works (including the WWTP and the main transport sewers) shall be carried out between 2009 and 2011, followed by a 30-year operational period: 2012-2041.

According to the updated Preliminary project design, the WWTP is assumed to have two distinct project phases, each with defined technology and associated investment and O&M costs:

- **Phase I** of the WWTP, (a priority Project targeted for EU-IPA assistance): the plant should cater for the existing and future users of the system in Šabac municipality, including its urban and suburban population and major industries (excluding Zorka complex –now US Steel, which would deal with its wastewater separately). The design organic loading is 126.000 PE (the maximum BOD_5 load is 7.560 kg BOD_5/day), while the maximum hydraulic loading is 650 l/s.
- **Phase II** of the WWTP can be only considered as a very long term perspective that can be implemented only if much more intensive urban and industrial developments take place in Šabac. Spatial provision has been made at the WWTP site in order to allow construction of phase II.

Phase I of the WWTP is recommended for implementation, based on the wastewater quantities projected in this study. However, because realistic urban and industrial developments may be affected by a number of uncertainties (general political and economic trends) the WWTP phasing should be re-evaluated on a regular basis.

1.4 Scope of Work of the Feasibility Study

- A basis for financial project appraisal by the EAR;
- Compose a plan for the institutional, organisational and financial setting of the waste water and sewage collection system in Šabac municipality;
- Compose a plan for the construction and operation of the new waste water treatment plant and sewage collection system in accordance with Serbia's and EU's legal, regulatory and environmental legislation.

2 GENERAL SOCIO-ECONOMIC CONSIDERATIONS

2.1 Introduction

This chapter describes the general social and financial/economic background information on the Municipality of Šabac.

2.2 Socio-economic structure

2.2.1 Geography

The Table 2.1 sets out the main indicators of the geography of the project area. The project area includes the Municipality Šabac, covering north-west part of Serbia. The Municipality of Šabac, falls within the territory of Serbia, and it occupies approximately 0.9% both of the total area of Serbia and the total project area. In respect to total agricultural area a high share of the agricultural land accounts to 76% and 74% of the project area, this is rather above the average for Serbia of 83%.

Table 2.1 Geography

Indicator	Serbia	Vojvodina	Central Serbia	Project area	Šabac
Total area in km2	88.361	20.229	1.557	762	795
Do, as % of total	100,0%	22,9%	1,8%	0,9%	0,9%
Agricultural area as % of total	66%	83%	75%	74%	76%

Source: Municipalities of Serbia 2005, Statistical Office of Republic of Serbia March 2006

2.2.2 Demography

Table 2.2 Demography

Indicator	Serbia	Vojvodina	Central Serbia	Project area	Šabac
Population 1991 census	7.576.837	1.970.195	5.606.642	120.332	120.332
Urban	4.126.728	471.315	3.025.802	53.653	53.653
Other	3.450.109	1.498.880	2.580.840	66.679	66.679
Population 2002 census	7.498.001	2.031.992	5.466.009	122.893	122.893
Urban	4.225.896	531.146	3.073.601	55.163	55.163
Other	3.272.105	1.500.846	2.392.408	67.730	67.730
Annual growth 1991-2002	-0,10%	0,28%	-0,23%	0,19%	0,19%
Urban	0,22%	1,09%	0,14%	0,25%	0,25%
Other	-0,48%	0,01%	-0,69%	0,14%	0,14%
Population estimate 30-6-1999	7.516.346	2.031.426	5.484.920	123.391	123.391
Population estimate 30-6-2004	7.440.769	2.012.918	5.427.851	121.287	121.287
Annual growth 1999-2004	-0,20%	-0,18%	-0,21%	-0,34%	-0,34%
Population density (2004, in persons/km2)	84	100	97	153	153

Source: Municipalities of Serbia 2005, Population Census 2002, Statistical Office of Republic of Serbia

The total population of the municipality of Šabac according to official 2004 population estimate was 121,287 or 1.63% of Serbia's total population.

In the census years 1991 and 2002 total increase in population of the Municipality of Šabac was 0.19%, the national average for the period was negative at – 0.10%. It could be observed that within this increase, the trend was towards the increase of urban population, which for the Municipality of Šabac showed an increase of 0.25%, slightly above the average at the national level. The trend during the period 1999 – 2004 however shows negative population growth of -0.34%. This decline is slightly lower, on the national level, in Central Serbia and in Vojvodina, showing the decline of -0.20%, 0.18% and 0.21% respectively (see Table 2-).
This, trend is strongly present in Serbia in general, reasons for this are usually a reflection of high unemployment rate, and the young population of the reproductive age is not ready to form families on an uncertain future.

As elsewhere in Serbia, a clear urbanization trend can be noted for the project area. The urban settlements in the project district grew with an annual average of 0.25 %, during the period 1991-2002, at the expense of rural areas with 0.14% annual growth. The rural areas are being depopulated at the high rate (see Table 2-8).

The population density in the project area (i.e. in the Municipality)is 153 persons per km2, being well above the country average of 84 km2.This high population density is the result of the population migrating from the war affected areas (wars 1991 to 1996), and settling in Central Serbia and Vojvodina (traditionally all the historical population migrations ended up in Vojvodina, and Šabac, although not in the territory of Vojvodina, but on its border, being one of the largest cities in the area and geographically close to the Bosnian border, is recorded to have increase in population from war affected areas).

2.2.3 Employment

Table 2.3 Demography and Employment

Indicator	Serbia	Vojvodina	Central Serbia	Project area	Šabac
Total employed persons (2005 average)	2.068.964	544.766	1.524.198	28.339	28.339
As % of total population	27,8%	27,1%	28,1%	23,4%	23,4%
As % of labour force	69,8%	66,6%	71,0%	58,0%	58,0%
Total unemployed persons (2005 average)	895.697	273.392	622.305	20.493	20.493
As % of total population	12,0%	13,6%	11,5%	16,9%	16,9%
As % of labour force	30,2%	33,4%	29,0%	42,0%	42,0%
(Un) Employed as % of total population	39,8%	40,6%	39,5%	40,3%	40,3%
# of adult persons receiving social welfare	220.262	69.353	150.909	2.384	2.384
As % of total population	3,0%	3,4%	2,8%	2,0%	2,0%

Source: Municipalities of Serbia 2005, Statistical Office of Republic of Serbia March 2006

The 2005 data show that the number of employed people per 1,000 inhabitants for the project area is 234, which is relatively close to the national average of 275 (see the above table). The Municipality of Šabac has employment rate below the national and Central Serbia average, at 23.4%.
The project region has several industries that are at the operational level.
The major company is **Zorka Holding- chemical industry**, founded in 1937, and according to data as at 31.12.2006, it had 1,183 employees. The holding was not entirely privatised and very few of its (11) legal entities are operating successfully.
Another major company is **Farmakom – Concern of food and metal industry companies**, employing 2000 people. However, many privately owned companies are now employing almost one third of the working labour.

By definition, active population is a number of people in their working age both employed and unemployed. The Municipality of Šabac has a high share of around 58% of active working force, the national average is 69.8%.

Another way to assess the socio-economic situation is to analyze data on social welfare recipients. Here, we can conclude that Municipality of Šabac has social welfare recipients at 2% of the total population, which is below the national average of 3% of the total population, for 2005.

Table 2.4 Employment by sector

Indicator	Serbia	Vojvodina	Central Serbia	Project area	Šabac
Agriculture. Fisheries & forestry	65.058	39.236	25.822	569	569
As % of total	3,1%	7,2%	1,7%	2,0%	2,0%
Manufacturing/processing industry	490.502	129.277	361.224	6.291	6.291
As % of total	23,7%	23,7%	23,7%	22,2%	22,2%
Energy & other utilities	45.554	9.022	36.533	568	568
As % of total	2,2%	1,7%	2,4%	2,0%	2,0%
Construction	88.063	20.955	67.108	777	777
As % of total	4,3%	3,8%	4,4%	2,7%	2,7%
Trade	204.730	47.667	157.063	3.202	3.202
As % of total	9,9%	8,7%	10,3%	11,3%	11,3%
Tourism	26.964	3.617	23.347	255	255
As % of total	1,3%	0,7%	1,5%	0,9%	0,9%
Logistics	115.961	26.201	89.760	1.770	1.770
As % of total	5,6%	4,8%	5,9%	6,2%	6,2%
Commercial services	92.206	19.570	72.636	901	901
As % of total	4,5%	3,6%	4,8%	3,2%	3,2%
Public administration & social sector	417.433	105.203	312.230	5.837	5.837
As % of total	20,2%	19,3%	20,5%	20,6%	20,6%
Entrepreneurs & sole proprietors	522.493	144.018	378.475	8.169	8.169
As % of total	25,3%	26,4%	24,8%	28,8%	28,8%

Total	2.068.964	544.766	1.524.198	28.339	28.339
As % of total	100%	100%	100%	100%	100%

Source: Municipalities of Serbia 2005, Statistical Office of Republic of Serbia March 2006

When analyzing the employment number by economic sector for the project area (Table 2.9), the most striking feature is the size of the manufacturing, public administration and social sector, and entrepreneurs & sole proprietors sectors, with 22%, 21% and 29 % respectively. The national average for these three sectors was 24%, 20% and 25%. The municipality of Šabac has a very developed social sector, and the municipality from its budget finances mobile teams that cover 24 hours functioning of these social services, exceeding the national level.
The Municipality of Šabac reflects the employment pattern of Central Serbia, having slightly better employment in the entrepreneurs and sole proprietors sector.

It is also striking that the Trade sector employs within the project area 11.3% of the total population, the national level is 9.9%. In the Construction sector the Municipality of Šabac is way below national average with only 2.7% totally employed in this sector. Employment average at the national level for this sector is 4.3%.

Employed at the energy and other utility services, within the project area, are almost at the national level of 2.2% (project area 2.0%), and this could also be said for the commercial services sector (project area 3.2%, national average 4.5%).

Also striking is the low share of tourism both on the national level 1.3% and of the project region 0.9%.

The labour market is rather dependent on the manufacturing sector and on the private sector, since, as mentioned above, a number of industries are still operational and a growing number of small companies are becoming very important in lowering unemployment.

Table 2.5 National income 2005

Indicator	Serbia	Vojvodina	Central Serbia	Project area	Šabac
National income (in '000 CSD, nominal)	918.732.972	291.063.478	627.669.494	20.608.926	20.608.926
As % of total	100,0%	31,7%	68,3%	2,2%	2,2%
As % of total project area				100,0%	100,0%
National income per capita	123.473	144.598	115.639	169.919	169.919

Source: Municipalities of Serbia 2005, Statistical Office of Republic of Serbia March 2006

The 2005 national income in the project area is 2.2% of Serbia's total national income. Per capita income in the province of Vojvodina in respect to national per capita level for the observed year was 31.7%, and in Central Serbia 68.3%.

Table 2.6 National income by sector

Indicator	Serbia	Vojvodina	Central Serbia	Project area	Šabac
Agriculture. Fisheries & forestry	156.437.867	65.573.667	90.864.200	3.292.679	3.292.679
As % of total	17,0%	22,5%	14,5%	16,0%	16,0%
Manufacturing/processing industry	294.890.188	108.148.656	186.741.532	11.229.846	11.229.846
As % of total	32,1%	37,2%	29,8%	54,5%	54,5%
Energy & other utilities	17.710.789	8.478.334	9.232.455	245.920	245.920
As % of total	1,9%	2,9%	1,5%	1,2%	1,2%
Construction	67.323.353	13.046.122	54.277.231	425.307	425.307
As % of total	7,3%	4,5%	8,6%	2,1%	2,1%
Trade	226.919.194	64.287.755	162.631.439	3.701.304	3.701.304
As % of total	24,7%	22,1%	25,9%	18,0%	18,0%
Tourism	16.602.919	3.085.440	13.517.479	164.226	164.226
As % of total	1,8%	1,1%	2,2%	0,8%	0,8%
Logistics	95.716.030	20.371.707	75.344.323	1.203.734	1.203.734
As % of total	10,4%	7,0%	12,0%	5,8%	5,8%
Commercial services	38.916.575	7.083.135	31.833.440	302.242	302.242
As % of total	4,2%	2,4%	5,1%	1,5%	1,5%
Public administration & social sector	4.216.057	988.662	3.227.395	43.668	43.668
As % of total	0,5%	0,3%	0,5%	0,2%	0,2%
Total	918.732.972	291.063.478	627.669.494	20.608.926	20.608.926
	100,0%	100,0%	100,0%	100,0%	100,0%

The national income by the sector data shows that the manufacturing/processing sector contributes the largest share of the total income of the project area with 54.5%, considerably higher than the national average of 32.1%. Second largest sector is agriculture with 16%, followed by the trade sector with the share of 18% of the total income.

It can thus be concluded that the project area's economy is dominated by the manufacturing/processing industry, but also has an important agricultural and trade basis.

2.3 General and Detailed urban plans

The main framework of economic development in the Municipality of Šabac is based on activation of northern work zone (or the "northern agro-industrial zone").
The intended use of the area and facilities within the Programme of City Planning is harmonized with: concept and dominant intended use of Provisional Construction Rules for the city of Šabac and its suburbs, development strategy of Šabac Municipality and Programme for elaboration of city plan for Šabac and its suburbs (general plan) whose elaboration is under way and for whose elaboration following studies have been done: transport, geo-mechanical, demographic, economic potentials, etc.

Based on Articles 39 and 54 of the Law on Planning and Construction ("Official Gazette of RS", No. 47/03 and 34/06), Modification and amendments of Provisional Construction Rules ("Official Gazette of Šabac Municipality", No. 10/05 and 35/05) and Articles 26 and 60 of the Statute of Šabac Municipality ("Official Gazette of Šabac Municipality" No. 8/02 and 24/04), Municipal Assembly of Šabac, at its session held on 03 October 2006 adopted the Detailed regulation plan North-western work Zone in Šabac municipality.

The scope of this action is to enable infrastructural development and investing in other sectors that would contribute to the realization of this plan. Medium term infrastructure development plan outlines investing in secondary water and wastewater network, distributive gas heating system (these are the preconditions for development of the zone). The plan includes also development of railway and river transport.

2.3.1 Memorandum on 2007 Budget and economic status of the Municipalities, and the revision of the Memorandum -(with 2008 projections)

By the directives of the Memorandum on the 2007 Budget (Based on the Law on Budget system, the Government adopts a Memorandum on the Budget), within its Projections for the years 2008 and 2009 and the policy on the Public finances, local communities are entitled to a share of 1.7% of total non-categorical transfers of the GDP.

Total of non-categorical transfers in absolute numbers, for the year 2007 are apportioned at RSD 29, 7 billion or € 371 million (Republic of Serbia is divided into 141 municipality and 4 cities, and according to this subdivision municipalities are apportioned RSD 18, 5 billion or € 230 million and the share for the 4 cities is RSD 1, 2 billion or € 15 million).

Local communities are also entitled to a share of RSD 2, 0 billion or € 25 million of categorical transfers for financing investments in healthcare and operating of tax authorities.

Based on the above provisions, the share of non-categorical transfer for the municipality of Šabac for the year 2007 is RSD 358 million (€ 4, 5 million).

In respect to 2006, transfers for 2007 were increased, based on the fact that, the GDP had not increased in real terms, but the increase was actually the result of lowered income tax (from 14% to 12%), and introduction of nontaxable part of the income (of RSD 5,000 monthly). And from the VAT, which was introduced in 2006.

Consequently, in respect to 2006, the transfers in 2007 were increased by 114% for the Municipality of Šabac.

In October 2007, the Government of Serbia had revised the Memorandum on 2007 budget and economic status of the Municipalities. By this revision, the increase in transfers for the 2008 is the result of the switch of property tax from allocated to original revenues, tax exemption on the purchase of the first flat, lowering of inheritance and gift tax. These are all allocated taxes and will be, according to the Law on local community financing, 100% allocated to the local communities.

According to this budget revision, the Municipality of Šabac will receive in 2008 transfers increased by 23% in respect to transfers received in 2007.

Table 2.7 Budget Transfers (000'RSD)

Municipality 1	2006 2	2007 3	2008 4/plan	Index 5(3/2)	Index 6(4/3)
Šabac	167,248	358,368	440,557	214.3	122.9

Source: Serbian Bureau of Statistics

Reference: Chapter 5, Analysis of the Municipalities' financial operations

3 TECHNICAL ANALYSIS

3.1 Current Level of Service Delivery and Demand Projection

3.1.1 Introduction

In 2005, the municipality presented as a priority for financial support an infrastructure project including extension and upgrading of the existing sewer system and construction of corresponding wastewater treatment facilities. The details of the wastewater related infrastructures are as follows:

- Diversion of the wastewater flow, originating from the suburban areas, away from the Town centre through a by-pass interceptor sewer, ending at the future wastewater treatment plant (WWTP) site;
- Construction of a sewage pumping station (SPS) named Glavna to be located at the existing wastewater outlet. The SPS will pump wastewater to the future WWTP through a new pipeline. It will also be designed to cater for a possible combination of wet weather flow and high levels of the River Sava, when the surface water level exceeds the invert level of the wastewater outlet pipe;
- Construction of the main sewers to reach the surrounding villages and built up areas around the Town centre;
- Construction of a new WWTP – Phase I with a hydraulic capacity Q max day = 420 l/s and Q max h = 650 l/s and for the design organic loading of 126.000 population equivalents (PE). The future WWTP is supposed to provide adequate treatment of domestic wastewater collected in Šabac and surrounding suburbs and other settlements, as well as the industrial wastewater subject to prescribed preliminary treatment prior to discharge into the sewer system. A separate wastewater treatment plant shall provide treatment of wastewater originating from the Town's major chemical industry complex Zorka. The WWTP shall be located close the outlet of the so-called Cerski Canal into the River Sava on a reserved site with an area of 5,6 ha. Substantial preparatory works have already been carried out at the WWTP sites including protective embankment in the WWTP zone as well as backfilling of some 100.000 m3 of gravel in order to improve foundation conditions. In brief, the treatment processes to be employed at the WWTP shall include the following: grit removal, primary clarifiers, biological aeration, final clarifiers, and sludge treatment: primary and secondary thickeners, anaerobic stabilization and dewatering. The location and concept of the WWTP are in accordance with the local General and Detail Urban Master Plans, and the WWTP design was approved by the Republican review committee and the corresponding building permit has been issued;
- Meanwhile, the municipality, financially supported by the GoS, is engaged in the construction of the raw water pumping station being the first component of the future WWTP. Construction of the raw water pumping station was accomplished in December 2007, and when it becomes operational, it will transfer collected wastewater via a temporary by-pass outlet into the Sava River.

3.1.2 Assessment of coverage of current systems

In this section an assessment is given of some (mainly technical) indicators of the operational efficiency of PUC Vodovod. An assessment of other operational and administrative performances of the PUC can be found in chapter 7.

Overview of the existing sewerage system

The total number of inhabitants of the town of Šabac and its suburbs that are within the scope of this project in accordance with the 2002 census was 80,100.

The existing sewer system is of the so-called combined type, i.e. collecting both domestic wastewater and storm water by the same sewers. The town area and consequently the sewerage system have gradients towards the North-East, meaning that collected wastewater is transferred by means of gravity and where necessary by pumping towards the main sewer outlet into the Sava River. Collected and transported wastewater is not treated prior to discharge, which is considered to be one of the major deficiencies of the existing system.

The total length of the existing sewers is around 116 km. The system is continuously being extended, and during 2005 and 2006 the main gravity sewer along the Cerski Canal was constructed, enabling the connection to the system of a number of suburbs.

The system layout is shown on the enclosed layout map.

At the moment, collected wastewater is discharged through a single outlet and is, without any treatment, evacuated into the Sava River, just downstream of the main bridge; *see Figures 3.1 and 3.2.*

Figure 3.1 Main sewerage outlet

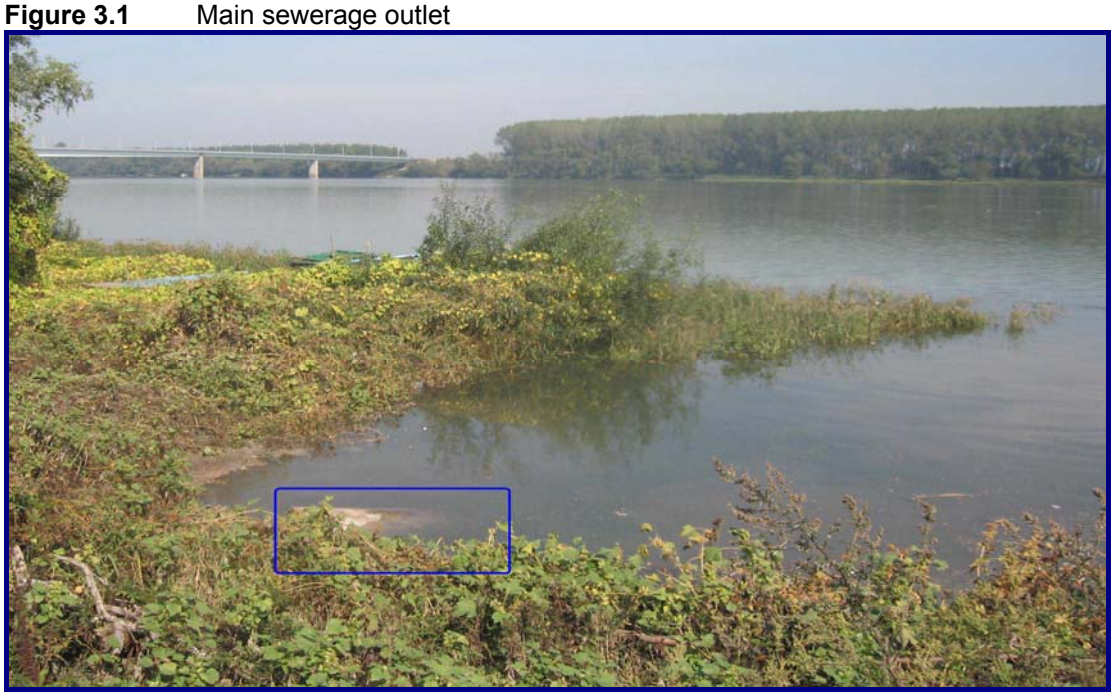
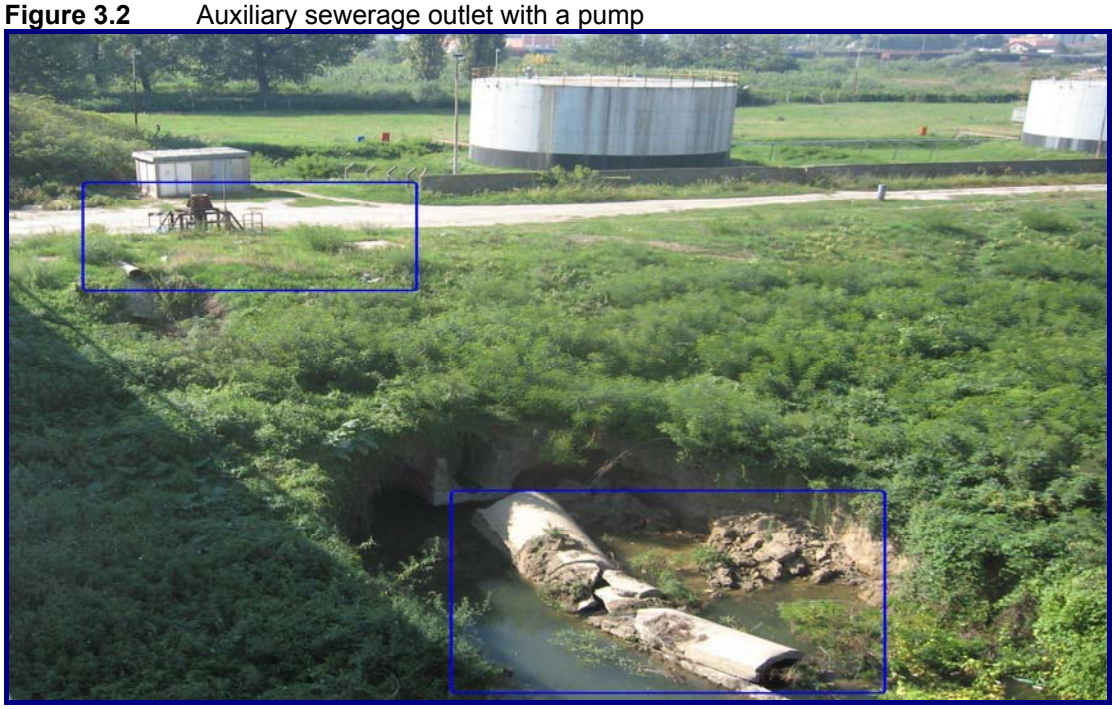


Figure 3.2 Auxiliary sewerage outlet with a pump



The sewerage network has been mostly constructed of standard sewer pipes with diameters ranging from 400 to 1.500 mm. However, due to the nature of the system (combined sewerage concept) the main sewer is composed of oval pipes 1.200/1.800 mm and 1.250/1.900 mm. The maximum discharge capacity of the main gravity sewer, with backwater-free discharge, is around 3,0 m3/s.

However, current operational practice of the system is such that, especially during periods of high water levels in the Sava River, the system comes under backwater effect, resulting in flooding of the zones with lower altitudes. For that reason, an auxiliary outlet has been constructed, with a pump that discharges wastewater and storm water runoff to the Sava, even for high water levels in the river.

The existing system has been exposed to the following operational problems:

- Too shallow secondary network and difficulties in connecting new users in some zones;
- Low gradients of the network resulting in depositing of settled materials and requiring intensive maintenance;
- Structural damages to the network caused by traffic loads and groundwater;
- Substantial infiltration due to damaged pipes and structures, further promoted by a high groundwater table;
- Poor maintenance of storm water inlets.

Apart from the network, the most important facilities in the system include the following pumping stations:

- Sewage pumping station (SPS) Letnjikovac is situated in the vicinity of the Cerski Canal which transfers wastewater from the Letnjikovac settlement. The SPS is equipped with 3 submersible pumps, each of 50 l/s capacity;

- SPS Metaloplastika is located in the Southern part of the system and serves the Jevremovo and Metaloplastika areas. The SPS is equipped with three wastewater pumps, with capacity 100 to 150 l/s each;
- SPS Hajduk Stanko serves the areas called Kamičak and Preki Šor. The SPS contains three wastewater pumps, with a capacity 140 l/s each;
- SPS Stari Grad is located close to the Sava River. It contains three wastewater pumps with capacity 20 to 40 l/s each;
- SPS Stevan Filipović is of local importance, serving a number of neighbouring houses and buildings. It has been constructed as a typical sewage pumping station with submersible pumps, with a capacity of 10 l/s each.

The raw water pumping station at the future WWTP is under construction, and should be completed in December 2007. It is going to transfer complete wastewater flows collected in the project area to a new outlet at the Sava River.

Close to the existing main outlet a hydraulic flow measuring structure has been erected in order to enable open-channel flow measurements. The flow measuring structure is used occasionally, for random flow measurements, although it would be of great importance to establish permanent flow measuring and recording in order to be able to monitor and analyse system characteristics and performance.

Performance indicators

Based on the information provided by PUC Vodovod, the total number of inhabitants connected to the sewer system in the town of Šabac is about 49.500 (representing 85% of the urban population). Furthermore, this means that the overall service coverage for the municipality is around 38%, and in the Project Area (including the town and suburbs) it is around 60%, see Table 3.1. It can be concluded that the overall service coverage with sanitary sewerage collection in the municipality and in the Project Area is rather low.

Between 2003 and 2006 an increase of number of sewerage service connections of 2.700 new service connections has been recorded.

The plans for the extension of the sewerage service area to the suburbs neighbouring the urban area that have been developed and gradually implemented, will connect an additional 23,000 inhabitants to the system. All additional wastewater from this extended service area shall be diverted to the future wastewater treatment facilities, in order to be properly treated. Therefore, in parallel with the planned extension of the sewer system, it is necessary to install adequate wastewater treatment facilities compliant with the required effluent standards.

Some of the major technical performance indicators related to operation of water supply and sewerage systems in the municipality of Šabac are shown in the following table.

Table 3.1 An overview of major technical performance indicators

Performance indicator	Town	Project area (town and suburbs)	Municipality
Drinking water service coverage (%)	> 98	73	46
Connection to the sewer system (as % of total population)	85	60	38
Wastewater Treatment (%)	0	0	0
Non revenue drinking water for period 2003 – 2006 (%)	45	45	45
Residential water consumption (l/cap/d)	160	160	160

From this overview the following conclusions can be drawn:

- Service coverage in terms of sewage collection is very low;
- Wastewater treatment is, and shall remain a high priority because at the moment there is none;
- The percentage of non-revenue water is unacceptably high;
- Recorded average residential consumption of around 160 l/cap/day can be assessed as reasonable.

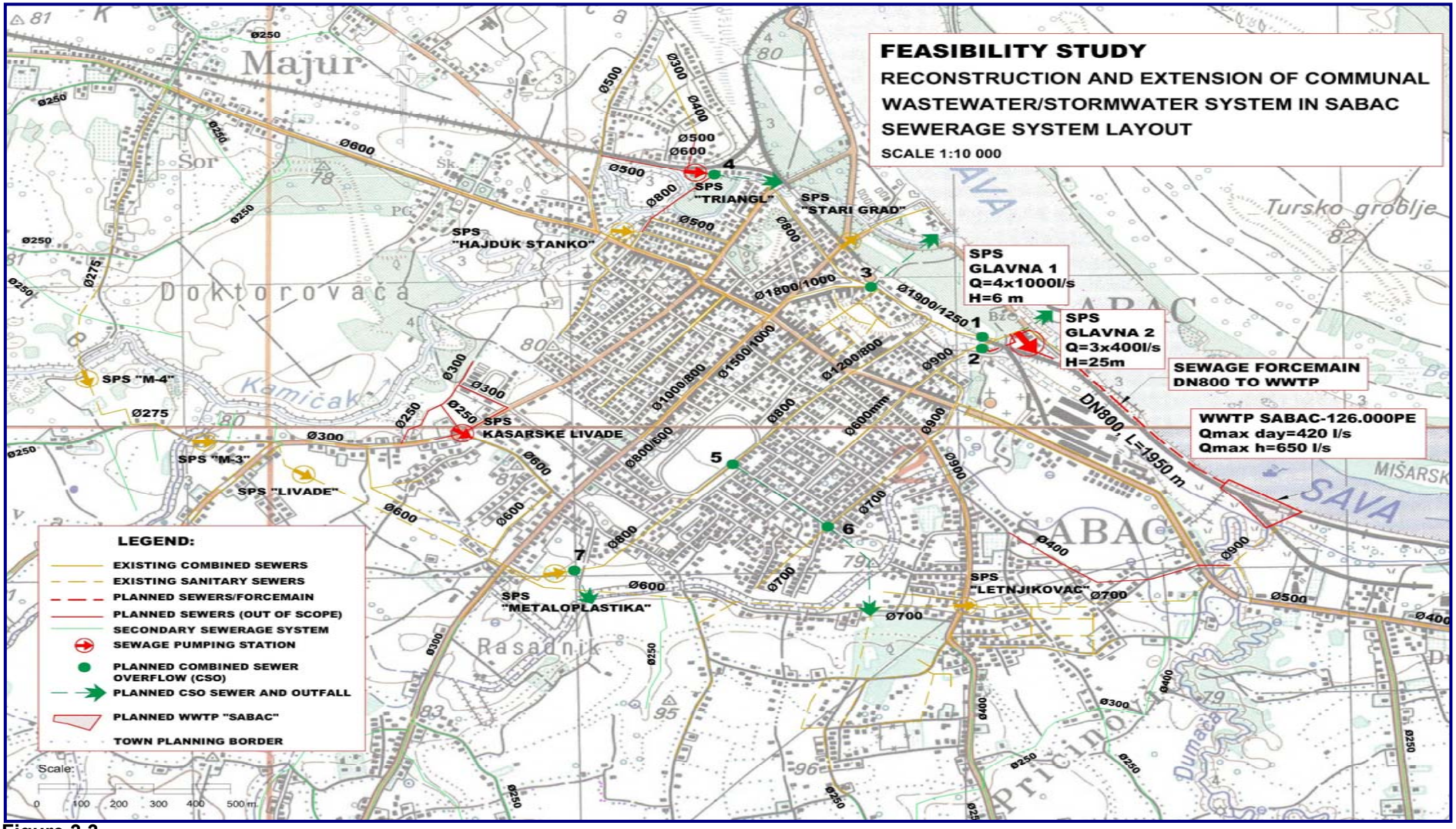

FEASIBILITY STUDY
RECONSTRUCTION AND EXTENSION OF COMMUNAL WASTEWATER/STORMWATER SYSTEM IN SABAC
SEWERAGE SYSTEM LAYOUT
SCALE 1:10 000
SPS "TRIANGL"
SPS "STARI GRAD"
SPS "HAJDUK STANKO"
SPS GLAVNA 1
Q=4x1000l/s
H=6 m
SPS GLAVNA 2
Q=3x400l/s
H=25m
SEWAGE FORCEMAIN
DN800 TO WWTP
WWTP SABAC-126.000PE
Qmax day=420 l/s
Qmax h=650 l/s
DN800 L=1950 m
SPS "M-4"
SPS "M-3"
SPS "LIVADE"
SPS KASARSKE LIVADE
SPS "METALOPLASTIKA"
SPS "LETNJIKOVAC"
Majur
Doktorovača
Kamičak
Rasadnik
Tursko groblje
SABAC
SAVA
LEGEND:
EXISTING COMBINED SEWERS
EXISTING SANITARY SEWERS
PLANNED SEWERS/FORCEMAIN
PLANNED SEWERS (OUT OF SCOPE)
SECONDARY SEWERAGE SYSTEM
SEWAGE PUMPING STATION
PLANNED COMBINED SEWER OVERFLOW (CSO)
PLANNED CSO SEWER AND OUTFALL
PLANNED WWTP "SABAC"
TOWN PLANNING BORDER
Scale:
0 100 200 300 400 500 m

Figure 3.3

3.1.3 Description of the service area and delivery

The municipality of Šabac, including its urban and rural settlements, belongs to the Mačva District. The town of Šabac, with its current population of around 58,500, represents by far the larges agglomeration in the municipality. The existing sanitation services are mostly developed and concentrated in the urban area of Šabac town, with a steadily increasing number of service connections. Based on the information supplied by the local PUC the system serves mostly urban population, local administration and other institutions, smaller private companies, trades, and also identified major industries.

Based on the sewerage Master Plan for the municipality, the Project Area includes Šabac town and its suburbs, i.e. the area from which all wastewater is to be collected, transferred and treated at the future wastewater treatment facilities. As shall be elaborated further on, it practically means that some 22,500 additional inhabitants of the Project Area have to be connected to the sewerage system in order to provide full service coverage.

The Project Area including Šabac and its suburbs is shown on the enclosed general layout map, see Figure 3.3.

The Project Area specifically includes the following settlements:

- Town of Šabac;
- Tabanović;
- Majur;
- Jevremovac;
- Pocerski Pričinović;
- Jelenča;
- Mišar

3.1.3.1 Current level of service delivery

In the assessment of the current service delivery, the information provided by the PUC Vodovod, Šabac has been used as reference.

Table 3.2 Water supply and sewerage service coverage in Šabac

	Data for 2006
Population - Šabac municipality	130.000
Population - town of Šabac	58.500
Population - in the Project Area (town and suburbs)	82.400
Population covered by centralized water supply	60.000
Population covered by sewerage	49.500
Water supply service coverage - municipality (%)	46,2
Water supply service coverage - town (%)	100,0
Water supply service coverage - project area (%)	72,8
Sewerage service coverage - municipality (%)	38,1
Sewerage service coverage - town (%)	84,6
Sewerage service coverage - project area (%)	60,1

According to the presented PUC data the actual service delivery rate in the urban area is around 85%, meaning that around 15% of the inhabitants in Šabac town are still not connected to the sewer system.

Assuming the mentioned boundaries of the project area (Šabac town plus suburbs to be connected to the sewerage system) the total population is around 82,400. Therefore, the actual service level for the project area is around 60%. A layout of the existing sanitary sewerage system is shown on the corresponding map of the project area, see Figure 3.3.

Based on the considerations above the following conclusions can be made:

1. The current level of service delivery related to sanitation in Šabac town and its suburbs is rather low, only around 60%, and it is therefore important to gradually increase this level, and improve the overall sanitation and hygiene in the project area;
2. Apart from wastewater collection and transport, provision of adequate wastewater treatment is also a critical issue, especially with regard to mandatory reduction pollution of the receiving water bodies and groundwater. Treating collected wastewater is likely to become even more critical after the connection rate to the sewers system increases. An increasing connection rate to the sewer system shall produce even more untreated wastewater to the main sewerage outlet, unless proper treatment is installed.

3.1.4 Demand Projections

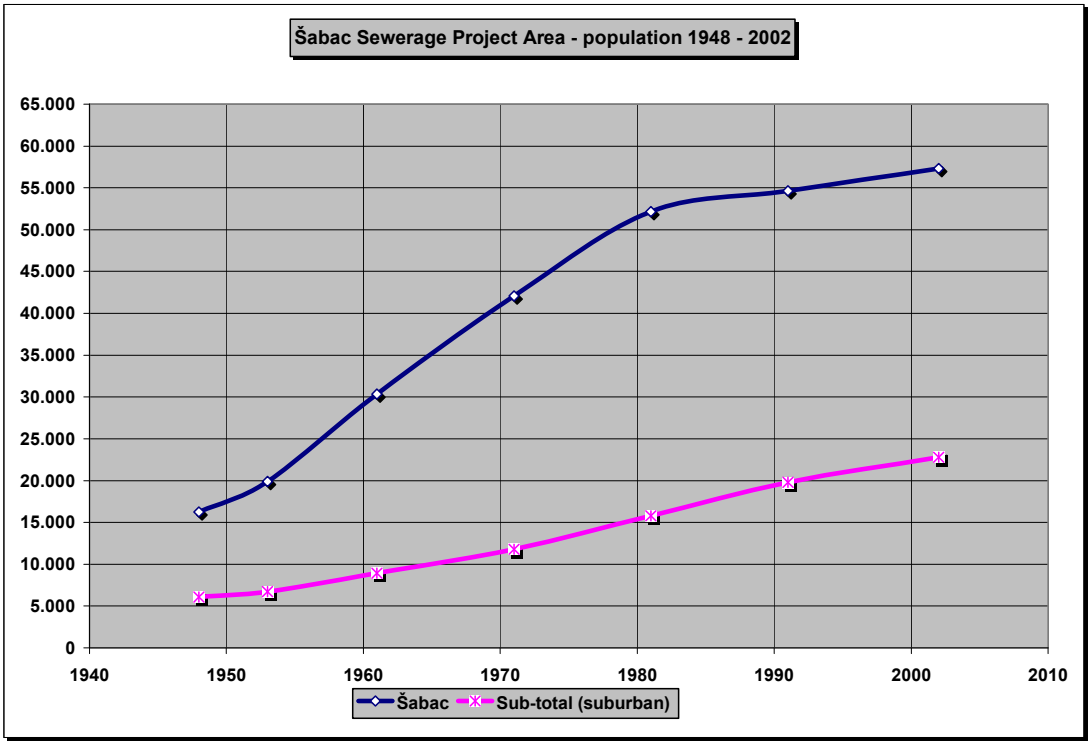
This section presents the assessment of the forecasts of population size, water demand and generated wastewater quantities and loads. For planning purposes a period of 33 years has been chosen, covering the period 2009 to 2041. It has been assumed that the major construction works (including the WWTP and the main transport sewers) shall be carried out between 2009 and 2011, followed by a 30-year operational period: 2012-2041.

3.1.4.1 Demography

The population forecast is an important starting point for estimating future water consumption and wastewater generation. The population projection has been based primarily on the recorded population trends in all types of settlements represented in the project area. The period 1991 – 2002 can be considered the most representative for an assessment of the current status and future projections. In the urban areas an annual increase of 0,44 % has been recorded, and in the suburban areas a positive annual trend of 1,29%. To allow for uncertainties, for further considerations in this study it was assumed that the growth rate in the urban areas shall remain positive but reducing from 0,40 to 0,25 %, and for the suburbs the growth rate from 1,0 to 0,5 % is adopted.

Basic demographic information for the project area, based on the censuses conducted from 1948 to 2002 is shown on the following figures. The most recent population estimate for the project is 82.400 for 2007.

Figure 3.4 Population in wastewater service area 1948 - 2002



The population projections in the project area are also shown in the following Table 3.3.

			Population					
No	**Settlement**	**Type**	**2002**	**2007**	**2011**	**2021**	**2031**	**2041**
1	**Šabac**	urban	**57.313**	**58.468**	59.410	61.522	63.393	64.996
	Sub-total (urban)	**urban**	**57.313**	**58.468**	**59.410**	**61.522**	**63.393**	**64.996**
	Growth rate (%) - urban			***0,40***	***0,40***	***0,35***	***0,30***	***0,25***
2	**Tabanović**	suburban	**1.525**	**1.603**	1.668	1.824	1.956	2.056
3	**Majur**	suburban	**7.133**	**7.497**	7.801	8.532	9.149	9.617
4	**Jevremovac**	suburban	**3.436**	**3.611**	3.758	4.110	4.407	4.632
5	**Pocerski Pričinović**	suburban	**6.347**	**6.671**	6.942	7.592	8.141	8.557
6	**Jelenča**	suburban	**2.047**	**2.151**	2.239	2.449	2.626	2.760
7	**Mišar**	suburban	**2.302**	**2.419**	2.518	2.754	2.953	3.104
	Sub-total (suburban)		**22.790**	**23.953**	**24.925**	**27.261**	**29.231**	**30.726**
	Growth rate (%) - suburban			***1,00***	***1,00***	***0,90***	***0,70***	***0,50***
	Gross total		**80.103**	**82.421**	**84.335**	**88.783**	**92.624**	**95.721**
	Growth rate (%) - total			***0,572***	***0,574***	***0,515***	***0,424***	***0,330***

Table 3.3

The actual number of users will be related to the annual rate of extension of the sewer systems. Based on the current status and expected implementation schedule, the following connection rates have been adopted:

Table 3.4 Anticipated connection rates to the sewerage system

Type of settlement	**2007**	**2011**	**2021**	**2031**	**2041**
Urban	**81**	**90**	**100**	**100**	**100**
Suburban	**15**	**30**	**55**	**75**	**85**

In accordance with these connection rates, projected numbers of the sewerage system users and quantities of wastewater are presented in Annex 3.1

3.1.4.2 Water supply – basic balances

Based on the Consultant's request a full set of data on produced and invoiced drinking water has been made available for the period 2003 to 2006 by the PUC Vodovod. Of particular concern for the wastewater flows assessment are the data concerning drinking water consumed and invoiced, because there is a direct correlation with the amount of generated wastewater. The average annual water consumption invoiced in Šabac per user category is presented in the following Tables 3.5 and 3.6:

Table 3.5 Basic balances in Šabac water supply system (m^3/annum)

	2003	2004	2005	2006
Water produced - Sabac and suburbs (m^3)	7.884.354	7.942.838	8.389.079	8.376.009
Water invoiced - population (m^3)	3.722.831	3.577.178	3.466.832	3.519.790
Water invoiced - industries (m^3)	912.810	822.034	763.614	729.910
Water invoiced - public services (m^3)	328.845	362.139	341.967	340.344
Water invoiced - total (m^3)	4.964.486	4.761.351	4.572.413	4.590.044
Water losses (m^3)	2.919.868	3.181.487	3.816.666	3.785.965

Table 3.6 Basic balances in Šabac water supply system (l/s)

	2003	2004	2005	2006
Water produced (l/s)	250,0	251,9	266,0	265,6
Water invoiced - population (l/s)	118,1	113,4	109,9	111,6
Water invoiced - industries (l/s)	28,9	26,1	24,2	23,1
Water invoiced - public services (l/s)	10,4	11,5	10,8	10,8
Water invoiced - total (l/s)	157,4	151,0	145,0	145,5
Water losses (l/s)	92,6	100,9	121,0	120,1
Water losses (%)	37,0	40,1	45,5	45,2

3.1.4.3 Peaking factors

Peaking factors – the ratios between typical design flows and the average flow - are important for a proper assessment of the design hydraulic loadings used in dimensioning wastewater collection and transfer systems and treatment facilities.
Due to a lack of relevant measured information on wastewater flows variations in Šabac, data from systems of similar characteristics and size in Serbia have been used for this demand analysis. The following peaking factors have been used in this study:

Table 3.7 Flow peaking factors

Year	2007-2041
$K_{max\ day\ -\ town}$	1,50
$K_{max\ day\ -\ suburbs}$	1,75
$K_{max\ day\ –\ industries}$	1,40
$K_{max\ h\ –\ town}$	1,50
$K_{max\ h\ -\ suburbs}$	1,70
$K_{max\ hour\ -\ industries}$	1,40

3.1.4.4 Unit water consumption rates

This section presents unit water consumption rates calculated on the basis of recorded water consumption and numbers of system users.

From this overview, and taking into account the data on the number of users in the system it is possible to derive unit water consumption and to allocate it per user category. In order to establish the unit water consumption the following analysis has carried out: based on the number of users defined by the PUC Vodovod – 58.500.

Table 3.8 Unit potable water consumption per category of users

	2003	2004	2005	2006
Unit rate - gross production (l/cap/day)	397,1	383,1	393,6	382,5
Unit consumption rate - households only (l/cap/day)	187,5	172,5	162,6	160,7
Unit consumption rate - industrial (l/cap/day)	46,0	39,7	35,8	33,3
Unit consumption rate - institutional (l/cap/day)	16,6	17,5	16,0	15,5
Unit rate - water losses (l/cap/day)	147,1	153,5	179,1	172,9

Based on the presented information, the following unit water consumption rates can be adopted as a baseline values for 2007:

- Households - 160 l/cap/day
- Industry - 35 l/cap/day
- Institutional - 15 l/cap/day
- **Total - 210 l/cap/day**

Corresponding current unit wastewater discharges, assuming 0,85 as a wastewater/water ratio are as follows:

- Households - 135 l/cap/day
- Industry - 30 l/cap/day
- Institutional - 15 l/cap/day
- **Total - 180 l/cap/day**

For the purpose of future wastewater flows analysis, the following unit wastewater rates are adopted and incorporated in the wastewater flow projection:

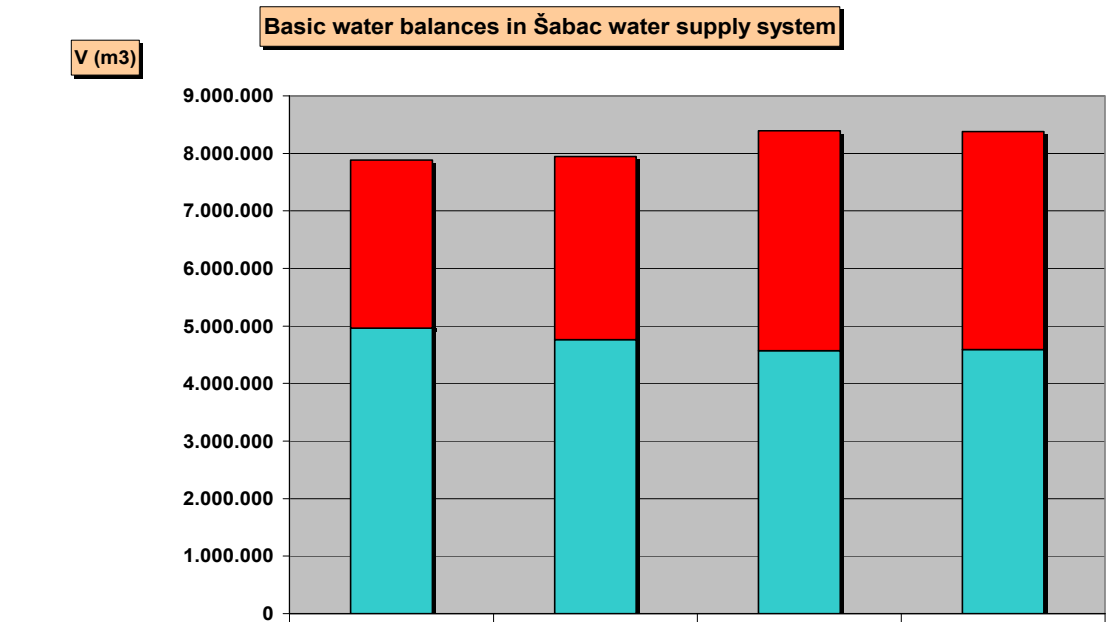
Table 3.9 Unit wastewater discharges for households and institutional/public customers till 2041 (l/capita/day)

Consumer category/Year	2007	2011	2021	2031	2041
Households	135	135	135	135	135
Institutional, public and other	15	15	17	19	20
Total	150	150	152	154	155

3.1.4.5 Unaccounted for water (UFW)

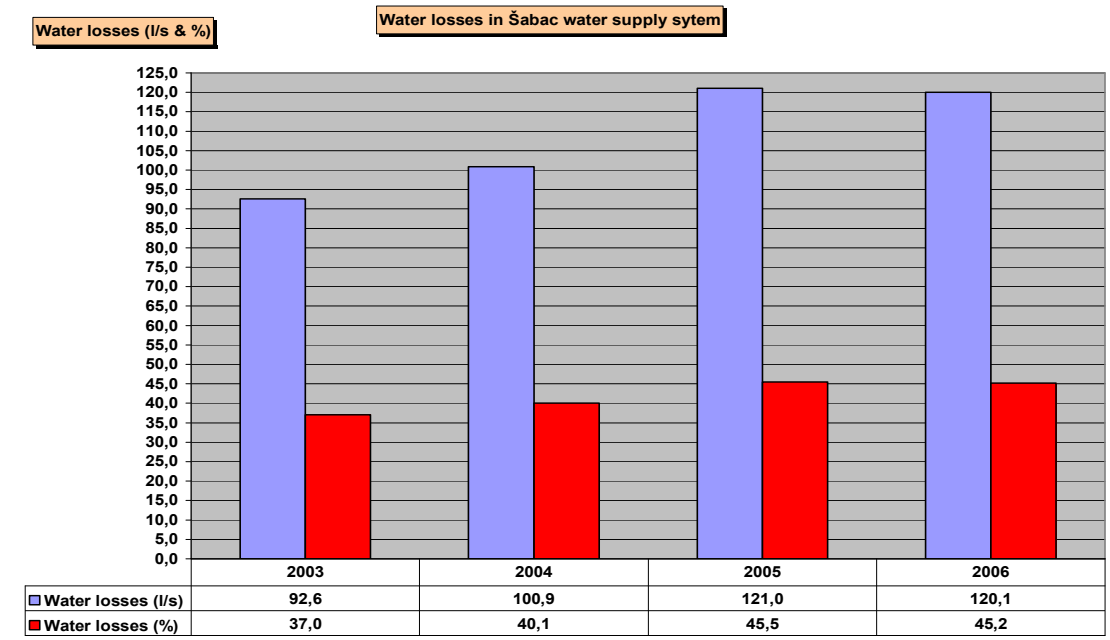
From the collected information on the amounts of produced and consumed drinking water, it was possible to derive basic water balances, including the UFW component. Below an overview of UFW is given, in terms of the total annual volumes and also expressed as a percentage of water produced.
From the data it can be concluded that the UFW expressed as a percentage of water produced is very high in the Šabac water supply system (37 to 45%, or around 120 l/s).
Based on the generally accepted international criteria, this percentage of UFW is unacceptably high, and this issue should be studied in more detail, aiming to bring it into a technically and economically acceptable range.
The program intended to improve the overall operational efficiency of the PUC Vodovod Šabac, supported by the KfW, is planned to start early 2008. This program specifically addresses the issue of UFW.

Figure 3.5 Water losses in Šabac water supply (m^3/annually)



	2003	2004	2005	2006
Water losses (m3)	2.919.868	3.181.487	3.816.666	3.785.965
Water invoiced - total (m3)	4.964.486	4.761.351	4.572.413	4.590.044

Figure 3.6 Water losses in Šabac water supply (l/s and %)



	2003	2004	2005	2006
Water losses (l/s)	92,6	100,9	121,0	120,1
Water losses (%)	37,0	40,1	45,5	45,2

3.1.4.6 Industrial Discharges

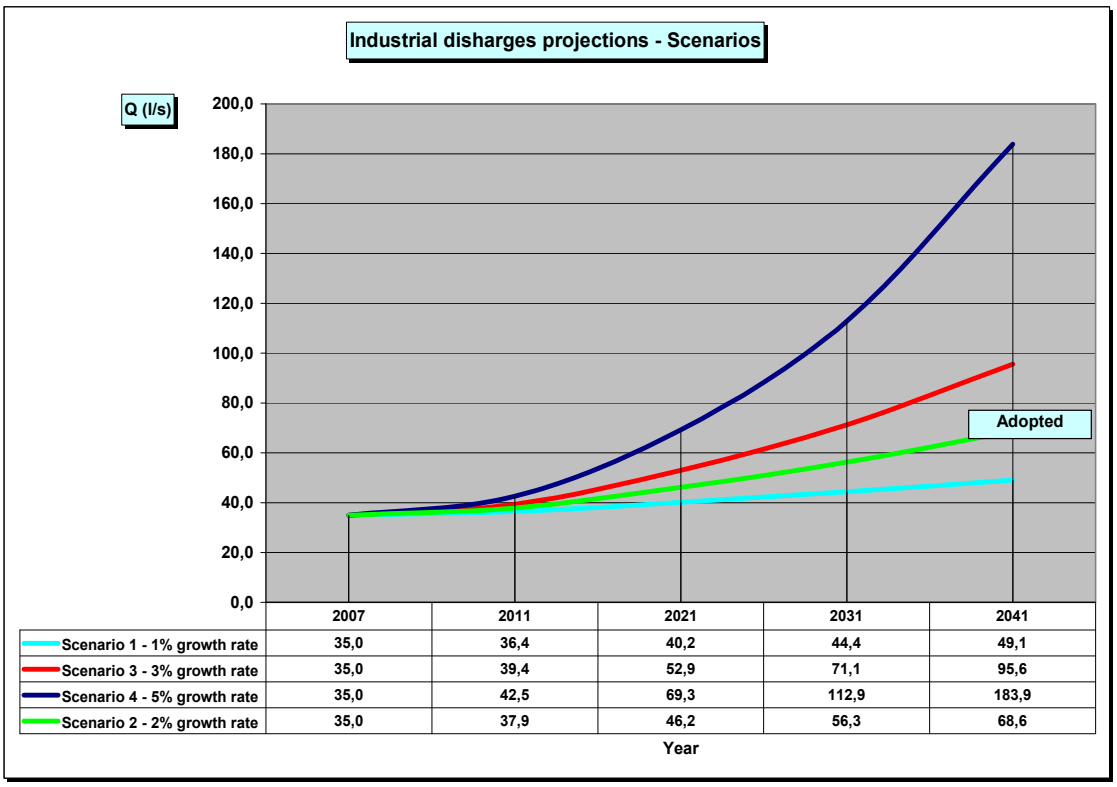
As a baseline for the projection of industrial discharges the average discharge in the existing system of around 35 l/s has been adopted. It should be noted that this figure includes not only the industries that are normally supplied from the existing public water supply system and already connected to the sewerage system, but also the major industries that use their own local water sources and are about to be connected to the existing sewerage system – when they meet the requirements set by the municipality.

Three development scenarios were examined:

1. Low development scenario: considering a low annual growth of industrial discharges of 1% annually;
2. Two medium development scenarios: relating the growth of industrial discharges to the GDP growth rate, but also assuming reduction of wastewater discharges due to water conservation measures, recycling and reuse within industrial premises;
3. High scenario: assuming a growth rate of industrial discharges in direct correlation to the assumed GDP growth rate of 5% annually.

Based on the available information only, it is rather difficult to give an accurate estimate of future industrial discharges over a 30-year period. However, it can be realistically assumed that the industrial activity will gradually recover (at a rate recorded over the last few years in Serbia). On the other hand it would be logical to expect some water consumption reduction measures driven by introduction of higher water tariffs. It has been estimated that the medium-growth scenario with 2% annual growth represents the best match for these assumptions, and it would be therefore adopted for further analysis in this study.

Figure 3.7 Industrial wastewater discharges



	2007	2011	2021	2031	2041
Scenario 1 - 1% growth rate	35,0	36,4	40,2	44,4	49,1
Scenario 3 - 3% growth rate	35,0	39,4	52,9	71,1	95,6
Scenario 4 - 5% growth rate	35,0	42,5	69,3	112,9	183,9
Scenario 2 - 2% growth rate	35,0	37,9	46,2	56,3	68,6

3.1.4.7 Wastewater to water ratio

As mentioned before, the wastewater flows at the main outlet are not recorded regularly, and it is not possible to establish an exact relationship between the water supply consumption and the consequently generated wastewater flow.

Therefore, for the purpose of this study a conventional value of wastewater/water ratio has been adopted: 0,85.

3.1.4.8 Infiltration

Based on the collected information it was established that the groundwater table in Šabac town, depending on the micro-location and season varies from -6 m up to 0,0 m (surface level) in the downstream part of the system close to the WWTP location and next to the banks of the River Sava. It is anticipated that most of the existing sewerage system is subject to infiltration. The total infiltration discharge has been calculated in relation to the length of the network and adopted infiltration rate of 0,5 l/s per kilometre of the collection network.

3.1.4.9 Storm water runoff

The existing sewer system has been developed in accordance with a so called combined system concept, i.e. a common system for collection and transfer of both sewage and storm water. To change the existing system would be overly complex, expensive and impractical. Therefore, in the relevant design documentation the existing system will remain a combined type, but the system extensions shall be developed like a separate system; separate networks for collection and drainage of sewage and storm water. This in particular relates to the planned extension of the sewers in the settlements. This is in accordance to the Urban Master Plan for the town of Šabac and also further to the General Project Design of the Wastewater Collection and Treatment for the Urban Master Plan Area (Energoprojekt, Belgrade, 1998).

The existing main city sewer shall still retain its current function of draining both sewage and storm water, and transport it to the existing outlet at the Sava River. The issue of the storm water drainage system shall be considered only with regard to the following two major points of consideration:

- Quantities, quality and frequency of the combined sewer overflow (CSO) that shall be introduced at the current main city outlet;
- A part of the collected storm water will be directed to the WWTP;

The schemes of the planned Šabac sewerage system illustrating basic wastewater and storm water balances are shown in Figures 3.8 and 3.9.

Figure 3.8 Schematic presentation of planned Šabac sewerage system with basic wastewater and storm water balances

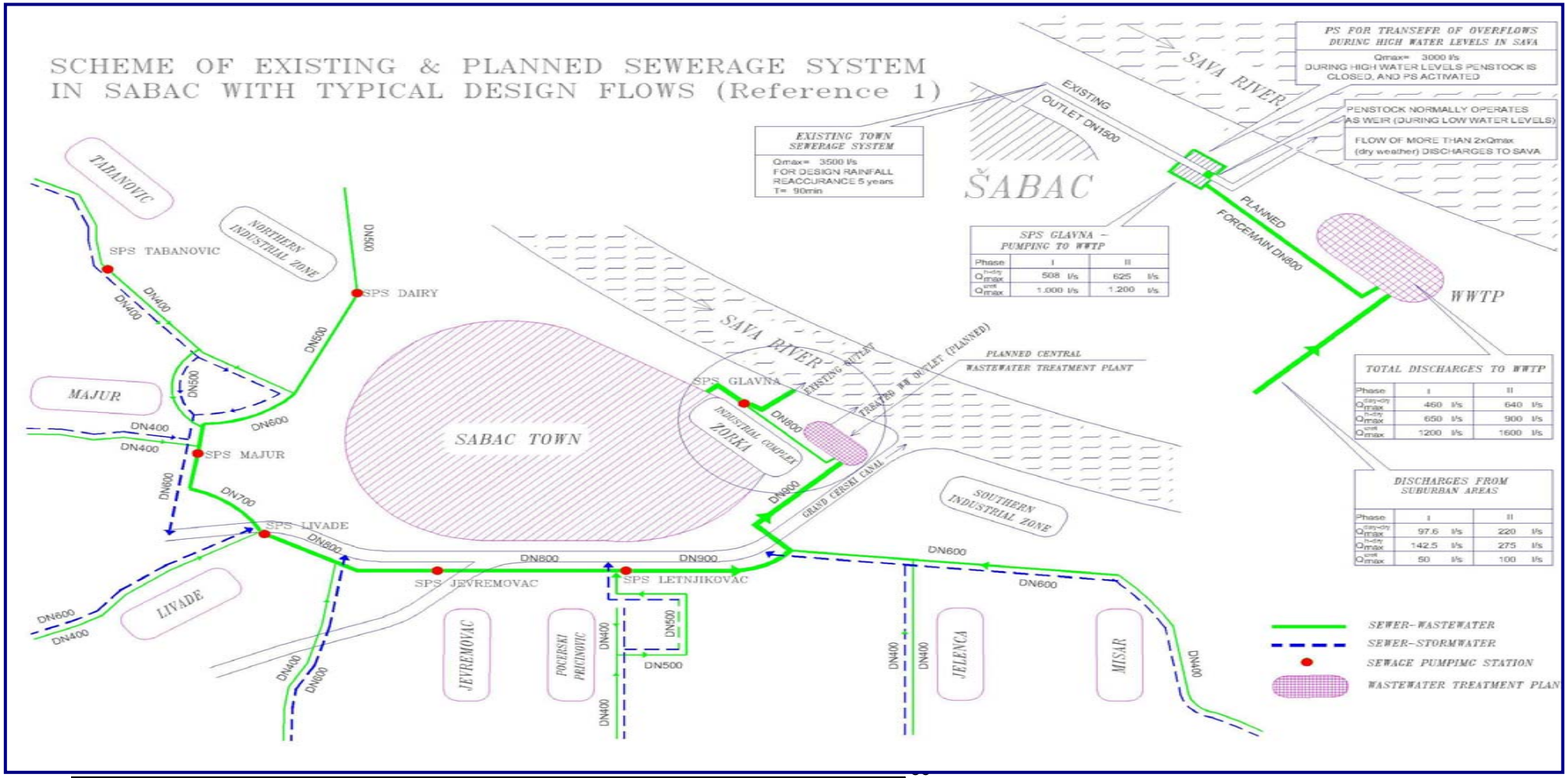
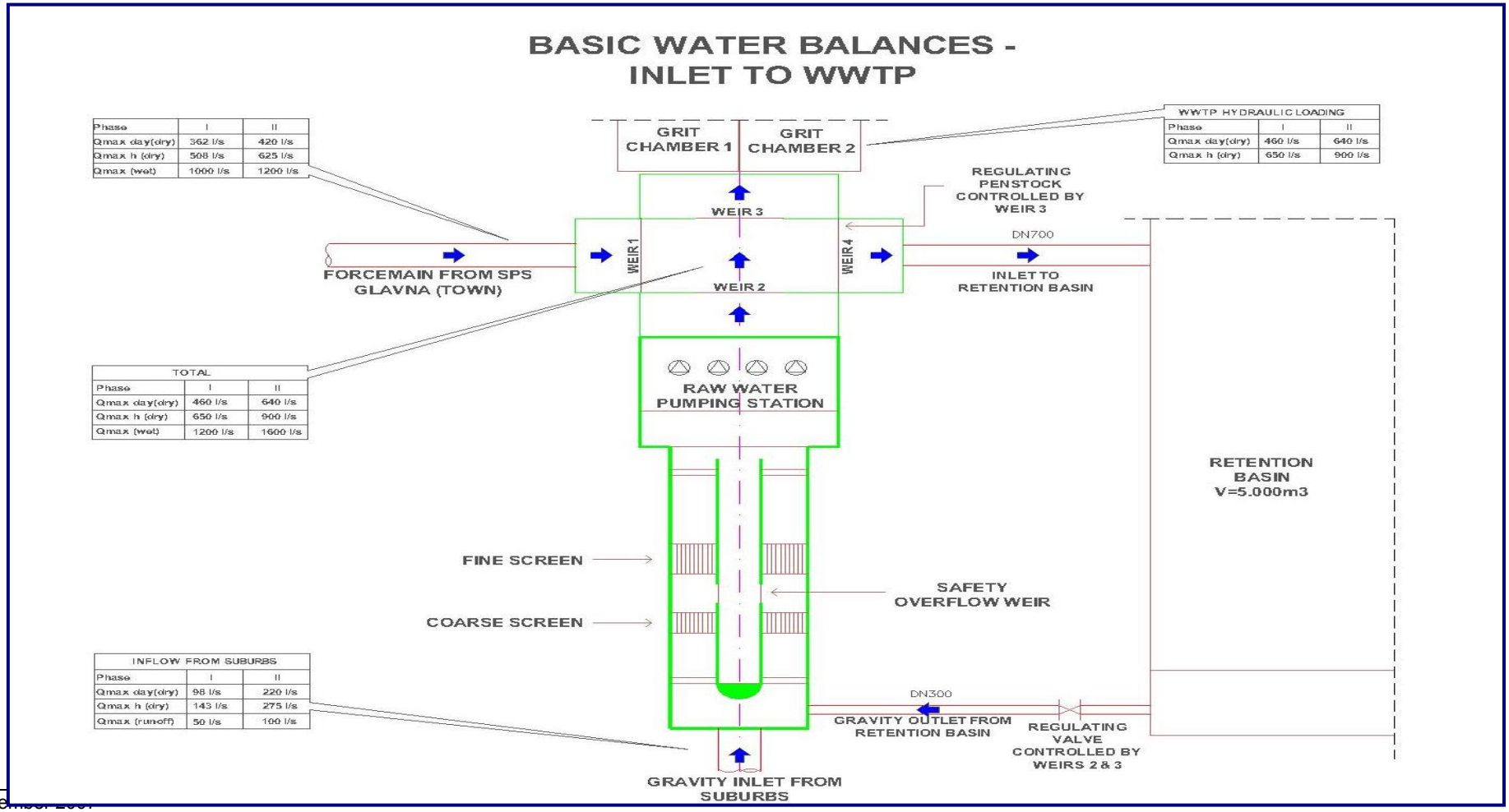


Figure 3.9 Inlet to WWTP – Basic wastewater and storm water balances



Phase	I	II
Qmax day(dry)	362 l/s	420 l/s
Qmax h (dry)	508 l/s	625 l/s
Qmax (wet)	1000 l/s	1200 l/s

WWTP HYDRAULIC LOADING		
Phase	I	II
Qmax day(dry)	460 l/s	640 l/s
Qmax h (dry)	650 l/s	900 l/s

TOTAL		
Phase	I	II
Qmax day(dry)	460 l/s	640 l/s
Qmax h (dry)	650 l/s	900 l/s
Qmax (wet)	1200 l/s	1600 l/s

INFLOW FROM SUBURBS		
Phase	I	II
Qmax day(dry)	98 l/s	220 l/s
Qmax h (dry)	143 l/s	275 l/s
Qmax (runoff)	50 l/s	100 l/s

The above given figures show the basic concept of planned Šabac sewerage system, and also basic wastewater and storm water balances in the system, and at the inlet of the WWTP:

- The existing town sewerage collects and conveys both wastewater and storm water to the existing outlet to the Sava River. The maximum total capacity is 3.500 l/s for the combined wastewater and storm water discharge;
- Close to the existing outlet a new sewage pumping station called Glavna is planned. This pumping station will assume multiple roles:
- Transfer of all wastewater collected in the town to the WWTP (**Q** $_{\text{max dry weather}}$);
- Transfer of the most polluted portion of collected storm water runoff (equal to **Q** $_{\text{max dry weather}}$) to the WWTP;
- When required (during high water levels in the Sava) pumping of all CSO-s in excess of 2 x **Q** $_{\text{max dry weather}}$ to the Sava via the existing outlet;

Although collected storm water runoff is partly transferred to the WWTP, dimensioning of the plant in terms of its hydraulic loading has not been affected. Namely, close to the plant inlet a retention basin of 5.000 m^3 has been designed to accommodate storm water runoff originating from the design storm with a retention time of 2 hours. Water retained in the retention basin is then gradually transferred to the plant in a regulated manner, in such a way that the maximum plant hydraulic capacity is not exceeded.

The WWTP is fed by wastewater and polluted storm water runoff from two basic sources:

- Pumping from the SPS Glavna (transferring combined wastewater and storm water from the town catchment);
- By gravity and then by pumping through the raw water pumping station catering for wastewater and storm water collected in the suburbs.

3.1.4.10 Demand Projection – Future Wastewater Flows

Since the existing sewer system is drained towards a single outlet point, it is possible to organise and conduct wastewater flow measurements to measure the total flows in the system. Some wastewater flow measurements have been conducted back in 1997, however, no flow measurements were carried out recently. Therefore, this study shall rely on wastewater flows derived from potable water balances that are recorded regularly.

In accordance with the preliminary project implementation schedule, the wastewater plant construction is planned to begin in 2009 and to finish in 2011. The planned exploitation period of the plant can be 50 years, and the period for economic analysis is 30 years, i.e. 2012 – 2041, inclusive. Therefore, the demand projection covers the period up to 2041.

Household Water Demand

The overall trend in Europe has been that the average per capita water consumption increased from the 1970s until the 1990s settling at an average of 150 l/cap/day. As shown earlier, the records indicate that in the existing water supply system of Šabac the average per capita household consumption is around 160 l/capita/day, and shows a declining trend.

Although according to the information provided by PUC Vodovod there have not been major supply restrictions or shortages in the water supply system, the plans have been laid out to gradually improve the level of service in water supply, both in term of water quality and operational pressure. It is therefore anticipated at this stage that the average per capita household consumption will remain stable around 160 l/capita/day over the project lifetime. At the same time it is estimated that the wastewater to water ratio shall remain around 0,85 throughout the project lifetime.
Thus the resulting wastewater unit discharge will be **135 l/capita/day**.

It is also anticipated that the water consumption related to public demand, municipal administration, medical institutions, schools shall gradually rise, so that the average overall unit per capita water wastewater discharge reach 155 l/capita/day. This increase, that is associated with so called dispersed pollutants, also contains a reserve provision for unforeseen developments of limited nature within the urbanized areas.

Table 3.10 Unit wastewater discharges related to public water users (administration, medical, schools, military, etc.)

Year	2007	2011	2021	2031	2041
Unit wastewater discharge (l/capita/day)	13	15	17	19	20

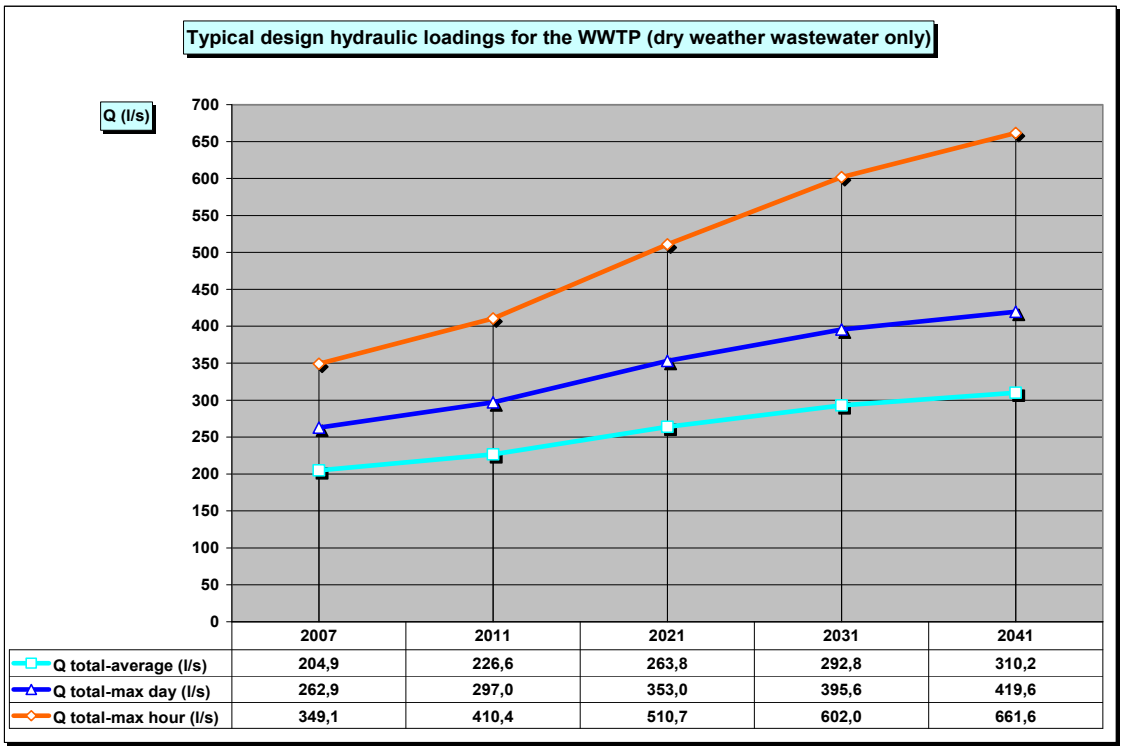
Infiltration
Infiltration in the future sewerage system has been calculated in accordance with the average infiltration rate (0,50 l/s/km), adopted earlier, and planned extension of the sewerage system (main sewers and collection network).

3.1.4.11 Wastewater Flows - an Overview

Based on the population projection, estimated per capita consumption, connection rates, wastewater to drinking water ratio, estimated industrial effluents, respective peaking factors, infiltration rates, hereinafter is presented an overview of the wastewater flow to be diverted and treated at the future WWTP, see Figure 3.10.

It is important to note that so far in the existing project documentation (preliminary design and general project) the WWTP has been sized based on a demand projections included in reference documentation 1 and 2, see annex 3.2.

Figure 3.10 Typical design hydraulic loads of the WWTP



The WWTP implementation was planned to be carried out in two consecutive phases. A summary of the basic hydraulic and organic loadings used in dimensioning of the WWTP in references 1 and 2 is presented in the following Table 3.11.

It can be noted that the wastewater projection until 2041 included in this study, and the design loadings used in the original design (notwithstanding assumed project periods 2041 in this study and 2011 in the Preliminary design documentation, references 1 and 2) are very much compliant for Phase I.

Table 3.11 WWTP design hydraulic and organic loadings used in original design – reference 1

WTP Phasing	Phase I	Phase II
$Q_{average - dry\ weather}$ (l/s)	325	450
$Q_{max\ daily - dry\ weather}$ (l/s)	460	640
$Q_{max\ hour - dry\ weather}$ (l/s)	650	900
Organic loading (population equivalent)	126.000	193.000

A detailed breakdown of the adopted demand projections for the project period until 2041 is shown in annex 3.1 and summarized in Figure 3.11 and 3.12 below.

Figure 3.11 Šabac WW Project - Annual WW Quantities to be treated at the WWTP

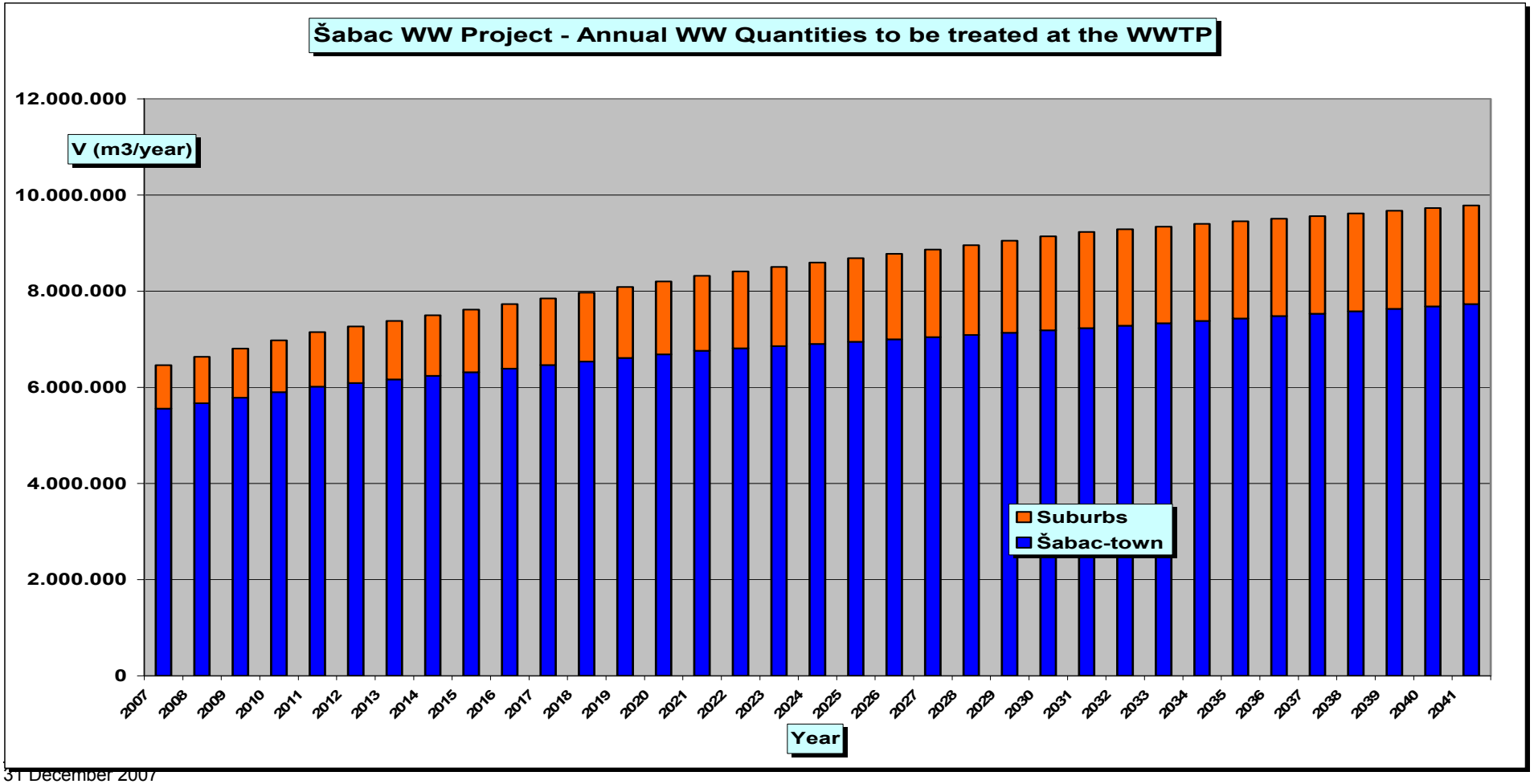
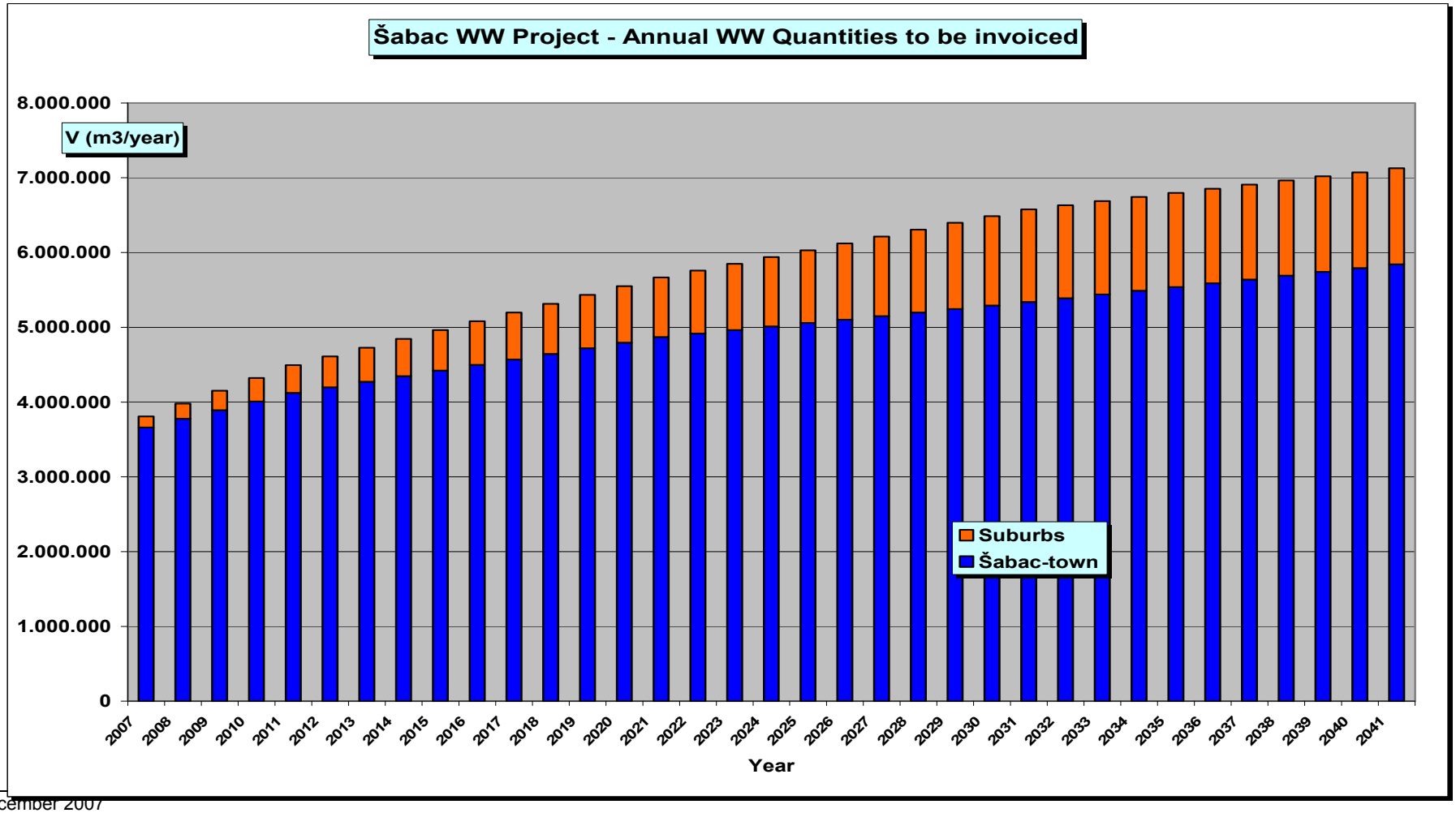


Figure 3.12 Šabac WW Project - Annual WW Quantities to be invoiced



3.2 Technical options

3.2.1 Introduction and background

The project aims at the construction of all missing major elements of the Šabac wastewater collection, conveyance and treatment system including:

1. The construction of the sewage pumping station Glavna to be located close the existing wastewater outlet. This SPS will pump wastewater to the future WWTP through a new transport line. The SPS will also be designed to cater for a combination of wet weather flow and high levels of the River Sava, when that level exceeds the invert level of the wastewater outlet pipe;
2. A force main from the SPS Glavna to the WWTP location of nominal diameter DN800 that will convey all wastewater collected in the town area, plus collected storm water runoff equivalent to the maximum wastewater dry-weather flow;
3. Construction of a new wastewater treatment plant (WWTP) with a Phase I hydraulic capacity of $Q_{max\ day}$ = 420 l/s and $Q_{max\ h}$ = 650 l/s and for the design organic loading of 126.000 population equivalent (PE).

A full list of relevant reference documentation is included in annex 3.2, however two of these documents of particular importance for the project are summarised below.

1. Inovirani Idejni Projekat centralnog postrojenja za preciscavanje komunalnih i induistrijskih otpadnih voda sa podrucja grada Šapca do 2021 godine (Updated Preliminary Design of the Central Wastewater Treatment Plant for Treatment of Communal and Industrial Wastewater from the region of the Town of Šabac) by “Energoprojekt – Hidroinzenjering”, Belgrade 2005;
2. Generalni Projekat sakupljanja, odvodjenja i preciscavanja otpadnih voda naselja Opstine Šabac, (General Project for Collection, Transport and Treatment of Wastewater from the Settlements of the Municipality of Šabac), by Vodo-Inzenjering, Belgrade, 2006.

These two documents are based on a range of other project-related documents, most importantly including Generalni Urbanisticki Plan Šapca i prigradskih naselja 1982-2000 (General urban Plan of Šabac and Suburban Settlements 1982-2000) and its revised version for 1994-2010. The Updated Preliminary Design of the WWTP (by Energoprojekt – Hidroinzenjering) is based on the previous versions of the General Project for the Collection, Transport and Treatment of Wastewater from the Settlements of the Municipality of Šabac of 1998 (by Energoprojekt – Hidroinzenjering) and older versions of the Preliminary design document from 1998 and 2005 (also by Energoprojekt – Hidroinzenjering). Besides these, the documents use and refer to various associated wastewater discharge legislation acts of Serbian and EU origin.

The two above stated base project documents are in contradictory order of appearance. Namely under local practice regulations a General project includes a preliminary feasibility assessment and precedes the Preliminary design. This is important because the General Project for the Collection, Transport and Treatment of Wastewater from the Settlements of the municipality of Šabac of Vodo-Inzenjering, Beograd of 2006 contradicts the proposed technical concept and solution elaborated in the Updated Preliminary Design of the Central Wastewater Treatment Plant for the Treatment of Communal and Industrial Wastewater from the region of the Town of Šabac of

Energoprojekt – Hidroinzenjering, Belgrade 2005. The recognised contradictions are in the field of plant design capacity, technology and costs.

Data from both documents are further elaborated leading to specific conclusions regarding the optimal technical alternative for the WWTP and arising recommendations for project implementation. Since the elaborated technical alternative for the WWTP from the Preliminary design of 2005 is also elaborated in the General project of 2006 the elaborated technical alternatives from the latter will serve as basis for conclusions and recommendations. The focus in this study will be on the WWTP and does not include the General project assessment of treatment alternatives for the surrounding villages.

It is important to outline the basic facts related to the abovementioned project designs regarding their scope, concepts, status, etc. in order to be able to use all project-related information in an optimal manner:

Table 3.12 Basic facts on the related project documents

Feature		Updated Preliminary Design of WWTP with Feasibility Study		General Project Design of wastewater system for the municipality		Comments
		(1)		(2)		
Scope		Urban Master Plan Area		Urban Master Plan Area plus villages		Both project designs are relatively compliant with the Urban Master Plan Area, while document (2) also addresses the rural area
Project period		Until 2021		Until 2031		
Concept of the system and location of the WWTP		Wastewater from the Urban Plan Area and polluted storm water to the WWTP, location downstream of Zorka complex		Wastewater from the Urban Plan Area and polluted storm water to the WWTP, location downstream of Zorka complex		
WWTP design capacity		Phase I	Phase II	Phase I	Phase II	Notwithstanding adopted design horizons final stage organic loading compliant, hydraulic loadings not compatible, different staging proposed.
	Q_{av}=	325	450	Not defined	557	
	$Q_{max\ day}$=	460	640	Not defined	728	
	$Q_{max\ h}$=	650	900	Not defined	1.112	
	Organic load	126.000	193.000	100.000	198.000	
Design conditions		Issued by relevant Ministries		Not present		
Review status		Review carried out by relevant Ministry		Not present		
Building permit		Issued		Not applicable for general project design		

From this overview the following can be concluded:

1. The updated preliminary design specifically dealt with the WWTP, and by its nature (preliminary versus general project design) provided much more detailed technical information on the proposed treatment concept;
2. The end user (PUC Vodovod Šabac) fully complied with the procedure set in the Law on construction, and based on the WWTP updated preliminary design obtained necessary design conditions, arranged for a review by the Republican review committee, and finally obtained the corresponding Building permit issued by the Ministry for Capital Investments. This procedure logically leads towards preparation of a detail design (compatible with the updated preliminary design) and construction of the WWTP;
3. From the prospective of project implementation it is logical and rational to consider the updated preliminary design of the WWTP as the baseline document setting out basic project characteristics and technical proposals. At the same time, these technical proposals shall be further reviewed in this study, and alternative technical proposals shall also be taken into account if deemed necessary.

3.2.2 Current status and project goals

According to the census 2002 data, the Municipality of Šabac has around 128,000 inhabitants spread over the city, its suburbs and 51 villages. The service coverage with sewerage collection in the town is currently around 85%. The sewerage system consists of approximately 90 km of primarily combined (sewage and storm water) sewer system and associated infrastructure (pumping stations, overflow weirs, discharges, etc.) and serves for collection, transport and discharge of wastewater from a total catchment area of 682 ha. City development led to capacity shortage of the system and flooding during high rainfall periods. To reduce the load on the system and collect water from unconnected city suburbs, construction of two main sewers (Northern and Southern rings) was undertaken. The abovementioned main gravity sewers were completed in 2006 and 2007.

The final destination of the main sewer is the mouth of the Cerski Canal into the Sava River. At this location wastewater is supposed to be introduced into the future WWTP, and after adequate treatment, effluent will be discharged into the Sava River. According to relevant Serbian legislation the Sava River is classified as Class II water course at the section corresponding to the WWTP.

In order to put into operation the abovementioned completed main gravity sewers and therefore to create prerequisites for intensified connection of the suburbs, the Municipality of Šabac, financially supported by the GoS, arranged construction of the raw water pumping station, including coarse and fine screening at the future WWTP inlet. This pumping station was finalized in December 2007 and it will transfer wastewater collected in the suburban areas to the recipient, and once the WWTP is implemented, it will lift incoming wastewater in order to enable gravity flow through the plant.

For suburban settlements the plans have been laid out to gradually extend the sewerage system. The first and most important step was the construction of the abovementioned main gravity sewers and of the raw water pumping station. Construction of the main sewers in some of the suburbs has been already started. However, the sewerage system is evidently underdeveloped in the suburbs and rural settlements, and the population still uses septic tanks, old wells and/or directly discharges wastewater into nearby open water.

The current status of the industry in the Town is poor and unpredictable. Many factories have been closed and/or operate at reduced capacities. The resulting industrial wastewater streams are currently limited, however, they release untreated wastewater into the Sava River.

The project aims at combined domestic and (pre-treated) industrial wastewater treatment at a single central treatment plant. The size of the plot of land reserved for the WWTP is approximately 5 ha. It is important to note that wastewater from the local industry Zorka, one of the major industrial pollutants (quantity and quality wise), will not be treated in the WWTP but in a separate wastewater treatment plant (next to the WWTP location) owned by the company.

The technical proposal adopted in this study should meet wastewater requirements by the end of the project period, 2041. A provision, a reserved plot area, has been made in case the WWTP would need to be extended, or in case tertiary treatment needs to be introduced. At this stage, plant construction could begin in 2009. The ultimately possible exploitation period of the plant is assumed at 50 years. The economic lifetime of 30 years has been adopted for the facility.
Equally important for a proper functioning of the future sewerage system in Šabac is completion of the SPS Glavna and the appurtenant force main to transport collected wastewater to the WWTP. Therefore, implementation of the WWTP and construction of the SPS should be carefully scheduled and coordinated.

3.2.3 Capacity of the WWTP Šabac

The central WWTP in Šabac will treat discharged wastewater originating from the following clients/entities:

- Domestic, administrative and public institutions of the Town of Šabac and its suburbs (total number of users in accordance with the demand projection in this study for the end of project period is approximately 96.000);
- local industries.

At present, there are no reliable data on the associated wastewater quantities. However, wastewater quantities can be correlated with the water consumption data, as presented earlier in section 3.1.4. There the corresponding demand projections have been elaborated in detail and here only a summary shall be given, outlining the basic design parameters for the WWTP

Table 3.13 Basic design parameters (hydraulic and organic loading) for the WWTP Šabac recommended in this study

	Parameter	Unit	Value
WWTP design capacity	**$Q_{average}$**	(l/s)	310
	$Q_{max\ daily}$	(l/s)	420
	$Q_{max\ hourly}$	(l/s)	660
	Organic load	Population equivalent	130.000

These design loadings shall be compared to the parameters used in the reference documentation:

Table 3.14 Basic design parameters (hydraulic and organic loading) for the WWTP Šabac adopted in reference 1 (WWTP updated preliminary design)

	Parameter	Unit	Phase I	Phase II
WWTP design capacity	**$Q_{average}$**	(l/s)	325	450
	$Q_{max\ daily}$	(l/s)	460	640
	$Q_{max\ hourly}$	(l/s)	650	900
	Organic load	Population equivalent	126.000	193.000

Table 3.15 Basic design parameters (hydraulic and organic loading) for the WWTP Šabac adopted in reference 2 (General project design of sewerage system for the municipality)

	Parameter	Unit	Phase I	Phase II
WWTP design capacity	**$Q_{average}$**	(l/s)	340	556
	$Q_{max\ daily}$	(l/s)	500	728
	$Q_{max\ hourly}$	(l/s)	790	1.112
	Organic load	Population equivalent	100.000	200.000

The estimate adopted in this study and recommended in the updated preliminary design – phase I are comparable, both in terms of hydraulic and organic loadings.

The estimate included in the general project design for the municipality (reference 5) are overestimated in terms of hydraulic loadings because it is based on unit wastewater rates that are much higher than those recorded in the existing system (see demand projection). These estimates therefore can not be used in this study.

The recommendations and demand analysis from the General project design for the municipality are contradictory. Namely in the text of the report the capacity of the first phase is set at 100.000 PE contradictory to the calculations summarized in the demand analysis (approximately 130.000 PE).

3.2.4 Wastewater quality

No recent wastewater quality data have been provided by the Municipality of Šabac. Wastewater in the project area can be generally categorised as:

- Communal wastewater from households, public and administrative institutions;
- Industrial wastewater;
- Infiltration water;
- (Polluted) storm water.

Quality of communal wastewater has been assumed in line with specific standard pollution loads per PE. For instance, the total pollutant loads can be calculated by multiplying the assumed number of population equivalent by the typical unit (per capita) pollutant loads, as recommended by the ATV DVWK.

Table 3.16 Typical values of unit pollutant loading per PE in accordance with the ATV DVWK recommendations

Parameter	Unit	Typical value
Biochemical oxygen demand, BOD_5	g of O_2 /PE/day	60
Chemical oxygen demand, COD	g of O_2 /PE/day	120
Total suspended matter, TSS	g/PE/day	70
Total nitrogen, TN	g/PE/day	11
Total phosphorous, TP	g/PE/day	1.8

The assumed quality of the influent, communal wastewater, pre-treated industrial wastewater and infiltrated water, has been elaborated in more detail in the corresponding updated preliminary project design, see reference 1.

It is very important to note that in the technical proposal it was assumed that all industrial polluters would introduce pre-treatment systems to ensure full compliance with the criteria set out in a rule-book on criteria for discharge of wastewater into the public sewers (Annex 3.3). The rule-book contains a comprehensive list of Mac's in wastewater that must not be exceeded in wastewater discharged by any subject to the public sewerage system in Šabac. The most important criteria include:

- BOD_5 ≤ 300 mg/l
- COD ≤ 450 mg/l
- SS ≤ 300 mg/l

Effectively, in the updated preliminary design of the WWTP it was assumed that both BOD_5 and SS in wastewater can reach the maximum allowable concentrations, 300 mg/l for both parameters, during the specified maximum daily flows.

3.2.5 Treated water quality requirements

The following EU and local Serbian legislation acts and design conditions issued by the relevant authorities define the quality of discharged municipal effluent from the future WWTP:

- EU (EU Council Directive 91/271/EEC, May 21, 1991) presented in Table 3.17 and 3.18;
- Uredba o kategorizaciji vodotoka (Sluzbeni Glasnik SRS nr. 5/68) presented in Table 3.19.;
- Design conditions issued by the relevant Serbian authorities:
  - Water management design conditions issued by the Ministry for Agriculture, Forestry and Water Resources of 25 December 2000, Annex 3.4;
  - Supplement to Water Management Conditions, issued by Ministry of Agriculture, Forestry and Water Resources of 6 February 2006, Annex 3.5.

The following EU emission standards for treated water quality are applicable:

Table 3.17 EU emission standards for municipal wastewater treatments.

Parameter	**Concentration**	**Lowest removal efficiency (%)**[1]
Biochemical oxygen demand (BOD_5 at 20°C) Without nitrification	25 mg/l O_2	70-90 %
Chemical oxygen demand (COD)	125 mg/l O_2	75 %
Total suspended matter	35 mg/l [(3)] 35 mg/l (>10.000 PE) 60 mg/l (2000-10000 PE)	90 %[(3)] 90 % (>10000 PE) 70 % (2000 - 10000 PE)

[(1)] Decrease relative to loading inlet water..
[(2)] The use of other comparable parameters is allowed: Total Organic Carbon (TOC) or Total Oxygen Demand (TOD)if a relation can be established between BOD_5 and these alternative parameters.
[(3)] Optional parameter

Discharge of wastewater effluents in sensitive areas implies tertiary treatment for the removal of nitrogen and phosphorus to required levels presented in Table 3.18.

Table 3.18 Emission requirements for discharge in sensitive areas.

Parameter	**Concentration**	**Lowest removal efficiency (%)**[1]
Total phosphorus	1 mg/l P (>100.000 PE) 2 mg/l P (10.000 – 100.000 PE)	80 %
Total nitrogen [(4)]	10 mg/l N (>100.000 PE)[(5)] 15 mg/l N (10.000 – 100.000 PE)	70-80 %
[(4)] Total nitrogen: sum of Kjeldal-N (organic- N + NH_4 – N), and NO_2 –N *[(5)] Alternative, daily average value must not exceed >20 mg/l N. This requirement relates to water with temperature of 12°C or above, during operation of the bio-reactor for waste water treatment. An alternative to temperature is the use of utilization time, that considers regional climate. This alternative can be applied if it can be proven that requirement 1 of Annex ID is fulfilled.*		

Besides the EU emission standards, care should be taken regarding the local imission standards, namely the sensitivity of the recipient water body (categorization I through IV, depending on flow and quality) to expected discharges. The Sava River at this location falls under category II of the local legislation.

Table 3.19 Imission requirements for water bodies of category II.

Parameter	Unit	MAC (Maximum Allowable Concentration)
TSS	mg/l	30
Total dry residue	mg/l	1000
Ph	-	6.8-8.5
Dissolved O2	Mg/l	6
BOD_5	mg/l	4
Degree of saprobity	-	ß mesosaprobic
NO_3	mg/l	10
NO_2	mg/l	0.05
P_2O_5	mg/l	0.15
Coli organisms	B coli/l	60000
Visible waste	-	None
Objectionable colour	-	None
Objectionable odour	-	None

Comparison of the EU and local legislation (Tables 3.17, 3.18 and 3.19) suggests that the local standards are more stringent, especially regarding dissolved oxygen, suspended solids (SS) and BOD_5.
Local imission standards are compared with the respective EU emission standards in Table 3.20.

Table 3.20 Imission standards for surface waters (EU and local).

Parameter	Unit	Category A2 (75/440/EEC)	MAC Category II
NO_3	Mg/l	50	10
NO_2	Mg/l	-	0.05
P_2O_5	Mg/l	0.7=0.3 P = 0.9 mg PO_4/l	0.15 P = 0.4 mg PO_4/l
Saturation O_2	%	min 50	min 75
BOD_5	Mg/l	5	4
NH_4^+	Mg/l	1	0.1

Again, it is clear that the local imission standards are stricter than the respective EU standards. However, these local standards should be looked at from the perspective of the specific recipient. The most important requirement outlined in the wastewater discharge regulations in Serbia is that the prescribed recipient category must not be degraded. Furthermore, the compliance with the said local requirement is to be checked against the representative flow regime in a recipient, which is low monthly flow of 95% probability. As defined in the Water Management Conditions issued by the relevant Ministry for this project, the representative flow in Sava is 274 m^3/s, which is approximately 600 times higher that the maximum daily hydraulic loading of the WWTP for the end of the design horizon. Therefore, the recipient carrying capacity is comparatively high, and if operated properly, it is not very likely to be able to prove that the WWTP Šabac can degrade the recipient category.

The following basic effluent parameters were adopted in the updated Preliminary design of the WWTP:

- SS = max 30 mg/l;
- BOD_5 = max 20 mg/l;
- NO_3 = max 10 mg/l.

The updated preliminary design does not contain a full justification of the adopted design criteria. There are no calculations of the impact of discharged effluent on the quality of the Sava River to verify the applicability of these figures and check their applicability relative to the valid discharge standards. The situation regarding total N and P effluent concentrations is also not addressed and clarified, both regarding Serbian imission standards and EU emission norms regarding discharges into sensitive areas. These analyses may have been included in the earlier technical documentation (the original General project design of wastewater collection and treatment for the Urban Master Plan Area, reference 1, and/or in the original Preliminary design of the WWTP prepared in 1998). However, the abovementioned documentation was not available to the Consultant for this study.

The General project design (reference 2) rightfully concludes that the local BOD_5 and SS imission requirements potentially impose the need for very high treatment process efficiencies (to be looked at in relation to a specific recipient). It also elaborates on the EU requirements for nutrients removal, the imposed process treatment efficiency, as well as the need for tertiary treatment. However, no conclusive and explicit recommendations with regard to required process efficiency and related to the criteria to be applied were made.

Obviously, the current situation with untreated wastewater discharges is alarming and requires urgent action. In such circumstances it is important that the updated preliminary design has already been approved by the relevant State Authorities:

- Of the Republican Review Committee;
- Of the Ministry for Infrastructure and Capital Investments.

who approved the design concept proposed in the Updated Preliminary Design of the WWTP, implying that the elaborated technical solution in the updated preliminary design is in line with the relevant National regulations and set design criteria.

Obviously, the nutrients removal issue and compliance with the local imission and EU standards has been omitted from the existing project documentation. Challenging the

design criteria in the Updated Preliminary Design against the EU Wastewater Directive, at this stage, it could not be found that the Sava River recipient falls within the category of “sensitive areas”, as defined in the Directive. Therefore the design criteria associated with so-called non-sensitive areas would apply. It is important to mention here that the relevant local imission regulations have not yet been fully harmonized with the EU Wastewater Directive. Once the Directive becomes fully and directly applicable in Serbia, the National territory would be precisely partitioned in non-sensitive and sensitive areas. At that point in time it would be relatively simple to determine whether the process at the WWTP Šabac needs to be technologically upgraded.

Bearing in mind these factors the following course of action is recommended:

1. The WWTP including primary and secondary treatment should preferably be tendered on the shortest possible notice, according to one of the further recommended scenarios (Red FIDIC book).
2. A mid-term study on the impact of the WWTP effluent on the nutrients concentration in the Sava River should be prepared. The developments on harmonisation of local and EU environmental legislation in the future should closely be followed. Compliance with the future, harmonised local nutrients legislation should timely be assessed. This will be the basis for assessing the necessity and extent of a nutrient removal treatment step in the following phase.
3. Capacity upgrading in the second phase (long term) should be carried out in line with a timely updated capacity analysis. The technology upgrading should be in line and to the extent implied by the above recommended nutrients compliance analysis. Depending on the urgency of the nutrients issue technology upgrading may have to be implemented sooner than the planned capacity upgrading. In case of capacity upgrading only the future extension could be based on the Red FIDIC book rules. In case of combined capacity and/or technology upgrade the extension could be based on the Yellow FIDIC book rules.

It is therefore very important for the long-term project perspective, that the provision for possible future upgrading of the wastewater treatment process (to include tertiary treatment) has already been incorporated in the updated preliminary design. This implies that the project can be adapted to suit even very stringent effluent criteria, including nutrients removal. For the time being, possible straightforward introduction of a nutrient removal can not be justified.

Table 3.21 summarises the base wastewater quality parameters that must be achieved by industrial wastewater pre-treatment to be allowed to discharge into the sewer system, in accordance with the municipal Rulebook on wastewater discharges in the public sewerage system.

Table 3.21 Local standards for sewer discharge (MAC = Maximum Allowable Concentration).

Parameter	Unit	MAC
* BOD_5 at 20°C	mg/l O_2	300
COD	mg/l O_2	450
Suspended matter	mg/l	300
P_{total}	mg P/l	10
N_{total}l	mg N/l	-
NH_4	mg/l NH_4	15
NH3	mg/l NH3	480
NO_2	mg/l NO_2	30
NO_3	mg/l NO_3	50
Al	mg/l	15-26
As	mg/l	0.1
Cd	mg/l	10-100
Ca	mg/l	2500
Cr6+	mg/l	1-10
Cr3+	mg/l	50
Cu	mg/l	1
CN-	mg/l	0.1-5
Fe	mg/l	1000
Pb	mg/l	0.1
Mn	mg/l	10
Hg	mg/l	0.1-5
Ni	mg/l	1-2.5
Ag	mg/l	5
Zn	mg/l	0.08-10
Phenols	mg/l	200

* - Individual industries could be allowed (subject to approval by the Municipality) to discharge wastewater with BOD_5 higher than 300 mg/l.

The issue of industrial wastewater pre-treatment should ideally be a subject of a separate inventory that should be carried out prior to the construction of the future WWTP. So far, there is no indication as to who would finance such activities and how they can be synchronised with the ongoing activities and the construction of the WWTP. Study on industrial wastewater quality and pre-treatments was carried out in 1998 (refer to Annex 3.4). However, bearing in mind dynamic changes in the overall industrial context – some industries privatised and modified production profile, new industries established, some industries closed - the study should be extended and updated so that it would incorporate all changes since 1998.

3.2.6 Basis of design of the WWTP

The completion of the main sewer system of Šabac will solve the problem of overflows during high rainfall periods and connect all suburbs in the Urban Master Plan Area to the location of the future WWTP. The WWTP will be built to cater for the demand of the Town of Šabac and its suburbs for the projected period of up to 2041 (phase I – subject

of this study). There is a provision for phase II, in case the overall urban and industrial developments generate additional quantities of wastewater and associated pollutant loads. At this stage phase II can be considered as a very long term perspective and it is not subject of this study. Respective capacities of phases I and II are two thirds and one third of the plant's ultimate capacity.

Apart from the treatment units recommended for implementation in this study, at the WWTP site there is also a plot provision for possible future extension of a tertiary treatment (nutrient removal).

An overview of the basic WWTP design loadings used in the updated Preliminary design is presented in the following Table 3.22:

Table 3.22 Basic design loadings for WWTP Šabac in updated Preliminary design

	Parameter	**Unit**	**Phase I**	**Phase II**
WWTP design capacity	**$Q_{average}$**	(l/s)	325	450
	$Q_{max\ daily}$	(l/s)	460	640
	$Q_{max\ hourly}$	(l/s)	650	900
	Organic load	Population equivalent/ (kg/d)	126.000 (7.560 kg BOD_5/d)	193.000 (11.580 kg BOD_5/d)

3.2.7 Description of alternative technical options

Different alternative technical solutions for treating wastewater from the various communities in the Municipality of Šabac were elaborated in the updated Preliminary design of the WWTP (reference 1) and in the General project design of the wastewater system for the municipality (reference 5). The proposed treatment process alternatives are presented for different capacities ranges:

- Settlements of >10.000 PE (town of Šabac and its suburbs – subject of this study):

    1. Conventional activated sludge (primary and secondary) treatment with anaerobic sludge digestion and mechanical sludge dewatering, adopted and elaborated in detail in the updated Preliminary design of the WWTP;

    2. SBR-Sequencing Batch Reactor (primary, secondary and tertiary) treatment with aerobic sludge stabilisation and mechanical sludge dewatering;

    3. SBRc-Sequencing Batch Reactor (primary, secondary and tertiary) treatment with continuous inflow, aerobic sludge stabilisation and mechanical sludge dewatering;

4. Continuously aerated lagoon system (primary and secondary treatment) with intermittent de-sludging of lagoons (land requirements limiting plant capacity to 100.000 PE);

5. Sequential lagoon system (primary, secondary and tertiary treatment) technology including membrane decanting, with limited de-sludging necessity.

- Settlements of <10.000 PE (i.e. 100 – 4,000 PE, smaller rural settlements, not subject of this study):

  1. Activated sludge treatment package units with sequential nutrients removal;

  2. Extensive wastewater treatment processes adapted for small and medium size settlements (500 – 5,000 PE), Implementation of Council Directive 91/271/EEC of May 21, 1991;

  3. Helophyte filters (wetlands).

Considering the subject of this study only the alternatives for the WWTP (i.e. >100.000 PE) will be addressed in more detail.

The updated Preliminary design (reference 1) practically elaborates and develops the first alternative: Conventional activated sludge, primary and secondary treatment, with anaerobic sludge digestion and mechanical sludge dewatering in detail.

Common to all five alternatives is the preliminary treatment comprised of:

- intake pumping station,
- coarse screening,
- automated fine screening,
- aerated grit chamber with provisions for fat removal,
- flow measurement device,
- collection and handling of accumulated waste materials from screens and grit chamber.

The same applies for accompanying structures, including the administration building, workshops, energy supply block, parking space, terrain water supply and sewerage.

Table 3.23 gives an overview of theoretically achievable process efficiencies of the five WWTP alternatives, based on practical experiences.

Table 3.23 Process efficiency of considered treatment alternatives.

Parameter	Explanation	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
		% removal	% removal	% removal	% removal	% remov

						al
BOD_5	Biochemical oxygen demand	75-95	80-95	80-95	75-95	80 - 95
COD	Chemical oxygen demand	60-85	65-85	70-85	60-85	65 - 85
TSS	Total suspended matter	85-95	80-95	85-95	85-95	80 - 95
TN	Total nitrogen	≤ 90	≤ 92	≤ 92	≤ 90	≤ 92
TP	Total phosphorus	≤ 30	≤ 35	≤ 35	≤ 30	≤ 35

<u>Alternative 1:</u> Conventional activated sludge (primary and secondary) treatment with anaerobic sludge digestion and mechanical sludge dewatering

Consists of the following elements per process line:

The **<u>water line</u>** is comprised of:
<u>Primary</u> (mechanical) treatment:

- coarse screening for the removal of coarse floating debris and waste;
- automatic fine screens for the removal of finer floating debris;
- pumping stage to aerated sand and grit chamber;
- aerated sand and grit chamber for the removal of sand, grit and oil and fat;
- primary sedimentation for settling of suspended and colloidal matter in rectangular basins.

The water line also includes a retention basin (with by-pass) for storage of high rain flow (dilution factor of >4); this is related to the combined sewer system to avoid wash-out/disturbance of bacterial population in the activated sludge treatment.

<u>Secondary</u> (biological) treatment:

- biological (activated sludge) treatment for the removal of organic matter by means of intensive submerged (diffused) aeration in rectangular basins, including nitrification/denitrification of ammonia in aerated/not aerated (oxic/anoxic) compartments;
- secondary sedimentation for sludge settling and recirculation in circular basins;
- sludge recirculation and excess sludge withdrawal;
- flow measurement prior to discharge.

The **<u>sludge line</u>** is comprised of:

- flocculation by means of polyelectrolyte dosing;
- preliminary thickening in circular thickening basin;
- anaerobic sludge digestion in circular tanks with bio-gas storage, gas driven electricity generation and excess gas flare system;
- secondary sludge thickening of stabilised sludge;
- dewatering of conditioned sludge by means of a filter belt press;
- collection and disposal of dewatered sludge cake to solid waste disposal site (reuse in agriculture or landfill);

- recycling of clarified and seeped water from sludge thickening process back to process inlet.

The **air line** is comprised of low pressure air supply necessary for the operation of:
- the aerated sand and grit removal unit;
- the aeration basin for provision of oxygen and mixing of biomass.

The **chemicals line** is comprised of:
- storage, preparation and dosing equipment for polyelectrolyte for sludge conditioning prior to thickening.

The conventional activated sludge treatment is based on primary sedimentation followed by activated sludge treatment in rectangular basins with plug flow conditions. Aeration is done by means of compressed air aeration through membrane diffusers. In the activated sludge basins biological decomposition of organic matter takes place. Horizontal mixing facilities are included in these tanks to enable plug flow conditions. The mixture of activated sludge and water is further led to circular secondary sedimentation basins to separate sludge and partially return it to the activated sludge basins or dispose excess sludge quantities. Supernatant water from the secondary sedimentation is disposed into the recipient with optional disinfection (UV).

Excess sludge is conditioned by means of polyelectrolyte and reduced in quantity by means of thickening. Together with primary sedimentation sludge excess sludge is transported to circular tanks for anaerobic sludge digestion and stabilisation. Stabilised sludge is transported to circular secondary gravitational thickeners. The supernatant is recycled while the sludge is further dewatered by means of a filter belt press, prior to disposal/reuse on approved site(s).

Achievable BOD_5 and SS concentrations are in line with the pursued Serbian and EU norms. The EU norm for N_{tot} <10 mg N/l (for settlements with >100.000 inhabitants) cannot be achieved at all times. The proposed plant design is neither able to significantly reduce nitrogen concentrations during high rainwater flow (dilution factor >5). Extensive N removal requires additional tertiary treatment. The removal of phosphorus to required EU levels (<1 mg P/l) is not possible. To achieve this, as well as to guarantee better organic matter removal during periods of high rain fall and dilution, upgrading of the plant is possible by introduction of chemical precipitation through dosing of $Al_2(SO_4)_3$ or $FeCl_3$.

Alternative 2 and 3: Sequencing Batch Reactor plant (with continuous inflow) and aerobic mechanical sludge treatment

consists of the following elements per process line:

The **water line** is comprised of:

Primary compact (mechanical) treatment:
- automatic fine screens for the removal of fine, floating debris;
- aerated sand and grit chamber for the removal of sand, grit and oil and fat.

Secondary (biological) treatment:

- biological oxidation (aeration by means of deep aeration bell type mixers or membrane diffusers), sedimentation and decantation in continuously loaded SBR (Sequencing Batch Reactor) basins; SBR comprised of pre-reaction chamber (10-15% of total unit volume) and reaction chamber;
- excess sludge withdrawal by mans of centrifugal sludge pumps;
- flow measurement by means of ultrasonic devices.

The **sludge line** is comprised of:

- thickening of primary sediment and excess sludge in aerated and mixed sludge basin;
- common chemicals (polyelectrolyte) conditioning of thickened sludge;
- dewatering of conditioned sludge by means of a filter belt press;
- collection and disposal of dewatered sludge cake to solid waste disposal site (reuse in agriculture or landfill);
- recycling of clarified and seeped water from sludge thickening process back to process inlet.

The **air line** is comprised of low pressure air supply necessary for the operation of:

- aerated sand and grit removal unit;
- SBR reactor unit;
- aerobic sludge stabilization.

The **chemicals line** is comprised of:

- storage, preparation and dosing equipment for polyelectrolyte for sludge conditioning prior to filter belt press.

This technology is able to achieve the following effluent concentrations of specific parameters:

- BOD_5 ≤ 20 mg/l
- SS ≤ 30mg/l
- N_{total} 10-15 mg/l
- PO_4^{3+}-P 1-2 mg/l

The continuous inflow of wastewater takes place in a pre-reaction chamber without primary sedimentation. Into the pre-reaction chamber, which has a volume of about 10 - 15% of the total volume of the SBR reactor, wastewater is brought from above and faces counter current aeration introduced at the bottom of the tank. The aeration enables 70 - 80% BOD degradation/adsorption in the pre-reaction chamber. This basin also serves as selector for organic matter and prevents the formation of filamentous bacteria common for the conventional activated sludge process. After this the water enters the reaction chamber where intensive aeration is applied (by means of deep aeration, bell type mixers, or fine bubble aeration with diffusers). When the maximum water level in the reaction chamber is achieved, the air supply is automatically stopped (PLC). Settling of flocculated sludge takes place and clarified water remains as supernatant. After a pre-set settling time an overflow weir is activated and lowered to accept supernatant water up to a pre determined level. After the supernatant is disposed the process is repeated. Supernatant water is disposed of with optional disinfection (UV). Sludge is disposed periodically in time intervals depending on design. The duration of specific phases with and without air supply is pre-determined based on the quantity and quality of treated

wastewater. The process can be fully automated and is largely dependant on functioning of process control equipment.

Achievable BOD_5 and SS concentrations are in line with the pursued EU norms. The EU norm for N_{tot} <10 mg N/l (for settlements with >100.000 inhabitants) will be hard to ascertain at all times. Extensive N removal requires additional tertiary treatment beyond the foreseen removal by means of sequentially applying oxic/anoxic conditions in the SBR. The same applies for the EU norm of <1 mg P/l, especially if peaks occur. This means that it is very likely that periodically additional removal of phosphorus by chemicals dosing (e.g. $Al_2(SO_4)_3$ or $FeCl_3$) will be required.

Excess sludge is conditioned by means of polyelectrolyte and transported to a circular basin for aerobic sludge stabilisation by means of air blowers. Stabilised sludge is transported to a filter belt press for dewatering, prior to disposal of sludge cake onto an approved disposal site.

Alternative 4: Continuously aerated lagoon system (primary and secondary treatment) with intermittent de-sludging of lagoons (land requirements limiting plant capacity to 100.000 PE)

consists of the following elements per process line:

The **water line** is comprised of:

Primary compact (mechanical) treatment:
- automatic fine screens for the removal of fine floating debris;
- aerated sand and grit chamber for the removal of sand, grit and oil and fat.

Secondary (biological) treatment:
- biological oxidation in first intensively and continuously aerated lagoon (aeration by means of deep aeration bell type mixers), including mixing with sludge recycle from intermediary sludge settling basin;
- further biological oxidation in second stage, low level aerated lagoon;
- settling in two parallel sedimentation lagoons;
- flow measurement prior to discharge.

No separate **sludge line** is needed due to the high degree of sludge mineralization achieved in the lagoons; intermittent use of sedimentation lagoons is possible with emptying of one lagoon while the other is in use.

The **air line** is comprised of low pressure air supply necessary for the operation of:
- aerated sand and grit removal unit;
- first and second stage lagoons for provision of oxygen.

No separate **chemicals line** is envisioned; this is due to the high degree of sludge mineralization achieved in lagoons.

Primary sedimentation is omitted in this process. Two activated sludge lagoons are included, both aiming at reducing the organic matter content through intensive and less intensive oxygen provision in the 1st and 2nd lagoon respectively. No separate

denitrification step is foreseen in the scheme, thus Serbian and EU requirements for N_{tot} concentration will not be achieved. The same applies for P.

No specific figures from practice are given regarding the efficiency of this process from similar projects elsewhere. It is presumed that the pursued EU and Serbian norms for BOD and SS can be achieved. The achievement of norms for N and P remains problematic, considering the continuous intensive and low level aeration in the 1st and 2nd aeration lagoons. Extensive N removal requires the sequential creation of oxic/anoxic conditions, which are only partly realised with the intensive and low level aeration in the 1st and 2nd aerated lagoon respectively. Extensive phosphorus removal can be achieved by means of $Al_2(SO_4)_3$ or $FeCl_3$ dosing. Clarified effluent from the sedimentation lagoons may optionally be disinfected prior to discharge, e.g. by means of UV.

The application of soil entrenched lagoons of this type requires relatively large surface areas. This limits the application of the system in Šabac for the second phase (200.000 PE) and is applicable only for the 1st phase (100.000 PE).

Benefit of the long retention times in the lagoon system is extensive sludge mineralization and generally low quantities of sludge to be externally disposed. Sludge would primarily settle in the sedimentation lagoons, which can be operated intermittently in case one is emptied. No separate sludge treatment is required prior to disposal.

Alternative 5: Sequentially aerated lagoon system (primary, secondary and tertiary treatment) technology including membrane decanting, with limited de-sludging necessity

consists of the following elements per process line:

The **water line** is comprised of:

Primary compact (mechanical) treatment:
- automatic fine screens for the removal of finer floating debris;
- aerated sand and grit chamber for the removal of sand, grit and oil and fat

Secondary (biological) treatment:
- biological oxidation in first sequentially aerated lagoon (aeration by means of deep aeration bell type mixers), including mixing with sludge recycle form intermediary sludge settling basin;
- further sequential biological oxidation in second stage aerated lagoon;
- further treatment in low level aeration lagoon;
- flow measurement prior to discharge.

No separate **sludge line** needed due to high degree of sludge mineralization achieved in lagoons; experience learns that even after 10 years of exploitation there is still no need for sludge evacuation.

The **air line** is comprised of low pressure air supply necessary for the operation of:
- aerated sand and grit removal unit;

– first, second stage and low level aeration lagoons for provision of oxygen.

No separate **chemicals line** is envisioned; this is due to the high degree of sludge mineralization achieved in lagoons

Primary sedimentation is omitted in this process. Two sequentially aerated activated sludge lagoons are included, all aiming at reducing the organic matter content, but also nitrification, denitrification and phosphorus removal. Incorporated in the system is also a membrane decanter with the possibility to regulate sludge discharges and control the MLSS (Mixed Liquid Suspended Solids), as well as the release of waste activated sludge. The low level aerated lagoon enables sufficient aeration for micro-organisms for organic matter oxidation, as well as possible settling of heavier particles and anaerobic degradation. Appropriate timing of sequences and aeration intensity results in fully mineralised and stabilised sludge and no separate need for additional sludge treatment.

This treatment is able to achieve the following concentrations of relevant parameters:

- BOD_5 ≤ 20 mg/l
- SS ≤ 30mg/l
- N_{total} ± 15 mg/l
- PO_4^{3+}-P ± 2 mg/l

The pursued EU and Serbian norms for BOD and SS can be achieved. The achievement of norms for N and P remains a challenge and requires exploitation experience. Extensive phosphorus removal can be further supported by means of $Al_2(SO_4)_3$ or $FeCl_3$ dosing. Clarified effluent from the sedimentation lagoons may optionally be disinfected e.g. by means of UV, prior to discharge.

The application of this system is limited for the second phase (200.000 PE) due to high land requirements.

3.2.8 Preliminary investment and O&M costs

A comprehensive cost estimate for the WWTP Šabac is included in the updated Preliminary design of the WWTP and appurtenant Feasibility study (reference 1). This cost estimate is presented in the following Table 3.24.

Table 3.24 Cost estimate for the WWTP in the updated Preliminary design

Nr.	Description	Amount Phase I
1	**Maximum daily wastewater flow (l/s)**	**460**
2	**Average daily wastewater flow (l/s)**	**325**
3	**Total yearly wastewater treated (m^3/year)**	
	- gross (with infiltration)	**10.249.200**
	- net (without infiltration)	**7.174.440**
4	**Population equivalents**	**126.000**
5	**Investments(€) ***	
	Civil works	***5.472.608***
	Equipment	***4.228.109***

	Ownership equity	***664.345***
	Current assets	***107.913***
	Total (€)	***10.472.976***
6	**Period of construction**	**4+1 years**
7	**Specific investments (total investments/sales) €/m^3**	**1,02**
8	**Specific investments (total investments/sales) €/PE**	**83**

** - In the source documentation, it is stated that the abovementioned costs include contingencies, adjustments related to inflation rate, contingencies and VAT calculated at a rate of 14%.*

Presented resulting specific investments for the components within the scope of this study of 83 €/PE are lower than investments considered realistic for such a system (within the range 100 -120 €/PE).

Comparison with cost figures of other similar wastewater treatment plant concepts and capacities confirms that the investment cost figures in the Preliminary design are underestimated, and that some adjustments have to be introduced.

For example, the specific investments for the technologically similar WWTP of Vrbas (125.000 PE) are in the range of 100 €/PE. The conclusion is that the abovementioned cost estimate must be further reviewed, validated and adjusted in order to be used for further analysis in this study.

On the other hand, Table 3.25 gives an overview of indicative investment and operational costs (energy and materials, excluding labour and maintenance costs) per alternative.

Table 3.25 Indicative investment and O&M costs of WWTP per alternative as presented in the General project design – reference 5

Type of treatment	<100000 pe		Comments
	Investment (Euro/PE)	Exploitation (Euro/PE/y)	
Conventional primary & secondary	100-120	22	Applicable also for >100.000 PE
SBR (Sequencing Batch Reactor)	70-80	14	Applicable also for >100.000 PE
Continuously aerated lagoons	120-140	16-18	Limited (for Sabac) to 100.000 PE due to large land requirements
SLR lagoons with BNR technology	120	18	Limited (for Sabac) to 100.000 PE due to large land requirements

The cost estimates presented in Table 3.25 are of generic type, based on general engineering practices for similar facilities. Therefore, since no detailed costs breakdown has been developed for the different alternatives for this specific WWTP, these can not be taken for granted, or used for making any final recommendations.

On the other hand, the cost data illustrate significant differences in investment and operational costs associated with the different applicable process technologies. This leads to the conclusion that the process technology for the WWTP implementation should not be fixed at this stage. Instead, flexibility in selection of the process technology could and should be allowed in the tendering stage, while project design requirements should be firm and fixed, and clearly presented.

The application of a lagoon-based system is limited in the case of the WWTP Šabac due to associated high land requirements. Constructing the second phase (totalling 200.000

PE) of the WWTP is very likely not possible within the boundaries of the reserved location. Although the exploitation costs of the lagoon based systems are on the lower side (16 -18 €/PE) the investment costs for the 100.000 PE range are comparable, even higher than that of the other alternatives, i.e. 120 - 140 €/PE vs. 100 - 120 €/PE for the conventional and 70 - 80 €/PE for the SBR based treatment.

Based on the costs overview from reference 5 (and Table 3.25), SBR technology implies the lowest investment and exploitation costs. Comparison with more detailed budget analysis of similar plant technology (i.e. Vrbas) confirms this.

The discrepancy between the indicative (unit) costs from the General project and the (more detailed) investment costs from the Preliminary design does not allow for firm recommendations. A suitable approach would be to extend the General project with more detailed cost calculations of investment and operation and maintenance costs of a number of realistic and locally proven technologies. Separating the water treatment line and the sludge treatment line would contribute to the transparency and a more objective cost comparison.

Experience further suggests that complex treatment (equipment) results in higher operation and maintenance costs. A fair comparison would thus include a more detailed assessment of the operation and maintenance costs for the analysed alternatives.

The results of such detailed cost analysis may fall into the same order of magnitude. This can further complicate the unanimous final choice of technology based solely on costs analysis and comparisons. It is thus recommendable under all circumstances to make a broader comprehensive assessment of benefits and drawbacks of the analysed technologies. A multi criteria analysis with relevant analysis criteria and assigned weights per criterion for each technology may offer a suitable approach for choosing the most appropriate alternative.

3.2.9 Justification of the WWTP preferred option

The benefits and drawbacks of the alternatives considered in references 1 and 5 have been summed up and compared.

<u>Alternative 1:</u> Conventional activated sludge (primary and secondary) treatment with anaerobic sludge digestion and mechanical sludge dewatering

This treatment technology is well proven in practice as robust and efficient. It is applied for many decades for wastewater treatment plants of similar magnitude and characteristics. The advantages of this alternative can be summarized as follows:

- Reliable and robust technology;
- Locally well established technology with considerable experience;
- Phased approach to (investment and) achieving effluent standards possible;
- Possibility of power generation/recovery from sludge treatment;
- Medium investment costs, higher than the SBR alternatives and lower/comparable with the lagoon alternatives.

The disadvantages of alternative 1 include the following:

- Highest operational costs;

- Limited ability to achieve standards for N and P, implying the need for additional tertiary treatment;
- Relatively large plot size (however suitable for the location and lower than the lagoons systems);
- Complex plant with a number of structures and appurtenant equipment;
- Largest labour requirements.

<u>Alternatives 2 and 3:</u> Sequencing Batch Reactor plant (with continuous inflow) and aerobic mechanical sludge treatment

In practice this technology has been applied mainly for smaller WWTP's of up to 50.000 PE capacity. However, by development of equipment and instrumentation this technology has lately improved and been applied also for large WWTP's (e.g. Dublin, Ireland, Q_{av}=6m^3/s).

The advantages of this option include:

- Reliable and robust technology;
- Compact plant, relatively small plot size required;
- Lowest number of water line related units;
- Lowest investment and O&M costs;
- Higher nutrients removal compared to alternative 1 and 4;
- Fast and efficient accommodation to fluctuations in water quality and quantity;
- Low labour requirements;
- No sludge recirculation required;
- Phased approach to (investment and) achieving effluent standards possible.

The disadvantages are the following:

- Additional N removal required beyond achievable with sequential oxic/anoxic conditions;
- Possible need for coagulant dosing for limiting peak P concentrations;
- Complex equipment for control and instrumentation;
- Reliability on constant/undisturbed electricity supply;
- Sensitivity of PLC system to variations/instability in the electricity transmission system;
- Economic considerations limiting technology application preferably for capacities <30.000 PE;
- Usually associated with aerobic sludge treatment, thus no energy recovery from sludge digestion;
- Largest quantity of resulting biological sludge;
- Relative lack of local experience.

<u>Alternative 4:</u> Continuously aerated lagoon system (primary and secondary treatment) with intermittent de-sludging of lagoons (land requirements limiting plant capacity to 100.000 PE)

Although often applied in the USA this technology is mainly associated with developing countries with sufficiently available and cheap land.

The advantages of this option include:

- Reliable and robust technology;
- Relatively simple to operate;
- Relatively simple equipment for control and instrumentation;
- Reduced quantities of mineralised sludge and limited needs for sludge treatment.

The disadvantages are the following:

- Large surface area required (extension beyond 100.000 PE is very likely not possible at plant site);
- Relatively high investment and O&M costs, comparable to alternative 1 and 5 and higher than alternative 2 and 3;
- Insufficient nutrients (N and P) removal, implying the need for additional tertiary treatment.

Alternative 5: Sequentially aerated lagoon system (primary, secondary and tertiary treatment) technology including membrane decanting, with limited de-sludging necessity

The advantages of this alternative include:

- Reliable and robust technology;
- Local Serbian and EU norms for nutrients removal (N and P) achievable under specific circumstances (build-up of relevant O&M experience);
- Highly reduced quantities of mineralised sludge with limited de-sludging needs.

The disadvantages are the following:

- Large surface area required (extension beyond 100.000 PE is practically not possible at plant site);
- Relatively high investment and O&M costs, comparable to alternative 1 and 4 and higher than alternative 2 and 3;
- Sensitivity of PLC system to variations/instability in the electricity transmission system;
- Relative lack of local experience with the technology.

Based on the benefits and drawbacks of analysed alternatives the following conclusions can be drawn:

- **Alternative 1** has been by far the most advanced technical proposal, in terms of project preparation, corresponding administrative procedures, reviewing, permitting. In brief, it is almost readily available for implementation.
- On the other hand, conducted preliminary technical and economical analysis of a wider range of available technical options and alternatives, showed that under the circumstances, **Alternative 2 and 3** could be very attractive for implementation from the point of view of treatment efficiency, favourable investment and operational costs, compactness and flexibility of the plant.
- Bearing in mind maturity and completeness of the proposed possible technical option, possible ways forward could be defined as follows:

- To arrange and engage in additional technical and economical assessment of the possible treatment proposals, and carry out a corresponding multi-criteria analysis, which should result in the selection of the optimum technical alternative. Practically, this would mean that all potential options have to be developed at a level corresponding to a Preliminary project design, with realistic cost estimates for investment and operational costs. The assessment itself would take 4 to 6 months, and could be carried out by a licensed local company. However, notwithstanding recommendations of this assessment, this would automatically imply repeating the complete administrative procedure regarding design conditions, reviewing by a competent republican authority, permitting, etc. This is certain to significantly prolong the overall project preparation, and finally this is not considered the best and most efficient way to implement the project.
- To allow for a competitive and flexible tendering procedure, with a possibility to introduce efficient and cost-effective technical proposals, generally in accordance with the FIDIC yellow book rules. The advantages of this approach are described later in the report, and this approach is recommended for further project implementation in relation to the WWTP.

3.2.10 Assessment of design

Phasing of WWTP works

The construction of a WWTP is based on accommodating future extensions of the sewer system of Šabac, and its suburbs, including the local industries. According to the updated Preliminary project design, the WWTP is assumed to have two distinct project phases, each with defined technology and associated investment and O&M costs.

Phase I of the WWTP: the plant should cater for the existing and future users of the system in Šabac municipality, including its urban and suburban population and major industries (excluding Zorka complex which would deal with its wastewater separately). The design organic loading is 126.000 PE (the maximum BOD_5 load is 7.560 kg BOD_5/day), while the maximum hydraulic loading is 650 l/s. Two of three identical process treatment lines will be built for the purpose, presumably construction starting in 2009. The technical alternative shall allow for compliance with the effluent concentrations defined in the Preliminary project design. Moreover, the technology shall focus on maximum achievable compliance with the Serbian (Table 3.19) and EU (Tables 3.17 and 3.18) normative standards for nutrients (N and P). Land has been allocated for a future extension, as well as process upgrading (tertiary treatment) regarding nutrients removal. In accordance with the projection of wastewater flows and pollutant loadings in this study, phase I of the WWTP will cater for the demand of the Town of Šabac and its suburbs till 2041. Therefore only phase I of the WWTP is included in the scope of this study. A layout of the WWTP, as elaborated in the updated Preliminary design of the WWTP is shown in Figure 3.11.

Phase II of the WWTP can be only considered as a very long term perspective that can be implemented only if much more intensive urban and industrial developments take place in Šabac. Spatial provision has been made at the WWTP site in order to allow construction of phase II. If phase II is realised, the WWTP would be able to cater for the organic loading of up to 193.000 PE (the maximum BOD_5 load of 11.580 kg BOD_5/day)

and the maximum hydraulic load of 900 l/s. The third identical process treatment line will be added to the two lines constructed in phase I. Process technology upgrading for full nutrients removal will be re-evaluated prior to the construction start.

To summarize, phase I of the WWTP is recommended for implementation, based on the wastewater quantities projected in this study. However, because realistic urban and industrial developments may be affected by a number of uncertainties (general political and economic trends) the WWTP phasing should be re-evaluated on a regular basis.

Process technology

The considered technologies from the Preliminary project design (reference 1) and General project design (reference 5) are technically sustainable and include necessary pre- and post-treatment. Both water and sludge processing are considered, aiming at minimizing the impact on the environment. One of the analysed alternatives includes sludge digestion and energy production, which bears additional positive environmental implications. The considered design parameters from the preliminary design are in line with theory and practice for the targeted pollutants.

However, both documents do not take a clear stance regarding the pursued effluent standards. Eventual accomplishment to the local Serbia imission norms is not substantiated (at least based on the available technical documentation) and is likely to be inadequate regarding nutrients (N and P) concentrations. The analysed process technologies and adopted effluent concentrations for the Preliminary plant design (reference 1) are in line with EU emission norms for discharge into non-sensitive areas. However, if in the future the project area would be declared as sensitive additional treatment would be needed, e.g. in the form of:

- advanced secondary biological treatment (separate anoxic/oxic process conditions);
- tertiary treatment in the form of filtration for N and P removal;
- coagulant dosing for (peak) P removal.

Such process conditions are partially incorporated in some of the alternatives elaborated in the General project design (reference 5), e.g. the SBR processes (full P removal likely requiring additional coagulant dosing during peak P concentrations) and the sequentially aerated lagoon system.

The cost overview from the Preliminary design is underestimated and not in line with benchmark unit costs, and they have to be reassessed and adjusted. On the other hand, for other proposed process alternatives (reference 5) the benchmark unit costs need further, more detailed elaboration per analysed alternative, in order to come to a more objective evaluation and recommendation.

Other factors also play a role for the technology choice, including (not necessarily in descending order of importance):

- possibility of phasing technology (e.g. nutrients removal in the second phase) and related investments;
- robustness of technology (ability to efficiently cope with quantity and quality fluctuation);
- reliability and flexibility of operation under fluctuating operational circumstances (e.g. variation of electricity voltage in the network);
- local familiarity with the specific technology;

- complexity of the installation and related operation and maintenance;
- labour requirements;
- environmental emissions (water, odour, aerosols, sludge, chemicals, noise);
- land requirements (lesser importance if land available).

These factors have been addressed in the overall assessment per process alternative. However, the evaluation is not finalised with a definitive ranking of the technologies, leaving space for free interpretation of the assessment and other choices, possibly influenced by local and/or client priorities.

To summarise:

- Based on the documentation available to the Consultant for this study, the adopted effluent standards for the Preliminary design of the plant could not be clearly correlated to the Serbian imission standards. However, the competent National authorities approved the design concept, which indicates that the compliance with the local standards and requirements have been assured.

- If the technological alternatives from the General project design are to be properly assessed, they would need more detailed elaboration, including the possibility of phased technology upgrading for nutrients removal.

- The presented cost assessments in the existing project documentation are contradictory, not fully substantiated and do not allow final recommendations regarding preferred technology.

- The technological design of the analysed alternatives does not allow full compliance with Serbian and EU legislation regarding nutrients concentration in the discharged effluent.

- The final decision regarding the need and extent of technology upgrading for nutrients (N and P) removal should be made in line with expected harmonised Serbian and EU discharge legislation. Compliance with these standards may be implemented in a phasing manner in future and needs to be taken into account for the planning.

- A mid term study on the impact of the WWTP effluent on the nutrients concentration in the Sava River should be carried out. Also, it is recommended to closely follow developments of harmonisation of local and EU environmental legislation in the future. Compliance with the future, harmonised local nutrients legislation should be assessed and the necessity and extensive step of a nutrient removal treatment, in a second phase of the project, should be evaluated.

The WWTP alternative 1 is the only available technical option that has been fully developed in accordance with the relevant Serbian legislation, with the corresponding design conditions issued by the competent authorities, reviewed and approved by the Republican Review Committee, and finally granted the construction permit (subject to further detailing in the corresponding detail project design). The proposed capacity of the WWTP, as described in the Preliminary project design phase I, is sufficiently

compliant with the wastewater projection in this study. Therefore, this technical option is the only readily-available for implementation of the WWTP.

Other technical concepts presented in the General project design are still in the early stage of development, far behind the alternative 1. Based on a number of considerations and cost implications, it is not recommended to eliminate the possibility of implementing other alternative process technologies. For instance based on the assessment of other relevant process criteria, including robustness, flexibility, operational & maintenance issues, and supported by the rough unit costs assessment, the SBR technology can also be attractive in the WWTP implementation.

An appropriate way to proceed to the final choice and recommendation of process technology could include:

- More detailed elaboration of possible technical alternatives;
- More accurate investment and O&M costs assessment and comparison of the elaborated alternatives;
- Multi criteria analysis of various (above stated) assessment criteria with a clear (as much as possible) objective assignment of weights and marks per technology.

Given the current status of the project development, an additional reassessment of various technical alternatives, as described earlier, can be very time-consuming, especially taking into account the complexity and timing associated with necessary permitting procedure, including:

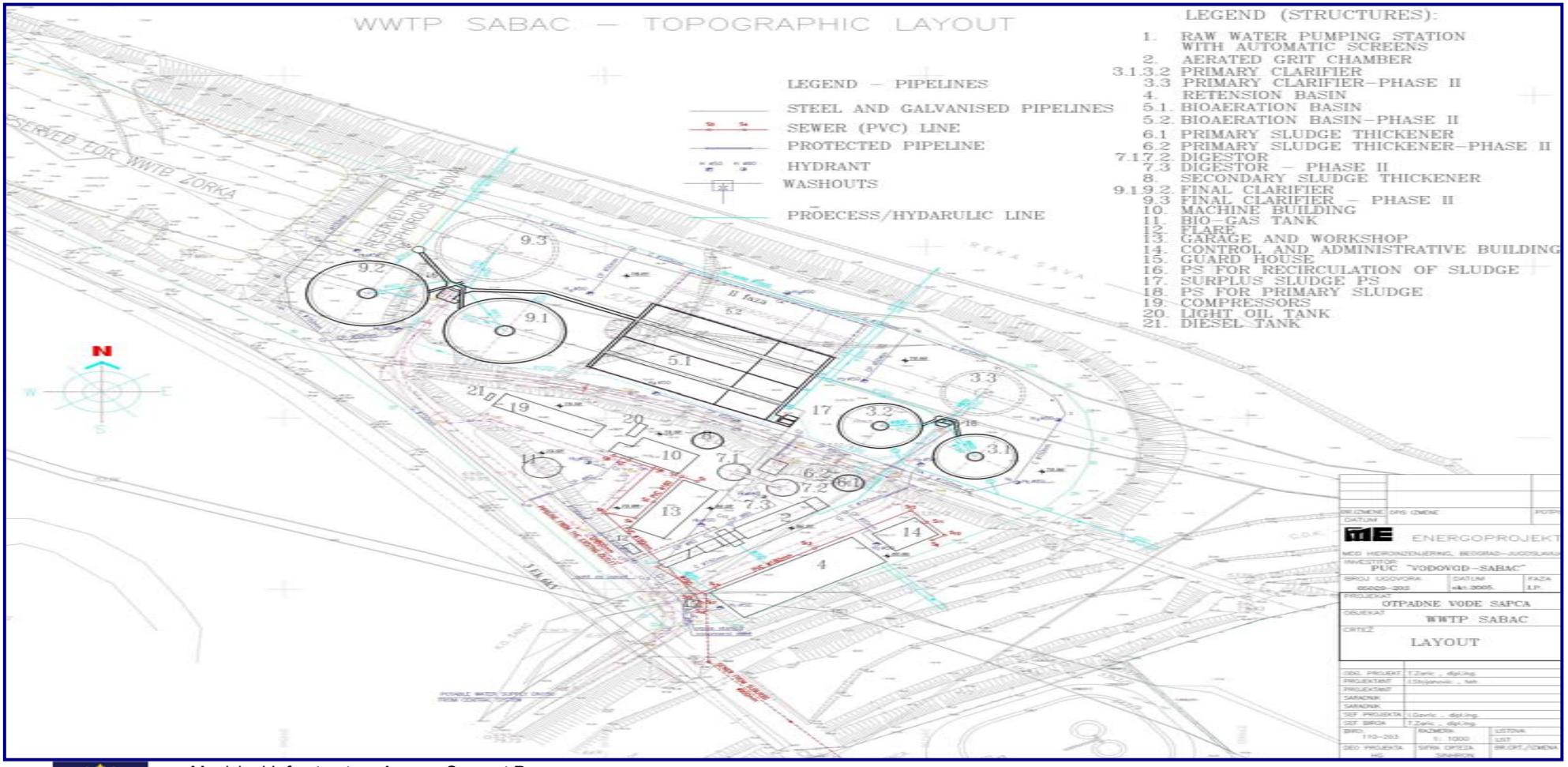
- Requesting and issuing design conditions;
- Consequent detailing of the proposed alternatives;
- Reviewing and approval of the proposed alternative by the Republican competent authority;
- Requesting and issuing of the corresponding building permit.

To summarize, it is not recommended to engage once again in this time-consuming and costly procedure. However, given the possible cost implications (both in terms of investment and operational costs), it is neither recommended to immediately rule out other possible technical options, bearing in mind the abovementioned possible benefits. It is believed that the plant tendering stage represents the best opportunity to introduce flexibility with regard to possible technical options. Namely, the tendering concept could allow different technical options to be proposed by various vendors, allowing for consequent assessment and selection of the preferred option using multi-criteria selection procedure.

The WWTP is the major project component considered in this project feasibility study. However, the project is interrelated with the completion of other key components of the sewerage system, including the SPS Glavna and the force main from the SPS to the WWTP. Similarly, it is also influenced by the short and long term extension of the sewers in the suburbs of Šabac. Finally, project implementation is interrelated to a detailed inventory of connected industries and the functioning of their wastewater pre-treatment facilities. In this context, the commitment of the chemical industry Zorka to treat its industrial wastewater discharges at a separate treatment facility, should be verified and confirmed. If non existent or unsuitable, wastewater discharges from of industries to the WWTP may pose a significant threat for the undisturbed and efficient operation of the plant. The WWTP should incorporate a robust technology, able to cope

with the periodic variations of the flow and quality of the received wastewater. Local experience with the preferred technology is also an important prerequisite for guaranteeing good effluent quality.

Figure 3.11 Layout proposed conventional activated sludge WWTP (primary and secondary) treatment with anaerobic sludge digestion and mechanical sludge dewatering



3.2.11 Completion of Šabac wastewater/storm water transfer system

Apart from the abovementioned construction of the WWTP, collection, transfer and treatment of all communal and pre-treated industrial wastewater, as well as of the most polluted part of collected storm water runoff, it is necessary to finalize the remaining key elements of the sewerage system in Šabac. Most importantly, it is essential to ensure transfer of all wastewater and a part of the polluted storm water discharge from the existing sewerage outlet to the planned location of the WWTP.

3.2.12 Sewage pumping station Glavna

SPS Glavna is planned to be constructed close to the existing main sewerage outlet, just downstream of the bridge over the Sava River. Basic functions of the SPS include the following:

- Pumping of all collected wastewater from the town area plus the most polluted portion of storm water runoff (equivalent to the peak dry-weather wastewater flow) to the WWTP;
- Pumping of the remaining part of the diluted mixture of wastewater and storm water (> 2Q max dry weather) to the Sava River during high water levels in the Sava;
- If water level in Sava is below 74,50 m at the concerned section, discharge at the location of the existing outlet can be by gravitation, and pumps in the SPS do not have to operate;

The SPS should discontinue and control a direct link between the town sewerage system and the recipient. Namely, all wastewater and polluted portion of storm water shall be diverted towards and treated at the WWTP, while a sufficiently diluted mixture of wastewater and storm water shall be discharged (by gravity, or by pumping into the Sava River).

The location proposed for future SPS is shown on Figure 3.12.

Figure 3.12 Proposed location of SPS Glavna

The existing main gravity sewer 1.250/1.900 mm shall be diverted towards the SPS Glavna. All dry weather discharges shall be pumped by the SPS towards the WWTP. During wet weather flows, after the maximum allowable flow to the WWTP is reached (1.200 l/s), a discharge to the Sava River is activated, either by gravity or by pumping – depending on the actual level in the river.
Four pumps, each of a capacity of 1.000 l/s, are to be installed in the SPS in order to ensure evacuation of the maximum design storm water discharge. Each of the pumps is installed in a separate wet-well, isolated by a penstock, so pumps can be cleaned, maintained or removed individually, as required. A mixture of storm water and wastewater is discharged in Sava via a DN1.500 mm sewer.

The pumps that are supposed to evacuate the mixture of wastewater and storm water should have the following characteristics:

- Type - submersible wastewater pump
- Impeller type - semi-open impeller
- Number of units - 4
- Delivery rate - ≥ 1.000 l/s
- Delivery head - ≥ 6,0 m
- Hydraulic efficiency - ≥ 75%
- Speed - 1475 1/min
- Motor rated power - 132 kW

Submersible sewage pumps for direct installation in a discharge pipe save space and installation costs. They are intended for large flows and moderate heads for sewage from commercial, municipal and industrial sources. The use of the impellers of the semi-open type ensures trouble-free pumping of liquids containing solids and fibrous material. The compact unit is lowered into a standard steel tube and needs no anchoring. Its own weight is sufficient to hold the unit securely in position. The robust design and quality materials ensure high operational reliability and hydraulic efficiency up to 86 %.
A typical cross section of the SPS Glavna indicating the pump installation arrangements is shown in Figure 3.13.

Another battery of pumps in the SPS will provide transfer of wastewater and polluted storm water to the WWTP, and more specifically to the inlet chamber just upstream of the aerated grit chambers. The required downstream head in the WWTP is 82 m, corresponding to the water level in the WWTP inlet chamber. The minimum level in the SPS Glavna wet-well is around 75 m.

In order to cope with a wide range of operational flows; from around 300 l/s to 1.200 l/s, 3 operational pumps are planned, with an additional pumping unit that will serve as a stand-by pump. Recommended features of these pumping units are defined as follows:

Wastewater submersible pumps for reliable and economic pumping of heavily polluted sewage in commercial, industrial and municipal applications. Water pressure-tight encapsulated fully flood-proof motors supplied as standard with jacket cooling system.
Hydraulics with open or closed, single or multi-vane impellers suitable for handling of clear water, polluted water, sewage containing solids, faecal slurry and sludge.

- Type - submersible wastewater pump
- Impeller type - two-vane channel impeller
- Number of units - 3 + 1

- Delivery rate - ≥ 400 l/s
- Delivery head - ≥ 22,0 m
- Hydraulic efficiency - ≥ 75%
- Speed - 975 1/min
- Motor rated power - 110 kW

Given the wide operational range and in order to be able to provide a stable influent rate to the WWTP, it is recommended that these pumping units be equipped with adequate frequency drives, so that the actual delivery rate can be fine-tuned.

It is also recommended to introduce both coarse and fine screens in this section of the SPS, since water is pumped directly to the aerated grit chambers of the WWTP.

Figure 3.13 SPS Glavna – Typical cross section with pump installation arrangement

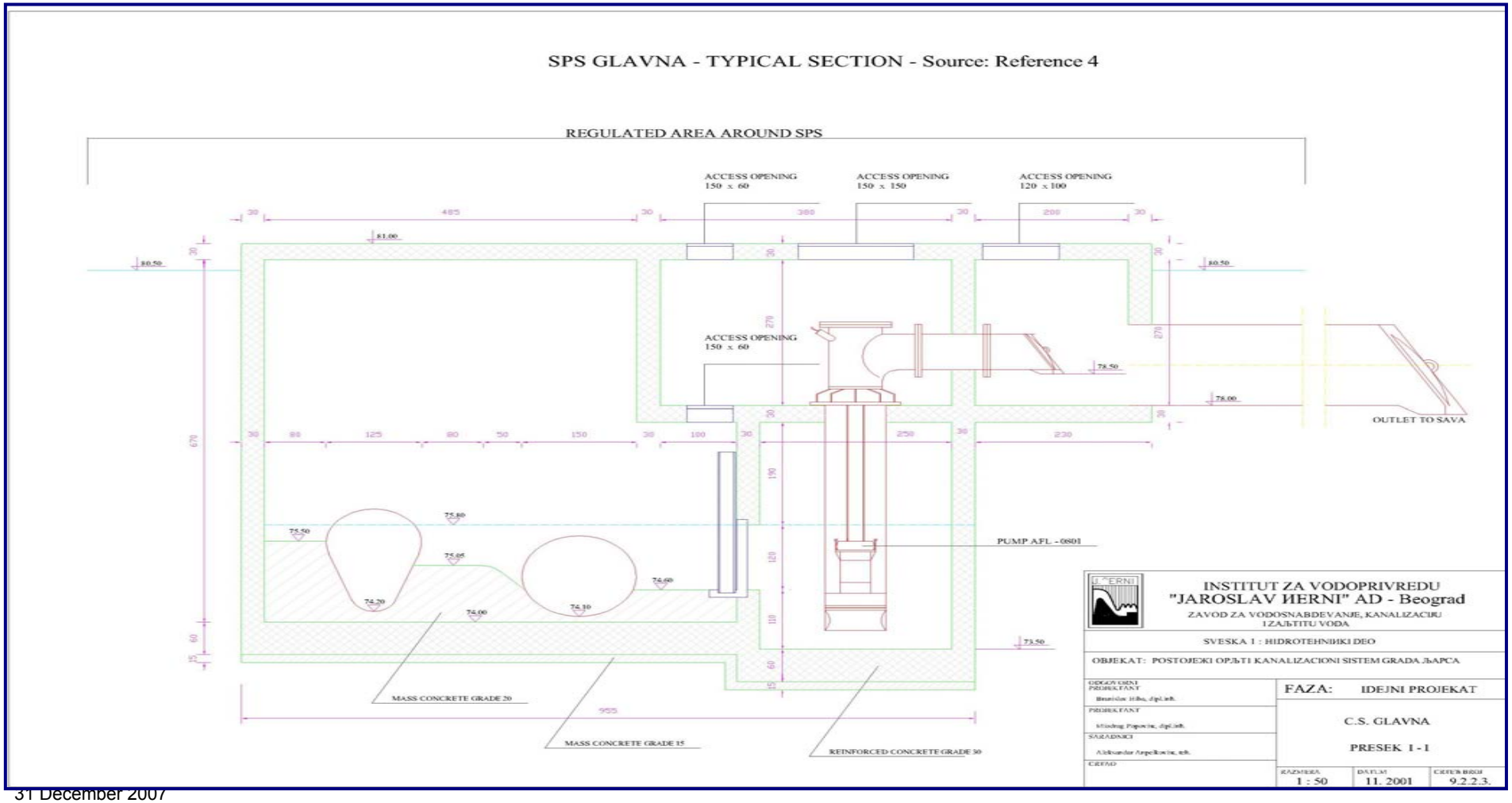
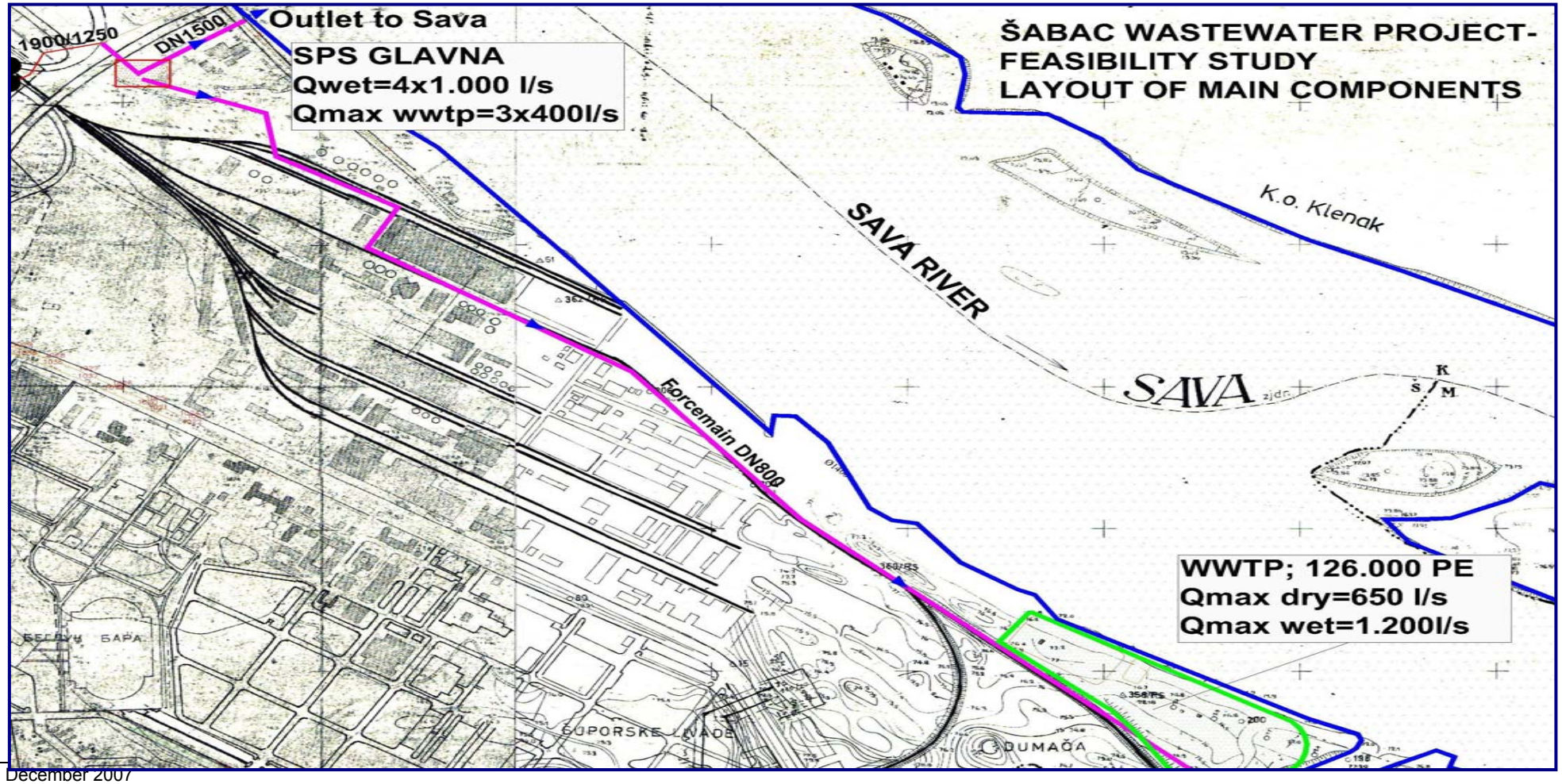


Figure 3.14 General arrangement of main project components



3.2.12.1 Force main SPS Glavna - WWTP

The preliminary route of the force main between the SPS Glavna and the WWTP is shown in the Figures 3.14 and 3.15. It passes through the industrial complex Zorka and ends in the WWTP inlet chamber, upstream of the aerated grit chambers in the WWTP.

The length of the preliminary route (subject to further adjustments in a detailed design) is 1.950 m. In order to provide the minimum acceptable flow velocities in the force main, and at the same time to allow for reasonably low head losses along the pipeline, the pipeline nominal diameter of DN800mm has been selected.

Figure 3.15 Preliminary route of force main SPS Glavna – WWTP through Zorka complex

Basic features of the force main are defined as follows:

- Operational range - 300 – 1.200 l/s
- Nominal diameter - 800mm
- Length - 1.950 m
- Pressure rating - PN10

Given the required operational capacities, the possible operational regimes, the length of the pipeline, the route and the longitudinal profile, it is highly recommendable to carry out a comprehensive hydraulic analysis of both stationary and transient flows, and if necessary to introduce adequate surge prevention and protection measures.

3.2.12.2 Cost estimates

This section includes the cost estimates for the following components of the Šabac wastewater project:

- SPS Glavna with appurtenant connecting pipelines and structures;
- Sewage force main between SPS Glavna and the WWTP (DN800, L=1.950 m)

The estimates are based on the reference documentation (reference 4), with costs adjusted based on recorded inflation and changes of €/RSD exchange rate, but are also supplemented with additional components deemed to be necessary for the project.

Table 3.26 Preliminary cost estimate for the components of the Šabac WW project

2 SPS Glavna and appurtenant external pipelines and structures		
2.1	Preparation of detail design for SPS Glavna, appurtenant local external pipelines and structures, including necessary topographical and geotechnical works	65.000
2.2	SPS Glavna - construction works	300.000
2.3	SPS Glavna - equipment	645.000
2.4	Connection existing outlet - SPS Glavna	40.000
2.5	Connection SPS Glavna - new outlet	30.000
2.6	Release overflow structure 1	33.000
2.7	Release overflow structure 2	35.000
2.8	Connection of overflows 1 an 2 to SPS	140.000
2.9	Construction supervision	61.150
	Sub-total SPS Glavna and appurtenant lines and structures - without VAT	**1.349.150**
3 Sewage forcemain SPS Glavna - WWTP		
3.1	Preparation of detail design for sewage forcemain SPS Glavna - WWTP including field investigation works	25.000
3.2	Construction of sewage forcemain SPS Glavna - WWTP including all works and equipment	975.000
3.3	Construction supervision	48.750
	Sub-total sewage forcmain SPS Glavna - WWTP - without VAT	**1.048.750**

3.2.12.3 Conclusions and recommendations

Apart from the future WWTP to be constructed downstream of Zorka industrial complex, next to the confluence of the Grand Cerski Canal into the Sava River, other key components that must be implemented to make the overall wastewater collection and treatment system for Šabac fully operational and functional, include the following:

- Sewage pumping station called Glavna – to be located close to the existing outlet structure;
- Sewage force main from SP Glavna to the WWTP

So far, basic features of these components have been defined at a level of general and preliminary project design.

In order to be able to proceed with the implementation of these components, it is necessary to arrange for preparation of corresponding detailed designs. These should be developed fully in line with the relevant local regulation (Law on construction and other acts) and with the prescribed design criteria and conditions issued by the

competent authorities. They should be fully compatible with the proposed features and capacities of the WWTP, as described earlier in the report. In other words, they should fully take into account characteristics and applicable boundary conditions related to the prepared, and already approved technical proposal of the WWTP.

The design of the section of the SPS Glavna that will pump wastewater to the WWTP should provide as much as possible reliability and stability of operation. It is highly recommendable to consider and introduce a stand-by diesel generator unit, and therefore minimize further environmental risks to the recipient.
Flexibility within the operational range is importance, since the SPS has to deal with a wide range of hydraulic loadings (originating from both dry and wet weather flows). Furthermore, operation of the SPS should be accorded with the operation of the WWTP to the required extent.

The estimated total preliminary investment (excluding VAT) for these components is 2,4 M€.

3.2.13 Investments Overview

This section provides an overview of the investment costs related to the project, elaborated in more detail earlier in the report.
The estimated investment amounts are summarized in the table below. Individual items include provisions for contingencies and VAT.

Table 3.27 Wastewater Project Šabac - Investments Overview

Table 3-1a Investments

WWTP (incl. contingencies, incl. VAT)	Units	Tot.	2009	2010
Investigation works & design	€ m	0.35	0.18	0.18
Construction works	€ m	6.91	3.45	3.45
Electro-mechanical equipment	€ m	5.01	2.50	2.50
Additional land acquisition (1,5 ha)	€ m	-	-	-
Trial run, staff training, operation	€ m	0.30	0.15	0.15
Sewerage			-	-
Sabac main sewers	€ m	-	-	-
Sabac SPS - civil works	€ m	1.64	0.82	0.82
Sabac SPS - elctr/mechanical	€ m	0.65	0.32	0.32
Sabac SPS - pipes & fittings	€ m	-	-	-
Supervision			-	-
Supervision WWTP	€ m	0.95	0.48	0.48
Supervision sewer extension	€ m	0.11	0.05	0.05
Total	**€ m**	**15.92**	**7.96**	**7.96**

Table 5-41b Re-investments

	Units	Tot.	2024/25	2039/40
WWTP - electro-mechanical equipment	€ m	33.57	7.15	9.6
Sewerage pumps Sabac suburban	€ m	4.24	0.90	1.2

3.2.14 Conclusions and recommendations

Based on the consideration mentioned above, a number of options arise regarding further project planning. These depend on the Client's interests and choices. Three possible scenarios with specific time and planning implications arise:

1. The client (PUC Vodovod - Šabac) accepts the results of this feasibility study and reconsiders the recommended more detailed technology assessment, choice and application of the optimal technology. If agreed upon, the additional assessment could be accomplished within 4 - 6 months, resulting in a documentation equivalent to a Preliminary project design level. This additional assessment should also include actualization of investment and operational costs included in the current technical proposal. A well substantiated technology choice could be followed by tendering of the WWTP with the preferred technology according to the PRAG. The design capacity of the plant should be in line with the calculated capacity in this feasibility study and should suffice until the year 2041. The technology choice will emerge from the recommended additional assessment.

2. The client (PUC Vodovod - Šabac) accepts the results of this feasibility study and agrees to proceed with tendering of the plant without a more detailed technology assessment. The design capacity of the plant should be in line with the calculated capacity in this feasibility study and should suffice until the year 2041. If agreed upon, the WWTP could be tendered according to open tender rules (Yellow FIDIC Book) implying that bidders may offer alternative technical solutions in line with the tender instructions and requirements. The final choice of technology would depend on the achieved scores for various tender criteria, including integrated and/or separate provisions for additional nutrients removal. This approach could be implemented on a short notice.

This approach is recommended for implementation in this study, for the following reasons:

a. ***Economizing solutions* -** To allow the market to have an impact on the most economic solution of the wastewater treatment plant a Design-Build contract form, such as the FIDIC Yellow Book, is preferred as it places the responsibility for both the design and the construction on the Contractor. Instead of imposing detailed solutions on Contractors the choice is made to allow contractors flexibility in choosing the most economic solution to achieve the project objectives. Therefore, the Tender Documents would be prepared with a limited number of boundary conditions, to be set in consultation with the final beneficiary. Limiting the responsibility of the Contractor to construction only, such as with the use of the FIDIC Red Book or the PRAG standard Works contract, will mean limiting the process design choice and therefore losing the advantage of flexibility by the Contractor which might increase the price.

b. ***Construction and delivery time* -** *With* Design-Build contracts time can be saved by allowing the Contractor to commence with his preparatory works prior to completion of the design and the receipt of construction permits.

c. ***Possibility of lowering costs -*** Due to the flexibility afforded to the Contractor in the final design configuration he is able to offer cost savings based on alternate methods and designs and this is often reflected in time savings due to the application of his own approach, within the basic parameters as set by the Employer, with which he is more familiar than an imposed methodology. These possibilities are less available in the traditional construction (Red Book) type contract. In this case, however, the flexibility with respect to the process design choice was somewhat curtailed by the inclusion in the tender documents of relatively detailed Employer's Requirements with a view to narrowing the variety of solutions to facilitate evaluation. This, in our opinion, will assist in reducing the time required by the Contractor for preparation of the Final or Main design. This approach was designed to reduce time and therefore costs.

d. **Risk allocation** When considering risk allocation it is necessary to ascertain which party is most capable of managing and controlling the apportioned risk. Risk allocation will vary according to the type of project and the location. The following factors were considered in this case:

- Regulatory compliance risks related to environmental and permitting issues;
- Construction phase risks related to differing site conditions, weather conditions, access to site and continuing operational issues;
- Post-construction risks related to the meeting of performance standards.

3. The client (PUC Šabac) does not accept the results of this feasibility study and proceeds with the implementation and tendering of the WWTP solely based on the technological alternative elaborated in the Preliminary project and independently from this EAR project. This implies that the PUC Šabac will finance the project from other resources.

4. A study on the impact of the WWTP effluent on the nutrients concentration in the Sava River should be carried out at mid term. The results of this study should be assessed vis-à-vis the future harmonised local and EU environmental legislation. Based on this assessment the final decision should be made regarding the need and extent of technology upgrading for nutrients (N and P) removal, if not already implemented in line with recommendation 2. This would imply technological upgrading in a second phase of the project.

Care should be taken regarding the planning of the WWTP under the different scenarios relative to the other project components. In this light it is recommended to include clear milestones in the project planning. The achievement of such milestones should be the prerequisite for further interrelated investments and construction activities. Such an approach will ultimately result in optimization of investment and O&M costs.

For other key components of the wastewater project (SPS Glavna, sewers, force mains), it is recommended to arrange for preparation of corresponding detail project designs, with full reviewing and permitting procedure, followed by tendering that would generally follow relevant local regulations and the FIDIC Red Book rules.

4 ENVIRONMENTAL AND SOCIAL ANALYSIS

4.1 Introduction & scope of EIA

The review of the environmental and social aspects of this project is set against the following requirements, to be found in the following documents:

- Environmental Integration Handbook for EC Development Co-operaton, EuropeAid, December 2006
- Local legislation, Law on Environmental Impact Assessment (2004)

An EIA was carried out by 'Energoprojekt-Hidroinzenjering MDD', reported in September – October 2005.

Scope of EIA in relation to project feasibility study
The EIA covers the WWTP but not the sewage connections. In the EIA the WWTP is referred to as the central WWTP for Šabac. The plant will treat all the faecal waste water (from urban and suburban population) and industrial waste water from the territory covered by the Šabac General City Plan, except the industrial waste water of 'Zorka'. Discharge takes place on the Sava river as recipient water body. The WWTP will also handle runoff water by rain.

In all, the WWTP complex comprises three elements that will be considered:

1. The WWTP itself;
2. the pipeline that feds the WWTP with combined sewage and runoff water;
3. the pumping station, that pumps the sewage/water through the pipeline to the WWTP.

The aim of this feasibility study is to assess whether the issues dealt with in the EIA are complete, followed by a more detailed check on the content of the EIA. This deals with the standard environmental issues during construction and operation of the WWTP complex.

4.2 EIA Procedure

4.2.1 Serbian requirements

According to Serbian legislation, an Environmental Impact Assessment has to be conducted and approved in order to obtain a construction permit. The Law on Environmental Impact Assessment (Official Gazette of the Republic of Serbia 135/2004) gives requirements for such an EIA. This law on EIA has been developed to be compatible with EU Directives.

EIA scope and contents
According to article 12 – 15 of the Serbian Law on EIA, the Competent Authority decides on the required scope and contents of an EIA study. Article 17 of the Law lists the following items.

1. The data on project developer;
2. The description of the location intended for project implementation;
3. The description of the project;

4. The outline of the main alternatives studied by the project developer
5. The outline of the environmental status at the site and its close vicinity (micro location and macro-location);
6. The description of likely significant impacts of the project on the environment;
7. The environmental impact assessment in cases of accidents;
8. The description of measures envisaged to prevent, reduce and, if possible eliminate any significant adverse impacts on the environment;
9. The monitoring programme for impact on the environment;
10. The short non-technical summary of data listed in points 2) to 9);
11. The data on technical shortcomings, absence of the appropriate expertise and skills or, impossibility of obtaining the appropriate data.

Public consultation
Article 14 of the Law on EIA requires public announcement of the decision by the Competent Authority on the scope. Article 20 and 21 describe the public consultation procedures to be followed on the results of the EIA.

4.2.2 Requirements set by EAR

According to the Environmental Integration Handbook, Annex 7, an EIA is necessary if the projected plant is of a large scale (i.e. >150.000 population equivalent) or if it effects a particular vulnerability of the recipient environment or an existing SEIA report advices it. On the basis of these conditions an EIA is needed to obtain a construction permit.

As the planned WWTP will serve about 126.000 population equivalent it is not necessary to carry out an EIA according to the EAR regulations. The location is not on a vulnerable location, since the recipient water body is - by Serban law - not classified as sensitive. Furthermore, an EIA is not advised in a SEIA report.

However, since an EIA has been prepared, it will be looked at seriously and recommendations will be made in order to ensure that the impacts on the environment will be kept to minimum.

4.3 Quick scan of main environmental impacts

In order to assess the construction of a WWTP, it is important to understand the scope of the environmental impacts on various aspects. Therefore, a description of the main impacts is given in tables 4.3 and 4.4 (paragraph 4.7) based on the description below. Another aspect dealt with in the tables is strongly reducing the discharge of untreated waste water on the Sava river. Preventing the discharge of untreated waste water will have a positive impact on the environmental and social situation of the inhabitants in the area. Therefore, in this quick scan, the (treated) discharge as well as the existing untreated discharge is considered.

The assessment of environmental impacts is based upon relevant document and on information gathered during fieldtrips in August and September 2007. On these occasions talks took place with representatives of the municipality, sites were visited and photos were taken.

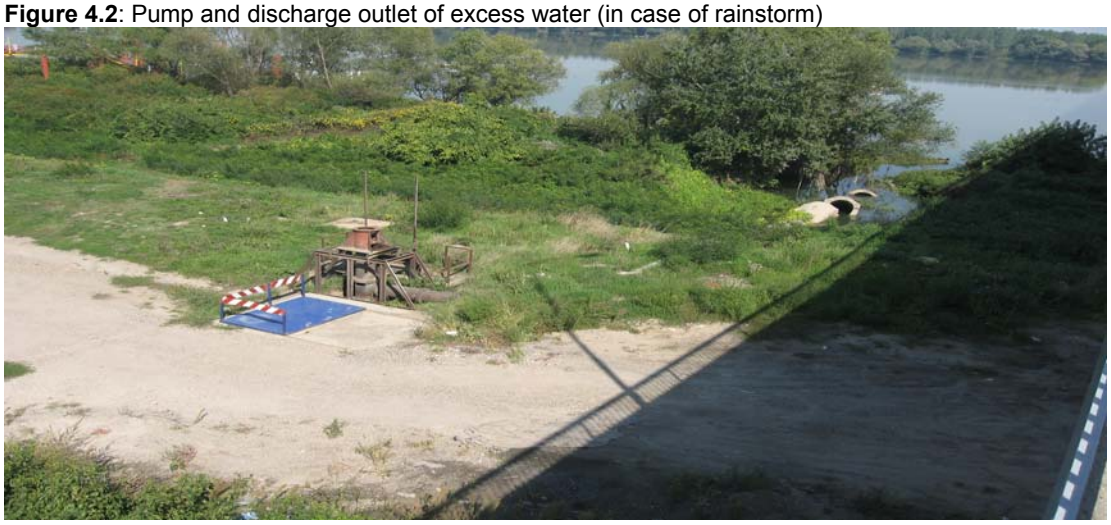
4.3.1 Current situation

At present, the sewage discharge is directly into the receiving water body, the Sava river. See figure 4.1.

Figure 4.1: Current point of discharge of untreated waste water in the Sava River

The existing sewerage network of the city of Šabac collects residential city waste water, waste water from some of the plants connected to the sewerage network and atmospheric precipitation (run off). All waste water is collected in one oval collector and conveyed to the discharge point at the Sava River. This point of discharge is located 500 m southerly of the so-called 'new bridge', directly adjacent to the new bridge another outlet discharges excess water, in case of a rainstorm, into the Sava river without any treatment. The present sewerage system consists of the sewerage network and four pumping stations ("Metaloplastika", "Letnjikovac", "Hajduk Stanko", "Stari Grad").

Figure 4.2: Pump and discharge outlet of excess water (in case of rainstorm)



The north and south main sewers of Šabac have been largely finalised, although some remaining work on side branches is still on-going. The collected waste water in the new sewage section is pumped to the existing network in the centre of town and subsequently discharges into the river without any treatment.

In the next two years some 6.500 new house connections to sewers are foreseen. During the period between finalising the pumping station and the WWTP, all collected waste water will be discharged without treatment from the current discharge point.

Surface water
By the discharge of untreated waste water on the Sava River the surface water quality is seriously affected by eutrophication (especially by nitrate and phosphate) and load of contaminants (such as heavy metals). The downstream areas suffer from this poor water quality. It threatens public health, fish and other water animals (fauna), plants and river bank vegetation (flora).

The public health issue is an explicit point of interest in for those circumstances where river water is used for drinking water purposes, for recreational purposes (swimming), fishery and consumption of fish.

Groundwater
Surface water is interlinked with groundwater. As groundwater in a number of places downstream is used for drinking water production, surface water threatens the quality of drinking water.
At the site ground water is present at a depth of approximately 3,5 m below ground level (measured in September/ October 2005). The groundwater table is directly influenced by the water level of the Sava river.

Soil quality of river banks

By inundation the river banks will receive water and river sediments that lead to deterioration and degradation of soil quality.

Underwater sediment layer
Sedimentation of contaminants has adverse effects on the quality of the underwater sediments. By dissolution, dispersion and diffusion water quality can be threatened over length of years.

Ecological quality (terrestial and aquatic ecosystem)
The ecological quality of the river banks and water body has been deprived. It is not known if those areas inhabited critical plant or animal species.

4.3.2 Future situation

Construction of the WWTP will definitely be an amelioration of the environment, especially the ecological status of the Sava river, which is the essence of the EU Water Framework Directive.

The construction is considered to be a source based measure in order to reduce emissions of nutrients, micro-pollutants, hazardous substances to the surface water of the Sava river. The WWTP aims at elimination of suspended matters and decrease of organic load. The technology includes three main groups of approved treatment processes:

- Primary/ physical treatment,
- Secondary / biological treatment with incorporated process of nitrification and de-nitrification,
- Sludge treatment.

The WWPT will treat sewage and run off water. The maximum quantity of rainwater entering the sewage is estimated to be 3500 l/s. At the WWPT the sewage and run off water will be diluted at a proportion of 2:1 compared to the maximum waste water hourly discharge. The remaining quantity would overflow to Sava River.
Out of 3.5 m3/s of precipitation, 1200 l/s of waste water and precipitation from the city area will be conveyed to the plant by the new pumping station “Glavna” and by a Ø800 mm delivery pipeline. Rainwater, delivered to the plant, will be captured by 5000 m3 catchment basin, followed by controlled disposal to the plant.

Figure 4.3: Projected site of new pumping station Glavna.

All the environmental threats as described in paragraph 4.3.1. will be greatly reduced, although long term effects of slow emissions of substances will last for years, until remedial measures will be taken.

Quality of treated water
Considering the Decree on water categorisation and classification (SRS Official Gazette No. 5/68) and Working Rules on dangerous substances, which may not enter surface water (SFRY Official List no. 31/82), the Sava by Šabac is ranked as category II water body. The following quality parameters of effluents are valid upon the secondary treatment at the WWTP Šabac:

- Concentration of suspended matters max. 30 mg/l
- Concentration of BOD5 max. 20 mg/l

Evident effects of discharge of treated water instead of untreated waste water are amelioration of surface water quality downstream and subsequently adjacent ground water bodies, ecological recovery, diminishing the load of contaminants on river banks and in underwater sediments.

Production of bio-energy
For the treatment of the sludge (which is the last process step) it is planned to incorporate an anaerobic process that produces biogas as result of break down of organic material. The produced biogas shall be used for production of electricity and heating. Excess gas will be stored in a gas tank. If the gas fails to meet quality requirements, or if the production exceeds the consumption and storage capacity, it is burnt at a flare.

In this way (at least) a part of the plants energy consumption is covered by the process.

Management of treatment process
Management of the treatment process implies monitoring and control in all treatment line phases. Monitoring implies a set of measurements of specific process values based on which the decisions on process management methods are made.

Assessment of the type and quantity of emissions into the air

WWTP emits unpleasant odours due to gases generated by the decomposition of organic matter. Gas emissions are non-quantifiable.

Assessment of the type and quantity of emissions into water
The treated wastewater, of quality compliant with the legally stipulated category of the recipient water, is under gravity discharged on the Sava river in the following quantities:

Phase I	Q=420 l/s
Phase II	Q=640 l/s

In case when the wastewater treatment process is stopped due to an accident, untreated wastewater is discharged directly into the Sava river via a by-pass.

All wastewaters generated in the WWTP process are directed into the treatment process of the WWTP, thereby precluding a threat to the environment (ground and surface water). Only storm water (including that of water-impermeable surfaces as roofs, roads, rail tracks and plateaus around buildings) is drained into open roadside gutters and trackside channels and conveyed into the Cerski boundary channel or the Sava River, without any treatment.
The volume of storm water from impermeable surfaces and from facility surrounding plateaus is relatively small.

Assessment of the type and quantity of waste
In the mechanical wastewater treatment, coarse and inert matter is removed from waste water by screens. The removed material is disposed of into containers. The estimated quantities of coarse, inert material are:

Coarse bar screens	Phase I	0.2 m3/day
	Phase II	0.3 m3/day
Fine bar screens	Phase I	0.8 m3/day
	Phase II	1.1 m3/day

In the primary treatment, the inert matter (sand, gravel and non-degradable organic matter) is removed in the aerated sand catcher. The mixture of sand and water from the sand catcher is evacuated by airlift pumps into sand silos. The estimated quantities of sand from the sand catcher are:

Phase I	3.5 m3/day
Phase II	5.3 m3/ day

The sludge is dewatered. The excess water is eliminated from the sludge, and the sludge is formed into a sludge cake that will be collected into the sludge containers. In the dewatering process, the following quantities of sludge cake are produced:

Phase I	21 m3/day
Phase II	32 m3/day

The estimated quantity of municipal solid waste generated in staff premises (15 employees) amounts to 0.02 m3/day.

4.4 Procedures undertaken

4.4.1 Master plan of Šabac

The works on the sewage system and treatment of waste water are proposed in the Master plan of Šabac, drawn up in 1995 by Energoprojekt-Hidroinženjering, covering the period of 1994 – 2010 and in the Final design for collection and treatment of municipal and industry waste water from the area covered by the Šabac Master plan.

At the existing outlet for discharge of waste water pumping station 'Glavna' will be realised.
The pumping station will pump waste water and run off through the interconnecting pipeline to the WWTP with a maximum capacity of 1200 l/s. The excess quantities of waste water and run off will be discharged to the Sava River through the existing outlet by gravitation at lower Sava water levels and by pumping at higher Sava water levels.

To secure proper functioning of the WWTP, industrial waste water containing different types of pollutants, has to be filtrated to meet certain quality levels, before it is discharged to the city sewerage. The quality of industrial effluents is prescribed by the Rules on technical and sanitary conditions for waste water discharge. Those Rules were developed within the Šabac City Project. Pre-treatment of waste water from each industry is defined by the characteristics of industrial waste water and requirements of the Rules.

EIA
In line with requirements by Serbian Law, an EIA was carried out for the Central Municipal and Waste Water Treatment Plant by 'Energoprojekt-Hidroinzenjering MDD', reported in September – October 2005. This EIA has been approved by the Serbian competent authority (i.e. the Ministry for Infrastructure and Capital Investments). This Ministry issues the building permit for the WWTP, pumping station and interconnecting pipeline.

Prior to the approval, the requirements for the EIA were received, whereupon in July 2007 it was decided by the local municipality that an EIA should be carried out. A technical commission of the Ministry reviewed the EIA and under the reference number 353-02-2640/2005/02 dated 10.07.2007 passed a judgement to the local authorities and the PUC Vodovod, Sabac that they agreed.

Urban planning
The commission for planning of the city of Šabac discussed on their sessions about the detailed urban plan for the new complex of WWTP, pumping station and interconnecting pipeline and about the strategic EIA .The commission advised the assembly of the city of Šabac to approve the detailed urban plan for the WWTP complex and the SEIA.

Prior, a public hearing was announced for 26 April 2007 with respect to the urban plan for the new WWTP and the SEIA. No comments or remarks were made.

4.5 Lay out of the WWTP

All the waste water from the area of the City of Šabac, suburbs, industrial zones and urban industrial plants, except industrial waste water from Zorka will be directed to the WWPT.

The following structures are planned for the water line: raw water pump station, aerated sand catcher, retention tank, primary sedimentation tanks, bio-aeration tanks and secondary sedimentation tanks.
Sludge line will consist of: primary sludge thickener, digesters, secondary sludge thickener, water and sludge recirculation pump station, excess sludge pump station, pump station for primary sludge, biogas reservoir, gas generator and flare.

The projected process will also include the following auxiliary structures: gatekeeper lodge, garages and workshops, control management building, machine shop, compressors, dispel generating set, power substation, reservoirs for diesel and light oils.

The area of the WWTP amounts to approximately 5 hectares.

4.6 Gap Analysis

In the table below a review is given of which parts are dealt with in the EIA (drafted by 'Energoprojekt-Hidroinzenjering MDD', and approved of in 2007). It does not give a judgement on whether it is sufficiently described.

Table 4.4 Summary of Serbian legislation

	Requirement	**EIA 2005**
1	The data on project developer;	√
2	The description of the location intended for project implementation;	√
3	The description of the project;	√
4	The outline of the main alternatives studied by the project developer	√
5	The outline of the environmental status at the site and its close vicinity (micro location and macro-location);	√
6	The description of likely significant impacts of the project on the environment;	√
7	The environmental impact assessment in cases of accidents;	√
8	The description of measures envisaged to prevent, reduce and, if possible eliminate any significant adverse impacts on the environment;	√
9	The programme of monitoring of impact on the environment;	√
10	The short non-technical summary of data listed in points 2) to 9);	√
11	The data on technical shortcomings, absence of the appropriate expertise and skills or, impossibility of obtaining the appropriate data.	-

Although the EIA by 'Energoprojekt-Hidroinzenjering MDD' is not carried according to the specific EAR requirements, the EIA is reviewed accordingly in the table below.

Table 4.5 : Summary review of EAR requirements

	Requirement	EIA 2005
1	Executive summary	√
2	Background	√
2a	Project justification and purpose	√
2b	Project location	√
2c	Project description and associated activities	√
2d	Alternatives	√
2e	Environmental policy, legislation and institutional framework	√
3	Approach and Methodology	√
3a	General approach	√
3b	Geographical or mapping units	√
3c	Environmental quality indicators	√
3d	Assumptions, uncertainties and constraints	√
4	Environmental baseline study	√
5	Impact identification and evaluation	√
6	Mitigation/optimization measures and residual impacts	√
7	Recommendations	√
8	Conclusions	√
9	Technical appendices	√
10	Other appendices	√

4.7 Gap analysis on content of EIA (impact & mitigation measures)

In the tables below an overview is given on the content of the EIA. It focuses on the possible impacts and mitigation measures proposed. Within the column 'evaluation' it is indicated whether the item is dealt with sufficiently or whether additional information is needed.
Table 4.6 describes the issues relevant during construction phase, and table 4.7 for the operational phase of the project.

In the tables below an overview is given of the main environmental and social issues related to this project. An estimation of the impact is made based on expert judgment and assisted with the criteria below. Further down a comparison is made of no-action (no investments – leaving for the current situation to continue) and investment made.

Criteria for minor and major impact setting

Criteria	Evaluation – Minor impact	Evaluation – Major impact
Intensity	Small	Large
Scale	Local or on-site scale only	Regional or National scale
Duration	Weeks or months	Years

Table 4.6: Main environmental issues and mitigation measures for **construction phase**

Type	Description of impact related to activity	Evaluation	Mitigation measures proposed
Physical environment			
Air pollution	Caused by • Release of aerosols and unpleasant odours, especially during dry and hot spells caused by construction works.	**No gap**	• During the construction phase it is not necessary to take any measures with respect to odour as this is not realistic.
Noise & vibrations	Caused by • Construction machinery; this may cause noise levels at short time periods which might exceed the allowed levels, however due to the timeframe of the works and the distance to the city and individual houses it is neglect able.	**No gap**	• Good maintenance and check up on vehicles and equipment. Periodic engine control should take place. • Prevent any unnecessary noise production, leaving equipment and vehicles running whilst they are not being used. • Provide ear protection if limits exceed safety standards
Soil pollution	Caused by • Prevent any spillage at the WWTP of waste water, waste and/or sludge	**No gap**	• Apart from protection against soil erosion, no mitigation measures needed during construction • Good housekeeping at the WWTP through good management during construction
Water pollution	Groundwater caused by: • Prevent any spillage at the WWTP construction site during construction works Surface water caused by: • Prevent any spillage at the WWTP construction site during construction works	**No gap**	Groundwater • Good housekeeping at the WWTP through good management during construction Surface water • Good housekeeping at the WWTP through good management during construction

Waste	Construction waste • Construction waste: all material which is finally not used during the construction. Domestic waste caused by • Construction workers daily needs, e.g. waste produced due to lunches, toilet.	**No gap**	Construction waste • Indicate what will happen with the construction waste. Domestic waste • It should be stated what will happen to this waste, construction workers should be made responsible for this.

Natural environment			
Terrestrial flora & fauna	There are no protected natural estates, habitats of natural rarities or protected or endangered species of flora and fauna. There are no negative effects expected on the terrestrial flora and fauna. The site of the WWTP complex is on an old industrial area.	**No gap**	No mitigation measures necessary
Aquatic flora & fauna	There are no negative effects expected on the aquatic flora and fauna during the construction period.	**No gap**	No mitigation measures necessary
Cultural estate	No protected cultural estate registered.	**No gap**	No mitigation measures necessary In case any archaeological objects are found during the construction, it is necessary to inform the authority and to take necessary measures.
Human environment			

General HSE	During the construction phase, workers are inevitably exposed to health, safety and security risks. The following activities (mainly safety) should have special attention; • Excavation work, • Working with heavy machinery, • Working with chemicals, • Working in very noisy environments (noisy machines), • Lifting and or loading of heavy loads. Receptors of this impact are the construction workers of the WWTP. The impact can be classed as minor or major, depending on what will happen in practice. If the correct measures are taken and the correct working atmosphere allows for safe working conditions then the impact will be minor as it will be as low as reasonably practical (ALARP).	Minor gap	For the construction phase an extensive HSE management plan should be made. It should include all relevant aspects (some of them are mentioned in chapter 7 of the EIA) but for labour protection the following is essential: • Provision of PPE (Personal Protection Equipment), specific for each task, • Regular checks in the field if regulations and standards are respected, • Well trained staff for the operations work needed at the WWTP. • Provide medical assistance to all workers, • Education of all workers on their risks and what to do (also hygiene and illnesses – working in an environment where pathogenic bacteria are present).
Population	As to the WWTP and its location there are no adverse affects envisaged for the people in Šabac during the construction period.	**No gap**	No mitigation measures necessary

Table 4.7: Main environmental issues and mitigation measures for operational phase

Type	Description of impact related to activity	Evaluation	Mitigation measures during operational phase
Physical environment			
Air pollution	Caused by • Release of aerosols and unpleasant odours, especially during dry and hot spells.	**No gap**	• **The adaption of a ventilation system in specific rooms** • **The impacts will be reduced by flaring of exhaust gases at recommended temperatures** • **If extreme cases of unpleasant odours appear, the necessary steps for their elimination and control should be taken immediately. This implies adding chemicals.**

Noise & vibrations	Caused by • General operations (compressor station, pumps, etc..)	**No gap**	• Adaption of special measures such as noise attenuators, elastic bedding. • Good maintenance and check up on vehicles and equipment. Periodic control should take place. • Prevent any unnecessary noise production, leaving equipment and vehicles running whilst they are not being used. • Provide ear protection if limits exceed safety standards
Soil pollution	Caused by • Leachate from storage. • Spillage of chemicals, sludge and waste water during operations. • Pollution of river banks and underwater sediments.	**No gap**	• Protection by disposal of waste streams in containers • Strong reduction of discharge of untreated waste water
Water pollution	Groundwater caused by: • Infiltration / leachate of substances on site. Surface water caused by: • Flooding of the WWTP area. • Pollution by discharge of untreated waste water on Sava river. • Accidents on incidences on WWTP • Waste water streams that excess capacity of WWTP • Spillage from chemicals used or cleaning solvents.	**No gap** **No gap** **Minor gap**	Groundwater • Waste streams are protected from rain and disposed of in containers. Surface water: • Apart from appropriate design level, no measures needed • Good maintenance and operation procedures by properly trained employees. Proper HSE plan and practices.

Waste	Domestic waste caused by • General operation of the WWTP, e.g. waste produced by the operators, maintenance.	**No gap**	Domestic waste • It will be collected by mobile containers, capacity determined on basis of number of employees. Disposal to be agreed with the competent public utility service.
	Mineral materials (sand, sludge) from WWTP • General operation of the WWTP and during incidences	**No gap**	Mineral materials from WWTP • Disposed of in containers and silos, according to regulations.
	Solid Waste from primary treatment • Miscellaneous types of solid waste	**No gap**	Waste from primary treatment • To be disposed of in containers and transported to appropriate landfill.
	Chemical management • The storage and use of a limited number of substances	**Minor gap**	Chemical management • It is not clear how these are stored and kept.
Natural environment			
terrestrial flora & fauna	There are no protected natural estates, habitats of natural rarities or protected or endangered species of flora and fauna. There are no negative effects expected on the terrestrial flora and fauna.The site of the WWTP complex is on an old industrial area.	**No gap**	No mitigation measures necessary
Aquatic flora & fauna	There are no negative effects expected on the aquatic flora and fauna.	**No gap**	No mitigation measures necessary. Due to the improvement of the water quality there will be a positive impulse to the aquatic live in the river (which is favourable for the aquatic ecological goals set within the EU Water Framework Directive).

Cultural estate	No protected cultural estate registered	**No gap**	No mitigation measures necessary

Human environment			
General HSE	During the operational phase, workers are inevitably exposed to health, safety and security risks. The following activities (mainly safety) should have special attention; • Working with heavy machinery, • Working with chemicals, • Working in very noisy environments (noisy machines), • Lifting and or loading of heavy loads. Receptors of this impact are the employees of the WWTP. The impact can be classed as minor or major, depending on what will happen in practice. If the correct measures are taken and the correct working atmosphere allows for safe working conditions then the impact will be minor as it will be as low as reasonably practical (ALARP).	**Minor gap**	For the construction phase an extensive HSE management plan should be made. It should include all relevant aspects (some of them are mentioned in chapter 7 of the EIA) but for labour protection the following is essential: • Provision of PPE (Personal Protection Equipment), specific for each task, • Regular checks in the field if regulations and standards are respected, • Well trained staff for the operations work needed at the WWTP. • Provide medical assistance to all workers, Education of all workers on their risks and what to do (also hygiene and illnesses – working in an environment where pathogenic bacteria are present).
Population	With this new WWTP and the choice of its location there are no adverse affects envisaged for the people in the city of Šabac. The WWTP will contribute to a better standard of living.	**No gap**	No mitigation measures necessary

4.8 Additional issues

4.8.1 Monitoring plan during construction and operational phase

Chapter 8 of the EIA deals with the necessity of monitoring. It is stressed that an information system forms a part of the management of the environmental quality.

Monitoring should be a applied during construction and operational phase. The description in chapter 8 needs to be extended to comprise at least:

- Location of sample points or material that will be sampled for analysis;
- Frequency of measurements;
- Analysis to be conducted;
- Filing and archiving of monitoring reports.

Table 4.8: Tentative monitoring plan (as example for consultant)

Environmental compartment	Location	Type of monitoring	Monitoring frequency
Physical environment			
Air quality - noise - odour	- In the vicinity of the WWTP - Based on physical registration		
Sludge	Study of bacteriological activity Sludge before and after drying	Chemical composition, depending on needs for disposal requirements (landfill/agriculture)	
Water quality	Influent WWTP itself Effluent Receiving water body - upstream of discharge point - downstream of discharge point	All relevant parameters, for example: BOD, pH, T, O2, E. Coli, metals (need to check with permit)	Not all parameters have the same frequency. (check with permit)
Human environment			
HSE	At the site	Correct PPE	

4.8.2 Health and safety measures and contingency planning

The EIA deals to minor extent with HSE issues. It is recommended to draw up a management plan that includes HSE matters.

It is advised to include HSE plans in construction permits. Based on interviews with experienced workers in Serbia this is a new way of working which is not so common. The MIASP will therefore be an opportunity to learn and implement this way of working.

4.8.3 Regulatory compliance

The study of estimation of the effects of the waste water treatment plant to the environment is carried in compliance with the Law on estimation of the effects on the environment („RS Official Gazette No. 135/04). Aside of the above, the following Regulations are also used:

- Law on environment basis («FRY Official List No.24/98),
- Law on protection of environment («RS Official Gazette » no. 135/04),
- Water Law (RS Official Gazette no.. 46/91),
- Law on construction of structures («RS Official Gazette » no. 47/2003),
- Decree on water classification (RS Official Gazette no. 3/68),
- Decree on classification of Inter-Republic and Inter-Country water flows (SFRY Official Journal No 6/78),
- Working Rules on hazardous materials and waters (SRS Official Gazette n. 31/82),
- Working Rules on permissible quantities of hazardous and detrimental substances in land (RS Official Gazette nos. 11/90 and 23/94),
- Law on safety at work (RS Official Gazette no. 42/91),
- Working Rules on permissible environment noise level (RS Official Gazette no 54/92),
- Law on cultural property (RS Official Gazette no. 71/94).

4.8.4 Public Participation

At the time of writing this study there was no report available on public participation.

4.8.5 Resettlement

Resettlement is not relevant to this project investment. There are no houses or any other buildings in the vicinity.

4.8.6 Social analysis of the project

Population
The construction of the WWTP at Šabac will not have an adverse effect on the population of the city.

Construction phase
During the construction phase this project will provide jobs for the construction of the WWTP. There is no need for people to be resettled. There will be an increase of traffic as to the transport of building-materials to the site. Since the site is on a industrial area inhabitants that could be burdened, are not present.

Operational phase
During operations, the WWTP needs to be maintained and controlled which will provide job opportunities in the region.

4.8.7 Impact on public health

The impact on public health of the WWTP will be very positive. It is expected that it will reduce the amount of sick people directly related to contact with the river. It will reduce the amount of E-coli bacteria which is an indicator for the presence of pathogenic bacteria which can cause illnesses (leading to diarrhoea, stomach pains etc.). Treating the waste water in this WWTP is a great start and in line with EU Directives.

Construction phase
There will be no negative impacts on public health during construction phase. To limit any possible negative impacts to the construction workers it is essential to have a Health Safety and Environmental Management plan in place, making sure that all the PPE (Personal Protective Clothing is present) is made available to the workers and that they are properly trained and aware of the risks during construction. This must be demanded by the construction company.

Operational phase
Possible impacts on the public are neglect able, as wind directions are favourable and there are no other risks involved for the WWTP.
The operator(s) of the WWTP must be fully trained and equipped to properly run the WWTP.

4.9 Conclusion and Recommendations

4.9.1 Conclusion

The construction of the WWTP in Šabac will lead to an amelioration of water quality of the Sava river. This will have a positive effect on public health and aquatic ecosystem of the river. From an environmental and social point of view there are no potential hazards or 'show-stoppers' in order for this project not to be financed as long as all the mitigation measures are taken and the monitoring programme is properly executed

4.9.2 Recommendation

The following issues need to be described or solved if not known. It is recommended to draw up a general management plan that includes the following plans:

HSE plan
For the construction and operational phase an extensive HSE management plan should be made. It should include all relevant aspects (some of them are mentioned in chapter 7 of the EIA) for ensure working conditions.

Chemical management
As to the management of chemicals used in the operation of the WWTP, it should be described what types will be used, how they are stored and kept. Preferably this forms part of the general management plan.

Monitoring plan
A monitoring plan should be part of the general management plan and elaborate on the monitoring of critical process issues.

5 FINANCIAL AND SOCIAL ANALYSIS

5.1 Financial assessment Public Utility Company

This paragraph sets out an analysis of the PUC Vodovod - Šabac of the Municipality of Šabac. The public utility company provides a variety of services related to the water and waste water system including sewerage system maintenance, it is also registered to render additional services such as civil engineering works, designing, and other services that include marketing and public relations. The analysis will deal with the PUC as a whole, but where required, will zoom in on specifically water and waste water related activities. This is done with a view to provide proper data for the financial modeling of the future water & wastewater activities.

5.1.1 Profit and Loss statements

In 1937, the city of Šabac introduced first organized water supply on its territory, and that year is considered the founding year of the present water supply company. After several organizational transformations the company was in 1989 registered by its founder, the Municipality of Šabac, as a public company.

The activities of the company set out at its founding, remained unchanged, and its primary activities are: the production and distribution of water and maintenance of the city's water system, purification and conveyance of sewerage and atmospheric waters, supervision over the quality of the potable water, sanitary protection and securing of the water system plant, maintenance, reconstruction and expansion of the water and waste water systems.

In financial reporting, the Company maintains its accounting records in Serbian dinar (RSD) and prepares its statutory financial statements in accordance with the Serbian Law on Accounting. The accompanying financial statements are based on the statutory records, with adjustments and reclassifications recorded for the purpose of fair presentation in accordance with IFRS. Official data are submitted to the Central Bank of Serbia.

Table 5.1 Profit & Loss statement PUC Vodovod - Šabac (RSD '000)

		2004 actual		2005 actual		2006 actual		2007 plan	
No	**Description**	**RSD**	**%**	**RSD**	**%**	**RSD**	**%**	**RSD**	**%**
1.	**Total revenues**	**138.518**	**100**	**192.163**	**100**	**214.441**	**100**	**247.941**	**100**
1.1.	Revenues from the business	137.162	99	179.203	93	200.223	93	247.941	**100**
1.2.	Other revenues	1.356	1	12.960	7	14.218	7	-	**0**
2.	**Expenditures**	**203.306**	**147**	**229.867**	**120**	**256.591**	**120**	**285.567**	**115**

2.1.1	Material costs	41.819	30	52.255	27	67.374	31	62.943	**25**
2.1.2	Salaries	71.436	52	87.446	46	101.404	47	114.852	**46**
2.1.3	Depreciation	61.633	44	62.227	32	64.801	30	74.136	**30**
2.1.4	Other	28.418	21	27.939	15	23.012	11	33.636	**14**
3.	**GROSS PROFIT**	**(64.788)**	**-47**	**(37.704)**	**-20**	**(42.150)**	**-20**	**(37.626)**	**-15**
3.1.	Net Interest payment	**4.399**	**3**	**21.736**	**11**	**7.018**	**3**	**8.735**	**4**
3.2.	Net extraordinary items	**(4.074)**	**-3**	**(71)**	**0**	**1.475**	**1**	**2.911**	**1**
3.3.	Taxes and contributions	-	**0**	-	**0**	-	**0**	-	**0**
4.	**NET PROFIT**	**(64.463)**	**-47**	**(16.039)**	**-8,3**	**(33.657)**	**-16**	**(25.980)**	**-10**

Below are some of the most important findings of the financial performance analysis of the PUC Vodovod - Šabac:

Profitability and revenues

- Main feature of the profit & loss statement of PUC Vodovod are consistent operational losses for the observing years, the highest loss was recorded in 2004 at 47%. In 2005 and 2006 operational losses were 20% of total revenues. Net profits were also consistently negative, again highest at 47% in 2004 to 16% of total revenues in 2006. A breakdown of this net interest receivable revealed that this mainly consists of large operational subsidies/transfers of the Šabac municipality through the Land Construction Management Public Company to the PUC, to cover the costs of non revenue generating services
- Financial performance at 0% profit (or in this case the result is negative at almost 50%) is more or less general practice of most other PUCs in Serbia, and the PUC Vodovod, Šabac is not an exception.
- Total revenues of the PUC Vodovod – Šabac range from RSD 139 million (€1,7 million) in 2004 to RSD 214 million (€ 2,7 million) in 2006. In total, revenues have increased by 56% for the period of 3 years. Revenues from business activities compared to total revenues are dominant throughout the observed period at 99% in 2004, and slightly decreasing, but still rather high at 93%, in 2006. This situation is typical for PUCs in Serbia.
- The plan for year 2007 is to increase total revenues by 16% and comprise of the 7.5%, the officially allowed tariff increase (which is maximized at 7.5%).
- Total expenditures of the PUC Vodovod - Šabac ranged from RSD 203 million in 2004, to RSD 256 million in 2006. Total expenditures exceeded total revenues at the average of 20% for the observing years.
- In 2005 and 2006 the Net extraordinary items relate to debts paid from previous years, sponsorships, insurance premiums. The PUC also signed a business agreement with one of the legal offices in the municipality, by which this office acts as a legal representative of the PUC in the court proceedings, charging the PUC percentage out of the amounts they succeed to retrieve.

Table 5.2 Total Expenditures PUC – Vodovod - Šabac (RSD 000)

No	Description	2004		2005		2006		2007 plan	
		RSD	%	RSD	%	RSD	%	RSD	%
2.	**Expenditures**	**203.306**	**100%**	**229.867**	**100%**	**256.591**	**100%**	**285.567**	**100%**
2.1	Material costs	41.819	21%	52.255	23%	67.374	26%	62.943	22%
2.2	Salaries	71.436	35%	87.446	38%	101.404	40%	114.852	40%
2.3	Depreciation	61.633	30%	62.227	27%	64.801	25%	74.136	26%
2.4	Other	28.418	14%	27.939	12%	23.012	9%	33.636	12%

Expenditures

- Most significant items on the expenditure side of the PUC are salaries and material costs. Salaries ranged from 35% in 2004 to 40% in 2006. This reflects the typical situation of state owned companies, in which labor costs overtime become almost fixed costs. Increase in salaries is strictly prescribed by the Government, through the Ministry of Finance. The planned 2007 expenditure on salaries is 40% same like in 2006. This increase in salaries of 13% in 2007 is the result of the legally allowed increase in mass of salaries of 9.5% plus some allowed increase for employment of the 3 new, full time workers and 20 part time workers, since the PUC had planned considerable investment activities. With the start of the autumn season, the PUC employs seasonal workers, in order to support the extended requirements in rendering a range of activities (repairs on the network, emergency teams etc.)
- Another large share of total expenditure can be attributed to material costs, ranging from 21% to 26%. Large expenditures on fuel, electricity and maintenance, are typical for this type of company.
- Depreciation costs as a share of total costs are range from 30% in 2004 to 27% and 25% in 2005 and 2006 respectively. These costs make almost one third of total expenditures. This is logical, and supported by the fact that the company had extensive investment activity in the earlier period, which resulted in the increase of its fixed assets; the plans for 2007 are depreciation costs at 26% in respect to total costs. This reflects the fact that the equipment and other assets are significant and in a relatively good condition. It could also be observed at this point that, there is an ever existing problem of a negative financial result, which the PUCs (in general) cannot overcome by permitted tariff increase (administratively set out), and are therefore unable to generate more revenue. It is also clear that depreciation costs are meant to replace fixed assets that are written off, and enable in the long run stable functioning of every such company, if this is not the case, functioning of the company is at a high risk. (in the PUCs in Serbia depreciation costs do not exceed 8 %-10%). In order to maintain its sound operating, this company had to take over additional tasks to overcome operational problems of their core activity.
- Net extraordinary items are rather insignificant and range from -3% to 1%. These consist of revenues from outstanding debts already written off that have undergone court proceedings and were decided in favor of the PUC.
- All these indicators reflect the poor financial performance of the PUC Vodovod - Šabac. In the period 2004 to 2006 PUC Vodovod - Šabac operated with negative financial result from operating activities. During the years 2004 to 2006, net profit was negative too. In 2007, the company fears that this negative financial result from operating activities will continue.

5.1.2 Cash flow statements

Table 5.3 Cash flow statement (RSD 000)

Description	2004 actual	2005 actual	2006 actual
A. CASH FLOWS FROM OPERATING ACTIVITIES I. Cash inflows from operating activities	**242.088**	**330.453**	**525.839**
II. Cash outflows from operating activities	**242.107**	**328.315**	**519.526**
III. Net cash inflow from operating activities (I-II)	-19	2.138	6.313
B. CASH FLOW FROM INVESTING ACTIVITIES I. Cash inflow from investing activities	**6.177**	**168.363**	**0**
II. Cash outflow from investing activities	10.045	160.629	0
III. Net cash inflow from investing activity (I-II)	-3.868	7.734	0
C. CASH FLOW FROM FINANCING ACTIVITIES I. Cash inflow from financing activities	**0**	**0**	**0**
II. Cash outflow from financing activities	1.337	0	0
III. Net cash inflow from financing activities (I-II)	-1.337	0	0
D. GROSS INCREASE IN CASH	**248.265**	**498.816**	**525.839**
E. GROSS DECREASE IN CASH	**253.489**	**488.944**	**519.526**
F. NET INCREASE IN CASH	**-5.224**	**9.872**	**6.313**
G. CASH AT THE BEGINNING OF PERIOD	10.090	4.866	14.738
H. CASH AT THE END OF PERIOD	**4.866**	**14.738**	**21.051**

In 2006 **cash inflow from operating activities** increased by 59% compared to 2005. The company plans for the further increase in cash inflow from operating activities. Cash inflow from operating activities increased over the observing period, it was highest from sale of services, the PUC's core activity. However, **cash outflow from operating activities** increased from 2005 to 2006 by 58%, and in respect to 2004, outflow in 2006

increased by two times. This was due to settling accounts payable and salaries for the employees. On balance, the operational cash flow improved considerably during the period, starting form a large negative operational net cash inflow during 2004 to RSD 6, 3 million cash inflow in 2006.

Cash inflow from investing activities for the 2006 was not recorded. However, a large investment inflow in 2005 increased to RSD 168 million. Funds were pooled from the Municipal budget, State allocations, and self-contributions of the local self-governing units.
Cash outflow from investing activities. With the exception of the year 2006, in which the PUC recorded zero investment activities, a significant increase in investment activities was recorded in 2005, amounting to RSD 161 million. Investment activities were mainly related to investing in the sewerage disposal system in the Municipality of Šabac.
On balance, cash flow originating from investment activities was negative in 2004, with the exception of the year 2005.

The cash inflow from financing activities in the period 2004 to 2006 recorded zero cash inflow from financing activities.

Cash outflow from financing activities in 2004 recorded RSD 1, 3 million due to short and long term liabilities. In 2005 and 2006 PUC recorded zero cash outflow from financing activities.

The **overall cash flow** of the PUC was negative in 2004 at RSD 5,0 million and positive at RSD 9,8 million in 2005, and 6,3 million in 2006. This is a common situation for PUCs in Serbia, which typically manage to cover their direct operational costs only, without building up a reserve for replacement and/or capital maintenance of their assets.

At the moment of writing this study, the Cash flow planned for year 2007 was not submitted for the analysis.

However, using as a source the Annual operation plan for 2007, it could be observed, that according to the 2007 plan, adopted R-438/12.2006 dated December 14th, 2006, the PUC Vodovod, Šabac had planned an inflow from investing activities of RSD 260 million or € 3,25 million, for the communal infrastructure development, to be secured from the municipal budget and the 2007 Program of the Directorate for waters. This plan included RSD 21 million (€ 263 thousand) for the water supply system, RSD 220 million (€ 2,8 million–grant by the Directorate for waters and the Municipal budget – 50%;50%) for building of the sewerage system, and RSD 5 million (€ 63 thousand) for the current maintenance of the rainwater inlets. Within these investment plans the PUC has also unsettled obligation of RSD 14,6 million (€ 183 thousand) from previous years' investment activities.

Table 5.4 2007 Investment plan of the PUC Vodovod Šabac RSD '000

No.	Investment	2006 Budget RSD '000	Republic of Serbia	Total
1.	**Water supply system**	21,000,000		**21,000,000**
2.	**Wastewater supply system**	110,000,000	110,000,000	**220,000,000**
3.	**Rainwater inlets maintenance**	5,000,000		**5,000,000**

4.	**Total 2007**	136,000,000	110,000,000	**246,000,000**
5	**c/f from previous period**	14,607,607		**14,607,607**
6	**Total 5+6**	**150,607,607**	**110,000,000**	**260,607,607**

Long term plans of the PUC are related to building of other new objects, reconstruction of the old one's and finalizing works commenced in 2005 and earlier years. These investments were planned at RSD 514 million (€ 6,4 million), and for the funding the PUC was relying on the additional budget transfers. Within these investments RSD 72 million (€ 900 thousand) was planned for the water supply system, RSD 437 million (€ 5,5 million) for building of the sewerage system, and RSD 5 million (€ 63 thousand) for the current maintenance of the rainwater inlets.

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Funds for building the secondary water network, for the satellite settlements, are (planned) to be pooled from the citizens that will participate with a total of RSD 13, million (€ 163 thousand).

5.1.3 Balance sheet review

The table below summarizes the balance sheet of PUC Vodovod, Šabac during the period 2004 to 2007:

Table 5.5 Balance Sheet (RSD '000)

Description	**2004**		**2005**		**2006**	
	RSD	**%**	**RSD**	**%**	**RSD**	**%**
ASSETS	**1.588.262**	**100%**	**1.796.969**	**100%**	**1.930.578**	**100%**
Fixed assets	1.516.155	**95%**	1.635.265	**91%**	1.728.905	**90%**
Current assets	72.107	**5%**	161.704	**9%**	201.673	**10%**
Inventories	21.056	**1%**	19.248	**1%**	18.121	**1%**
Account receivables	46.034	**3%**	108.825	**6%**	150.784	**8%**
Cash and cash equivalent	4.866	**0%**	14.738	**1%**	21.051	**1%**
Accrued	151	**0%**	18.893	**1%**	11.717	**1%**
LIABILITIES	**1.588.262**	**100%**	**1.796.969**	**100%**	**1.930.578**	**100%**
Equity	1.545.536	**97%**	1.729.772	**96%**	1.875.641	**97%**
Losses	64.463	**4%**	79.668		112.156	**6%**
Long term reserves	0	**0%**	0	**4%**	0	**0%**
Liabilities	42.726	**3%**	67.197	**0%**	54.937	**3%**
Long term liabilities	4.960	**0%**	3.690	**4%**	1.703	**0%**
Long term loans	4.960	**0%**	3.690	**0%**	1.703	**0%**
Short term liabilities & Accrual	37.766	**2%**	63.507	**0%**	53.234	**3%**
Short term loans	0	**0%**	0	**4%**	0	**0%**
Accounts payable	34.772	**2%**	59.937	**0%**	49.149	**3%**
Accruals	2.994	**0%**	3.570	**3%**	4.085	**0%**

Compared to 2004, fixed **assets** increased by 23% in 2005 and 9% in 2006. On the average there was little change in the structure of fixed to total assets.

Current assets in this period increased almost two and half times. Within current assets, **account receivables** were dominant. In 2006 account receivables increased twice compared to 2004. The PUC plans to improve its situation regarding their debtors and lower this trend significantly.
However the **Equity** of the company remained over the past several years almost on the same level. There was an increase in 2006 (in respect to 2004) of 23%.Since at the time of writing the study financial reports were not submitted for the analysis, the observation can be made according to the investment activities that the company has planned to further increase its capital in 2007. This situation, in general would change, once the public companies enter the process of privatization.

In respect to borrowing from commercial banks, the company has taken one long term loan during the analyzed period**.** The total outstanding amount on 31 December 2006 was RSD 1, 7 million or € 21,2 thousand. Short term loans in 2006 were not recorded. In 2007, the company plans to take further long term loans.

Accounts payable for the period show that the company still had not succeeded in lowering its debts. Their share in total liabilities ranges from 2% to 3%, and they are actively working on settling their past due obligations. However, the company owes less than it is owed to, and the policy to settle the outstanding debts is occasionally successful (as elaborated on earlier in the text).

Accruals are related to advances (contracts signed) from households for connections to the wastewater network, which is being built for the (6) settlements within the Municipality of Šabac. Connection fee for one household is set at € 600, for budgetary beneficiaries
€ 1,000, business premises € 1,500 and industry € 2,000.

According to the Decision of the Ministry of Waters, Agriculture and Forestry, the company is also obliged to pay to pay an annual fee of RSD 300 thousand (€ 4 thousand) for the protection and utilization of waters).

The PUC Vodovod – Šabac in the observed years recorded **Losses** ranging from 4% to 5% in respect to total assets. Compared to 2004 the Company recorded losses at 74% in 2006. According to annual reports of the PUC Vodovod, Šabac, these losses relate to the losses on the network (35% to 40% in 2006), and overstaffing.

For the purposes of analyzing the balance sheets of the PUC and specifically the level of indebtedness and liquidity, the following indicators are used:

- **Net Current Fund (NCF)**: the relation between long term assets (fixed assets plus long term financial investments) and long term funds (own capital plus long term debts/financial obligations). A positive value of NCF is a simple and relatively reliable indicator of soundness of the financial situation of the company;
- **Relation between NCF and stocks**: this is an additional test of company's financial position of liquidity and general indebtedness. Again, a positive value of this indicator reflects a good financial position;
- **Relation between total revenues and net debt**: calculated as the share of fixed assets, other long term investments and stocks, which are financed with borrowed

funds. This includes loans, but also receivables and other non-paid financial liabilities. A common benchmark is that borrowed funds expressed as a share of total revenues should not exceed 10% of total revenues.

Table 5.6 Balance sheet indicators – PUC Vodovod Šabac (RSD '000)

No.	Indicator	2004	2005	2006
1.	Long term sources (own capital and other long term sources)	1.550.496	1.733.462	1.877.344
2.	Long term assets (fixed assets and long-term investments)	1.516.155	1.635.265	1.728.905
3.	Net current fund - NCF (1-2)	34.341	98.197	148.439
4.	NCF minus Stocks	13.285	78.949	130.318
5.	Borrowed sources/Total revenues (general indebtedness)	28,7%	33,1%	23,7%
	LIQUIDITY RATIO I, II and III			
6.	Rigorous Liquidity Ratio (Cash/Short term liabilities)	0,13	0,23	0,40
7.	Current Liquidity Ratio (Short term receivables and cash/Short Term Liabilities)	1,35	1,95	3,23
8.	General Liquidity Ratio (Short term receivables and cash and stocks/Short Term Liabilities)	1,91	2,55	3,79

The main findings regarding the balance sheet review of Vodovod PUC are:

- A common benchmark is that General Liquidity ratio should be 2, and Current liquidity ratio and Rigorous liquidity ratio should be 1.
- ***General liquidity ratio.*** This ratio was well over a common benchmark of 2 in the observing years 2005 and 2006, and the liquidity was almost 2 in 2004. During the years 2004 and 2006. ***Current liquidity ratio*** shows good performance of the PUC for the observed period. However, ***rigorous liquidity ratio*** over the observed period shows actually that the PUC has problems in covering short term liabilities, since it is dramatically less than 1. There is a lack of cash for current operating activities (as a rule present in every public utility company in the country).
- **Net current fund** has a positive value in all years. The indicators of indebtedness are relatively high in the range of 29% in 2004, 33% in 2005 and 24% in 2006. This reflects a relatively active investment activity of the PUC and at the same time a model of investment in which the local budget is taking an active part. (However, a common benchmark is that borrowed funds expressed as a share of total revenues should not exceed 10% of total revenues. It is clear that PUC Vodovod Šabac exceeds this criterion.

5.1.4 Capital structure

The PUC Vodovod Šabac was founded in 1989. The PUC, as the majority of public utility companies in Serbia is organized as a 100% state owned company. Therefore, the Municipality of Šabac has a majority right of management. Ever since founding of the PUC Vodovod - Šabac, there was no change in the capital structure. However, with the Government plans on privatizing public companies, there will definitely be some change in the capital structure of public utility companies in the near future.

Table 5.7 Ownership structure (2006)

No	Capital	'000 RSD	Structure (%)
1.	Legal reserves		
2.	Shareholders capital		
3.	Public capital	1,875,641	100%
4.	Other capital		
	Total Capital	1,875,641	**100%**

5.1.5 Water and waste water tariffs, revenue and collection rates by customer group

Tariffs and revenues

Tariffs for utility companies are regulated and capped by the Ministry of Finance since the year 2006. The current general policy is that tariffs are not allowed to be increased beyond the year's estimated inflation. For the year 2007, the maximum tariff increase has been set at 7.5%. For this reason, PUCs are currently severely constrained in applying a full cost based tariff setting approach. In general, water and waste water tariffs are already at below cost recovery levels, whereas considerable investments will be required to rehabilitate existing infrastructure, let alone extension of service coverage or introduction of new services like waste water treatment.

Tariffs are differentiated by customer groups, with the set for lowest for households and the highest tariff for the business category and the army and (and in this municipality this ratio is 1:3).This differentiation is not based on actual cost of service, but rather on the perceived ability to pay. The third category relates to schools, hospitals, and other budgetary beneficiaries. This category is charged slightly higher than the households.

The tariff policy is decided on and approved by the Municipal Assembly. Each municipality in Serbia has its own policy of deciding on the moment of tariff increase, often using its power as the PUC owner, and holding the increase for the political or other reasons. Tariffs are often not increased before political elections to maintain social peace.

In this paragraph, a breakdown of customers, revenues and collection rates for the combined services of the PUC Vodovod, Šabac will be provided and analyzed. The following customer groups are distinguished:

- Domestic users
- Industries and small businesses
- Institutions/budget organizations
- In 2007, a category of Social beneficiaries is introduced

The Municipality of Šabac had allowed last tariff increase, for the PUC's operating on their territory, in July 2007. The analysis was done based on the tariffs approved by the Municipal Assembly, in December 2005 to be applied in 2006.

The tables below show tariffs invoiced and collected revenue and collection rate as at 31.12.2006, separately for water and waste water, and a combined table for both services, which is the core activity of the PUC Vodovod, Šabac.

Table 5.8 Total Revenue and Collection rates for water services in 2006 RSD '000

No	Consumers/categories	Tariff/m3 (no VAT)	Consumption in m3 in '000	Annual revenue in RSD '000	Average collection rate%	Revenue collected
1	**2**	**3**	**4**	**5(3x4)**	**6**	**7(5x6)**
1	Households	14.68	3,531,176	51,827	97%	50,459
2	Industry/businesses	46.55	725,327	33,763	87%	29,453
3	Schools/culture/sports	17.47	340,344	5,945	86%	5,133
	Total		4,596,847	91,536	93%	85,044

The PUC Vodovod Šabac, also has a very poor system of waste water treatment a plant that has low capacity to treat all the consumers in the municipality. The only industry that has some wastewater treatment is the factory of "White Tin" production (owned by the USSteel). Other industries are discharging their waste waters directly into the river Sava.

The Municipality of Šabac, and the state of Serbia will have to deal seriously with the problem of waste water discharge, and this is crucial for the entire region and for the WWTP project.

Table 5.9 Total Revenue and Collection rates for waste water services/2006 RSD '000

No	Consumers/categories	Tariff/m3 (no VAT)	Consumption in m3 in '000	Annual revenue in RSD '000	Average collection rate%	Revenue collected
1	**2**	**3**	**4**	**5(3x4)**	**6**	**7(5x6)**
1	Households	5,99	3.531.176	21.138	88%	18.663
2	Industry/businesses	18,70	725.327	13.561	80%	10.893
3	Schools, Institutional	7,01	340.344	2.384	80%	1.898
4						
	Total		4.596.847	37.083	85%	31.455

Waste water tariffs are set at 27% of the drinking water tariffs. Waste water tariffs are charged pro-rata the quantity of drinking water consumed, without applying a factor water to waste water (usually, wastewater actually discharged into the sewer system is less than the quantity of drinking water consumed).

Finally the table below summarizes data on the households on one side and other consumers on the other, and their consumption, collection rate and revenue invoiced and collected:

Table 5.10 Šabac Total collection rates for water/wastewater services/2006 RSD' 000

No	Consumers/categories	Consumption in m3	Annual revenue/invoiced	Average collection rate%	Revenue collected
	Households	3,531,176	72,965	95%	69,122
	Other	1,065,671	55,654	85%	47,377
	Total	4,596,847	128,619	91%	116,499

The tables below set out tariffs for respectively water and waste water services, charged to different groups of users during the last 7 years. As can be concluded from the table, the Municipal Assembly has approved two rather steep tariff increases during in February 2002 (almost doubling the tariffs from August 2001), and in December 2004. The Assembly was than increasing tariffs only once a year and there were no significant increases in the later years. The last tariff increase was allowed in 2007. It must be mentioned that as from 2005, 8% VAT is applicable to utility invoices. This resulted in an increase of the tariffs payable by final consumers with 8%. For the years 2006 and 2007, tariffs are increased with the maximum allowed percentage of respectively 9.3% and 7.5%.

Table 5.11 Water tariffs RSD/m3 (without VAT)

Consumers/ Categories	**2000 June**	**2001 Jan**	**2001 Aug.**	**2002 Feb.**	**2004 May**	**2004 Dec.**	**2005 Dec.**	**2006 Dec.**	**2007 July**
Households	1.65	2.47	3.64	7.2	7.33	11.05	14.68	16.26	17.21
Business/ Industries	6.6	9.87	14.55	28.8	29.05	44.27	46.55	51.65	54.59
Schools/culture/sports	2.21	3.31	4.85	9.36	9.61	14.57	17.47	18.67	20.42
Social category									8.69

Table 5.12 Wastewater tariffs RSD/m3 (without VAT)

Consumers/ categories	**2000 June**	**2001 Jan**	**2001 Aug.**	**2002 Feb.**	**2004 May**	**2004 Dec.**	**2005 Dec.**	**2006 Dec.**	**2007 July**
Households	0.6	0.9	1.35	2.8	2.94	4.53	5.99	6.12	7.02
Business/ Institutional	2.4	3.59	5.38	11.2	11.34	17.27	18.70	19.16	22.05
Schools/culture/sports	0.79	1.18	1.79	3.64	3.78	5.72	7.01	6.96	8.34
Social category									3.60
Emptying septic tanks/m3							150.0	163.95	176.25

5.1.6 Cost structure water and wastewater services

Cost structure

PUC Vodovod Šabac records all its costs at company level. No breakdown is available for costs by service or place of origin. Therefore, for the purposes of estimating costs incurred for water and waste water and to arrive at an estimate of variable and fixed costs, data had to be extracted manually from the companies' financial accounts.

Certain costs vary directly with each increase or decrease of production units. For example, electricity consumption will increase if more water is produced from the PUC's drinking water wells. These costs are called variable costs. For this study, the following variable costs are identified:

- Electricity consumption
- Fuel consumption
- Chemical consumption

Other costs do not directly fluctuate in the short run when production is increased. These costs are known as fixed costs. The following costs belong to this category:

- Wages & salaries
- Repair & Maintenance
- Taxes and fees
- Depreciation

For the purpose of the financial analysis, the PUC has divided the company into four departments, subdividing costs into fixed and variable for each department:

- Drinking water supply;
- Wastewater/sewerage;
- Financial and general department overhead costs. This includes costs for the financial & accounting unit, sales department, customer service, billing & collection;
- Other overhead costs. This includes costs for general management, department for investment and development as well as human resources and legal affairs department.

An organization chart of the current PUC organization is included in chapter 7. The PUC often shifts people and equipment between departments, in case of urgent repairs, leakages, lack of staff for interventions etc. Therefore, it should be kept in mind that costs cannot be divided strictly between the various identified departments. Despite this, it is believed that the table below provides the best available estimate of direct costs incurred by service.

Table 5.13 Cost break down for different services

	2006	2007 plan
Water supply	**182.988,115**	**206.705,947**
Variable costs	12.171,502	13.285,906
Fixed costs	170.816,613	193.420,041
Water supply/total costs	70%	72%
Wastewater	**12.425,514**	**14.700,937**
Variable costs	2.049,941	2.254,935
Fixed costs	10.375,573	12.446,002
Wastewater/total costs	5%	5%
Financial	**49.650,258**	**46.661,708**
Fixed costs	49.650,258	46.661,708
Financial/ total costs	19%	16%
Overhead costs	**15.469,126**	**19.239,215**
Fixed costs	15.469,126	19.239,215
Overhead/total costs	6%	7%

Subtotal Variable costs	**14.221,443**	**15.540,841**
Subtotal Fixed costs	**246.311,571**	**271.766,966**
Total costs	**260.533,013**	**287.307,807**

Fixed costs account for by far the largest share of total costs with more than 90%. This is mainly comprised of wages and salaries, as well as large write downs of bad debt. Variable costs are small at less than 10%.

Drinking water costs are the largest cost component with more than 70%. Overhead costs are 6% of total costs.

The share of total variable and fixed costs of the wastewater department in total costs of the company vary and are low due to the fact that the company does not actually treat waste water and thus does not consume a lot of chemicals or electricity. Total sewage collection services only account for 5% of total costs. The PUC Vodovod Šabac has very small capacities that are functioning for wastewater removal, and very little wastewater treatment.

Since the PUC does not have a decentralized financial management system which allocates overhead to various (productive) departments, the following methodology is used to arrive at an estimate of total water/wastewater costs, including overhead:

- First, total overhead costs are calculated. For PUC Vodovod Šabac, overhead costs consist of the costs of the financial department and other overhead costs;
- Next, for each of the productive departments, the total gross payroll costs are determined;
- Finally, total overhead costs are divided over the various productive departments pro-rata their share in gross payroll.

The rationale for this methodology lies in the assumption that the majority of overhead costs (office costs, human resources costs, financial accounting etc) are directly related to the number of people employed by each of the productive departments.

Cost recovery

As a general rule, in the analysis of this PUC and in the PUC's alike, full cost recovery can only be achieved through economically set tariffs. From the profit & loss it can be concluded that for the PUC as a whole, tariffs are just sufficient to cover the operating costs. However, it should be kept in mind that the PUC receives considerable operational subsidies from the municipality. These subsidies are in principle paid to offset the costs of non revenue earning services performed by the PUC such as street cleaning, road maintenance etc. However, from the accounts it is not clear what the individual services actually cost and thus, whether the subsidies received are sufficient or not.

Since this study is mainly concerned with water & wastewater, an attempt is made to assess the level of cost recovery for these services.

It can be concluded that the current tariffs are just sufficient to cover the current costs, with a clear declining trend over the years. A continuation of this trend would deteriorate the financial sustainability of the company.

5.1.7 Assets

Except for land, capital assets are depreciated each year and the total accumulated depreciation is deducted from the original cost. With the exception of land, capital assets wear out in time or otherwise lose their economic usefulness. Between the time when a given asset is acquired and when it is no longer economically useful, a decrease in its value takes place. This loss in value over a period of years is known as depreciation. Depletion is a term applied to tangible fixed assets, whereas amortization is a term sometimes used to describe the writing off of intangible assets such as patents and trademarks.

All the purchases during the observed years 2004 to 2006 are valued at historical cost. Depreciation is calculated based on the historical value of the real estates, installations and equipment, and intangible assets, applying the linear method.

Table 5.14 Plant and equipment at 31.12. 2006 (RSD '000)

No.	Item	Land	Buildings	Equipment	Plants/ equipment in preparation	Total
1	Purchase value (31.12.05)	95,688	966,573	564,444	501,202	2.127,907
2	Additions		82,196	1,956	156,485	240,637
3	Written off (31.12.06)				82,196	82,196
4	Subtotal 31.12.2006	95,688	1,048,769	566,400	575,491	2.286,348
5	Accumulated depreciation 31.12.2005		175,881	318,690		494,571
6	Depreciation 2006		20,781	44,020		64,801
7	Disposals					
8	Subtotal (5+6)		196,662	362,710		559,372
9	Net book value 31.12.2006 (4-8)	95,688	856,107	203,690	575,491	1.726,976
10	Net book value 31.12.2005 (1-5)	95,688	790,692	501.202		1.633,336

Total net asset value for plant and equipment as at 31 December 2006 is RSD 1, 7 billion or € 22 million. Plant and equipment in preparation were also depreciated in 2006. Land is not depreciated.

As we have seen earlier through the analysis of the Profit and Loss statement, in case of the PUC Vodovod,Šabac, depreciation costs are rather high, ranging from 25% to 30% in the observed period 2004-2006, due to intensive investing in fixed assets. In addition, some fixed assets are not recognized in the balance sheet of the PUC, but remain with the body which originally invested or financed the assets. For example, quite some assets operated by the PUC, but invested directly by the Municipality through its Land construction management (public) company are not shown in the PUC's balance sheet. It is not known currently what the size is of these off balance sheet assets,

The major categories of assets related to water and waste water are depreciated annually at the following rates:

- Buildings and civil works:
- Head office 2.5%;
- Water distribution network 2.5%;
- Pumping stations 1.5%;
- Wells 10%;
- Other buildings / water treatment 2.5%;
- Other buildings / water supply network 8%;
- Other buildings / waste water treatment 2%;

For mechanical and electrical equipment, the following rates are used:

- Electrical equipment on capital objects 8%;
- Other mechanical/electrical equipment 6% - 10%;

These rates are in accordance with the government regulation, and are applied respecting the instructions from the Treasury department. By these instructions, fixed assets are depreciated annually, at the end of the fiscal year. However, legal option also leaves it at the company's discretion to depreciate its assets according to their internal regulations, within the period not exceeding 5 years.

The PUC does not regularly revaluate their fixed assets. In an inflationary environment, this leads to the understatement of the real value of the fixed assets if this is valued at historical cost.

5.1.8 Extraordinary revenues and expenditures

Apart from the substantial operational subsidies the PUC receives from the municipality, no other significant extraordinary revenues and expenditure are incurred.

5.1.9 Financial self sufficiency and the current use of profits

In our analysis of the PUC Vodovod,Šabac and through the practice in analyzing other PUC's in Serbia, it is evident that none of these companies is capable of functioning on its own. At best, tariffs are sufficient to cover the direct operating costs. Investments usually are funded directly by the municipality, since these cannot be funded by the PUC from internally generated cash flow. As a result of near zero profits and a low capital base/low depreciation charge, the generated cash flow is only slightly positive.

The PUC is limited in setting its own tariffs. Any tariff adjustments need to be approved by the municipal council, and since 2006 are regulated by the Ministry of Finance.

Any profits made are added to the internal reserves of the company, rather than paid out as dividend.

5.1.10 Billing and collection system

- Billing of the customers is done through a combined invoice covering district heating, solid waste collection and water & waste water services. Invoices are issued every month for all consumers' categories.

- In respect to outstanding debts, the PUC Vodovod - Šabac is developing a policy by which it hopes to overcome various collection problems. Namely, problems are present within the largest group of debtors – owners of small businesses. The premises they occupy are usually rented and they are often changing tenants, water meters are hard to access, and readings are usually incorrect. Cutting off water supply is almost impossible, since these premises are usually in residential buildings, where this measure is impossible to apply. Next consumer category – the citizens, is another large debtor, and legal actions of the PUC to take non paying citizens to court, as a method of settling outstanding debt, proved to be inefficient. The PUC has no mechanism of sending every individual debtor to court, and their policy is that, at the year end, complaints are delivered to all clients to settle their outstanding debts before being sent to court. In the past two years they were also offered a possibility to reschedule their current debt.

- The policy of the Company in this period was also directed towards settling of the entire debt without charging overdue interest. This action was successful, but in the long run, the Company is concerned that it would discourage regular paying consumers. Due to various (above said) reasons, the PUC is unable to read the consumption of over 30% of their clients. The problem of cutting off the water supply for the non paying clients is as well supported by the fact that water meters are the property of the clients. In order to cut off one of these clients (living in residential houses) the entire water supply in that particular block has to be disconnected. The citizens usually prevent the PUC team to access the water shaft, and the action is therefore disabled. The company also encourages direct collecting by sending company employees to the non paying clients (the company pays to these employees 2.5% commission of the amounts they collect directly - presently there are 4 permanent and 8 part time employs on this assignment)

Table 5 .15 Revenue collected by various methods in 2006/ RSD'000

Collection method	Collected amount	% of the Total
At PUC counters	67,099	57.5%
Though gyro accounts	31,641	27.0%
Cutting off of services	6,503	5.6%
Through legal proceedings	7,449	6.4%
Directly by PUC employees	4,063	3.5%
Total	116,756	100%

The above table shows that the highest share of 58% of invoiced revenues was collected directly at the PUC counters; 27% was collected through gyro accounts; settling of debts after cutting off water supply for non payment; through legal

proceedings the revenue collected was 6% of the total revenue collected in 2006. Door to door collection, by the company employees, was only 3.5% of the collected revenues.

The PUC Vodovod Šabac, has also developed a system of automatic-telephone access to their data base available for clients through menu options which enables clients to inquire about certain services.

Although the PUC regularly sends to court all the clients that fall under the non-paying category, the courts in Serbia are rather slow in addressing complaints, and it may take up to several years before any court decision actually emerges. However, upon reaching court decision, the PUC, has the legal right to write off their outstanding debts. This practice is not in line with international accounting standards (IAS) and might lead to the underreporting of expenditures and liabilities of the company.

A number of measures could be considered, such as:

- Determine a strong policy on detecting and eliminating losses, by replacing those parts of the network that are causing leakage problems.
- Introduce policy on water meter replacement, with timely planning. The early identification and prompt removal and replacement of non-functioning meters. For metered customers, a monthly estimate could be made and invoiced, based on their past consumption patterns. Meter reading could then be done on an annual basis, followed by a final settlement; Intensify control over the water meters that are detected to be incorrect.
- Improve water metering along the supply and distribution network, not just at the end consumers.
- Pursue settlement of each invoice, instead of waiting until the end of the year;
- Introduce a plan for advanced monitoring of the consumption in order to decrease a number of illegal consumers (non-paying)
- Establish a clear disconnection and reconnection policy, backed by the municipality and council.

5.1.11 Financial management and budgeting practices and systems

<u>Budgeting system & investment planning</u>
Once per year, a consolidated annual plan and budget is submitted to the Municipal Council for approval. This budget contains:

- A review of last year's operations, including financial overview (budget/realized);
- A descriptive part setting out the plan for the next year;
- A cost/spending budget for the next year;
- An investment plan for the next year, including financing plan;
- A proposed tariff structure for the next year;
- A proposal for operational subsidies from the Municipality.

If approved, this annual plan forms the basis of the operations for the PUC. Problems with this system are:

- Only a 1 year investment and financing plan is prepared. Investments in water/waste water infrastructure are long term in nature, necessitating long term planning and its financing as well;
- Management of the budget is centralized. Monthly management reports compare (cumulative) actual expenditure against the approved budget at the level of the PUC only. No budgets are made available by service line, managed by department heads, nor are costs recorded by service line. Such a hierarchical management system prevents flexibility of operations and actually might lead to higher cost.
- Limited information is available on the actual costs by service; setting of cost based tariffs is therefore next to impossible.
- Data generated for the Financial Reports are not detailed for disclosing information on the costs and revenues related to specific customer groups.

Short term financing

In order to maintain uninterrupted functioning of its company, the PUC has two ways of providing necessary financial means. It is either through borrowing from commercial banks, or through municipal subventions. In respect to subventions from the Municipality of Šabac, the PUC Vodovod, Šabac has to follow a rather strict procedure in order to obtain any funding. The PUC has to provide a list of documents that is often more extensive than the list of documents required by a bank for a commercial loan. However, PUC Vodovod, Šabac rather requests subventions, since this is interest free.

The PUC Vodovod Šabac, however does not take any short term loans, in order to perform their core activity.

Long term financing

PUC Vodovod, Šabac took one long term commercial loan in 2003 with AIK bank, to finance purchase of a special truck plus spare parts, for different purposes, in the total amount of € 103 thousand By this loan agreement the, the company had to place advance payment of 20% of the total contract value, and the remaining 80% is repayable in RSD at Euribor+9%. The repayment period was spread over 48 equal monthly installments (4 years), the first falling due 15 days from signing of the contract (December 15, 2003). The last installment has fallen due on November 15, 2007.

5.1.12 Accounts receivable and bad debts

Accounts receivable

The table below shows a list of major debtors of the PUC Vodovod Šabac for the years 2005 and 2006. During these years, the highest debtor is the “7 Juli Šabac”, a Public Transport Co. making respectively 5% and 6% out of the nine major debtors.

The second largest debtor is the PUC Land construction management with which the PUC Vodovod Šabac signs bilateral contracts for the operations that are within the scope of activity of the PUC Vodovod. For the performed services the PUC Vodovod Šabac presents an invoice to the other company. The settling of outstanding debt with Land construction management (public) company is an issue of continuous negotiations. The Municipality of Šabac is also among the first four debtors in both years (the same payment procedure is applied as with Land construction management company).

It could be observed that the total receivables in 2006 increased by 39% compared to 2005.

Table 5.16 Major debtors 2005

No	NAME	RSD (000)	%
1	7Juli Šabac (Public transport Co.)	5,082	5%
2	PUC Land construction management Co.	2,615	2%
3	Jugent Šabac (Sports Centre)	1,430	1%
4	The Municipality Šabac	1,194	1%
5	Ingo Šabac (Metal Construction Co.)	1,542	1%
6	The Army	937	1%
7	Semenarstvo (seeds and replanation)	866	1%
8	Nama Šabac (Trade Co.)	838	1%
9	Žitoratar (Milling Co.)	747	1%
	TOTAL	**15,251**	**14%**
	Total account receivable	**108,825**	**100%**

Table 5.17 Major debtors 2006

No	NAME	RSD (000)	%
1	7Juli Šabac (Public transport Co.)	8,943	6%
2	The Municipality Šabac	2,951	2%
3	PUC Land construction management Co.	2,788	2%
4	Jugent Šabac (Sports Centre)	1,618	1%
5	Ingo Šabac (Metal Construction Co.)	1,541	1%
6	The Army	937	1%
7	Semenarstvo (seeds and replanation)	867	1%
8	Nama Šabac (Trade Co.)	838	1%
9	Žitoratar (Milling Co.)	747	0%
	TOTAL	**21,230**	**14%**
	Total account receivable	**150,784**	**100%**

Bad debts

No bad debt policy is applied to make provisions for debt, or to write off debt after a certain event, or time. This leads to the understatement of actual cost of the business and thus the PUC's profitability.

5.1.13 Accounts payable

For the years 2005 and 2006, PUC Vodovod, Šabac owed to their creditors respectively RSD 49.1 million and RSD 59.9 million. Out of this, the nine largest creditors had claims totaling respectively RSD 39.2 million (80%) and RSD 43.9 million (73%).

Table 5.18 Major Creditors 2005

No	Creditor	RSD (000)	%
1	Proektomontaža	27.286	56%
2	Peštan	4.956	10%
3	Elektrodistribucija	2.126	4%
4	Petrohemija	1.480	3%
5	Vodoinženjering	850	2%
6	Livnica Leskovac	674	1%
7	PVF	653	1%
8	Bakar komerc	670	1%
9	Poslovnost	550	1%
	TOTAL	**39.245**	**80%**
	Accounts payable	**49.149**	**100%**

Table 5.19 Major Creditors 2006

No	Creditor	RSD (000)	%
1	Proektomontaža	32.802	55%
2	Petrohemija	2.605	4%
3	Peštan	2.013	3%
4	Poliester	1.439	2%
5	Elektrodistribucija	1.478	2%
6	Kopaonik osiguranje	1.329	2%
7	Instelinženjering	938	2%
8	Livnica Ljig	680	1%
9	Wetrikom	588	1%
	TOTAL	**43.872**	**73%**
	Accounts payable	**59.937**	**100%**

In the above Table are some of the most important findings of the major creditor's of the PUC Vodovod Šabac in 2005 and 2006. The total outstanding debt, accounts only to the total outstanding debt for the nine major observed creditors. Therefore the ratios are given in accordance to major creditors.

When comparing the two observed years it could be noted that PUC Vodovod Šabac total outstanding debt towards nine major creditors in 2005 was RSD 49.1 million (€ 614 thousand and RSD 59.9 million (€ 749 thousand) in 2006. The debt within these major debtors increased by some 22%;

Total accounts receivable amounted to RSD 108.8 million (€1. 4 million) in 2005 and RSD 150.8 million (€ 1.9 million) in 2006.On the average the debt increase was 39%.

In the observing years, both Municipality of Šabac (share of 2% and 1% respectively for 2005 and 2006) and the Land construction management (public) company (2% for both observing years) are among the highest debtors.

The share of nine largest debtors in the total accounts receivable in 2006 and 2007 is 14% for both years. It could be observed, that the major debtors are always the same companies, apart from the above mentioned, among the largest debtors are also: Šabac Sports Centre, Metal construction (producing) Co.

- In both years, the major creditor is the Projektomontaza, with 56 % in 2005 and 55% in 2006. This is the company that performs works on hydro technical objects and installations, electric installations and civil engineering works. This company was engaged by the PUC for these works as a subcontractor.
- Obligations to Pestan, the company that produces pipes for water, sewerage and gas systems, plastic tables and chares, trash canes, PVC and Aluminum doors and windows were 10% in 2005 and 3% in 2006.
- Other creditors include Electric Company with 4% and 3% of debt owed in 2005 and 2006 respectively, to the Livnica Ljig and Livnica Leskovac (foundries) 1% of debt each was owed in 2005 and 2006.

Until now, the creditors have not imposed any legal measures against PUC Vodovod Šabac. The existing debts toward creditors are settled by means of negotiations and good business practice. Creditors are ready to wait for the PUC and the only measure imposed, is usually an interest and/or penalty fee. The PUC has not experienced any disruptions of their ordinary activities because of the delay in payments.

5.1.14 Non cash settlements

The PUC Vodovod, Šabac does not have any operating activities that are covered through non cash settlements.

5.1.15 Tax settlements

Main taxes payable by the PUC are value added tax (VAT) and payroll related taxes and statutory contributions. Corporate tax is also applicable; however in the absence of profits this is usually negligible.

PUC Vodovod Šabac follows the regulations prescribed by the Law on Value Added Tax which states that VAT has to be paid on the 10th of the current month for the previous month. Regulations for taxes on salaries and all other taxes payable to the tax authorities are also prescribed by law for settling each category of taxes.

All of these taxes are paid in cash. No evidence was found on any in kind tax settlements.

5.1.16 Summary and conclusions

<u>Main findings:</u>

- PUC Vodovod Šabac operates at 0% net profit;
- Labour costs form the largest share of total costs, reaching 46% in 2007. The share of labour costs in total costs is increasing over time;
- Depreciation costs significant and range between 25% to 30% of total costs;
- The company operates at a slightly positive cash flow, however, it does not rely on short term bank loans to fund operational expenditure;

- The generated cash flow is insufficient to finance investments; most investments are funded directly by the Municipality or are provided for with capital subsidies;
- Balance sheet ratios are sound; however net debt is relatively high.
- The collection rate is high 91%; the revenue from the core activity includes also revenues from sale of the material and civil engineering works.
- For the PUC as a whole, current tariffs just cover operating costs, although the level of operational subsidies and the costs which they are supposed to cover is difficult to assess in the absence of a cost centre based financial management system;
- The water and waste water tariffs are projected to just cover costs during 2007. The cost coverage ratio is, however, declining as a result of costs increases higher than allowed and applied tariff adjustments;
- Fixed assets are not revaluated regularly. In an inflationary environment, as has been the case in Serbia, this leads to the understatement of the asset base in the balance sheet, but also to the understatement of the depreciation charge and might lead to tariffs being set at below cost recovery levels.
- The PUC does not make *provisions* for doubtful debts. Instead, uncollectible debt is written off directly, but also this happens irregularly. The PUC prepares annual plans and budgets, in conformity with guidelines provided by the Ministry of Finance. There is no multi year planning, integrated with this annual planning & budgeting cycle;
- Management of the budget is centralized at director level;
- There is no tariff setting formula or procedure, since it is currently national policy to cap tariff increase with the estimated inflation for the next year;
- The top 9 of large debtors account for 14% of total accounts receivable during 2005 and 2006. Therefore, there is no concentration of debtors. Largest debtor is the Public transport company “7Juli Šabac”.
- The top 9 of largest creditors account for 80% of total accounts payable in 2005 and 73% in 2006, which is highly concentrated. Main creditor in both 2005 and 2006 was Projektomontaza a company offering hydro technical facilities and installations, construction works, electrical engineering, accounting for 55% and 56% of the total PUC’s debt.

<u>Main recommendations:</u>

- Review and improve current collection system with the aim to increase the collection rate, revenues and cash flow. Both billing hardware/software and collection procedures can be improved. This would have as an added advantage that the company would be less reliant on short term loans;
- Improve current financial management system by establishing a cost centre based financial management system. In relation to this, establish a more decentralized budgeting and financial management system;
- Based on the improved financial management system, agree on a cost based tariff setting formula or procedure. This is also useful if tariffs continue to be capped, since it serves as facts based information on the required level of tariff;
- Introduce also a more advanced good quality accounting and financial information for cost based tariff setting;
- Establish a long term financial planning system and integrate this with the annual planning & budgeting cycle;
- The Company has to concentrate on their core activity rather than on trade (wholesale and retail).

- Make an inventory of the existing physical asset database and verify these with the financial fixed asset register. Refer also to recommendations made at the end of chapter 6 – institutional analysis;

Conclusion:

2006 results were not according to planned. There was no increase in tariffs as the company requested, and the planned revenue from core activities was rather below planned. Consequently revenue from non core activities was also not at the planned level. The company, however was operating rationally in respect to expenditures, and by cutting certain costs, financial result was much better than planned.
This company, like all the other public utility companies, has no potential problems (unless under serious failure in operating) in delivering their services of water supply and wastewater discharge. Their main concern lies within the fact that they are unable to collect revenue from the services they are rendering.

Planned in 2007

The management will concentrate on generating revenue from company's core activity, with a tendency to achieve water and wastewater tariffs based on economic principles.
Legal department will be more actively engaged in sending to court non paying clients. The plan in 2007 is to send over 1000 consumers to court, approximately 80 consumers monthly.
The Managing Board will also meet on monthly bases, for the consistency in decision making, relevant for the sound operating of the company.
In order to improve collection, the company plans to print out invoices in a 4 to 5 days sequence for different consumers. The due dates for payments will be therefore different for different groups.
Water meter replacement should be carried out permanently along with the campaign (that the PUC has already adopted) for rational water consumption. Selective water meter replacement campaign would be carried out at approximately 50 meters replaced monthly, every month in continuity.
The plan is to intensify arrangements on increasing awareness of citizens in the satellite settlements and proceed with beginning of works on building wastewater and water network. As a result this will generate additional revenue through construction works, and additional revenue through new connections (by activating new capacities).
Legalization of software programs used in operating will increase utilization of the existing programs.

5.2 Creditworthiness assessment of the Municipality of Šabac

5.2.1 Introduction

The PUC Vodovod Šabac is founded and owned by the Municipality of Šabac and its functioning is under the direct influence of the local government. This is reflected in all segments of its operations, especially in relation to financial matters. The managing board of the PUC Vodovod Šabac is established in such a way that local government representatives are forming the majority. The managing board of the PUC is entitled to propose tariffs for the services that the PUC is delivering to the citizens. The proposals become effective after municipal assembly approval.

In order to support low income households, tariffs are usually set at a minimum level, that is, at a level at which the PUC can cover their operating costs only without making any profit. As for depreciation costs, which are supposed to recover investments made for long term assets, the PUC is including this item in its costing schemes in accordance with the accounting and other laws and regulations. However, the problem is that the assets of Serbian PUCs were worn out during the 1990-ties with hardly any re-investment or capital replacements taking place. Thus, PUCs were effectively financing their operations - and very often some other social needs - on the expense of their capital asset base. As a result of this policy, most of today's PUCs have a low capital base with corresponding low tariffs. Consequently, they are in a bad position to finance any larger investment from consumer tariffs through internally generated cash flow.

The current situation is that most investments made in Serbian PUCs are financed from the municipal budget. Municipal budgets are the source of direct investments and/or provider of guarantees to the banks for commercial loans. After completion of the investment, the acquired assets are transferred to the PUCs and become part of their balance sheet. The PUCs usually do not have any financial obligation against municipal budgets for these assets. To the contrary, if PUCs can not service their debts, the local government is legally obliged to assume all liabilities and cover the financial obligations.

Therefore, when considering investment in PUCs, it is important to identify the financial position and development of the municipal budget, as well as the financial position of the PUC. The analysis of the budget of the Municipality of Šabac presented below is based on data from official reports submitted by municipal budget offices to the Ministry of Finance at the end of every budget year, in accordance with the current budget law.

5.2.2 Analysis of the national and local context

The current legal basis for local budget revenues is governed by the Law on Local Self-Government from 2002. Financing of local governments, went through some changes:

- In 2004, local governments' share of revenues based on salary fund tax was discontinued. In order to compensate this decrease in revenues to local budgets, the share of local government in income taxes was increased from 5% to 30%, In addition, the share of sales tax was increased in favour of selected poorer municipalities;
- From January 2005 onwards, sales tax has been replaced with value added tax (VAT). This change affects the way of providing local government budgets with revenues. Instead of sharing the sales tax with central government, the VAT is now going directly to the central funds, from which local governments are getting current transfers.
- In 2006, a new Law on local government finance has been adopted. The Law became effective on June 23rd, 2007. The main novelty is the decentralization of property tax. Property tax used to be collected by local offices of the National Government and than distributed to local government. By the provisions of the new Law, property tax is directly collected by local government, enabling them to broaden their own tax base/original revenues. Consequently, a unit for collecting property tax is established at the local level and related expenditure is to be borne by local government.

According to the new Law, the local government budgets obtain revenues from three main sources:

- Through local level, where local government can set taxes and collect its own revenues. These are called original revenues, according to the law terminology;
- Through central level, by allocating or sharing the revenues with the central government. These are called shared revenues; and
- Through transfers from central government. This source is defined separately, but since it is coming from central funds it might be considered as a specific type of shared revenue.

Original (own) revenues

The original revenues of local government budgets comprise:

- **Local fees** – administrative, communal and tourist fees;
- **Charges on construction land** – charges for utilization and for development of the city construction land;
- **Other revenues** – include a dozen different revenues (charges for natural resources, charges on sales of assets, interest on deposited budget funds, etc). Generally, revenues generated from this group are small compared to the above two sources. In particular cases these can however provide substantial revenues
- **Self-contribution** – this revenue can be introduced by the decision of citizens made through local referendum. By definition, it is used for development of local capital infrastructure;
- **Donations** – donations could come from different sources such as central level, international organization and other. In this case, they are going directly to the local government;
- **Property taxes** – according to the new Law on local government financing, taxes on property of the private and legal entities are becoming original revenues. This change is important as such, but equally important is the change related to the way how it is collected. After the introduction of this Law (June 23rd, 2007), local governments have taken over part of the central tax administration in order to fully control collection of this revenue. However during the initial phase, the Republic will for a certain period control the spending of money from property taxes.
- **The tax on passing the absolute rights** – from (June 23rd, 2007), is reduced from 5% to 2.5%.

Shared (allocated) revenues

The second large group of local budget revenues consists of revenues that are allocated by national level to the local level. According to the legal terminology, these are called allocated revenues. These revenues consist of:

- **Income taxes** – include a number of taxes on different personal incomes generated from different sources: agriculture and forestry, private business activities, immovable property, leased movable property; prizes in games of chance, personal insurance, part of the salary tax and others; This tax was lowered from 18% to 12% by the Law on income tax in 2006.
- **Property related taxes** – include taxes on inheritance and gift tax, on transfer of absolute rights and on goods and services;
- **Different charges on assets of public interest** – include charges for the utilization of different assets of public interest like mineral raw materials; river

material; forest land; agricultural land, public roads, environmental protection and environment; investments;

- **Privatization revenues** – include part of the funds (5%) collected through the sale of capital in the privatization process that is taking place within the municipal territory;
- **Transfers** – include transfers from central government. Transfers as a specific type of local budget revenues were introduced in 2005 when the sales tax was replaced by VAT. The new Law on local government finance introduces a wide array of transfers: categorical and non-categorical transfers (which include equalization transfers), compensation, transitional, general and block transfers.

The investment capacity and creditworthiness of local budgets depends on the efficiency of the overall local financial management, which includes the capacity for generating revenues as well as the way in which these revenues are spent. Certain revenues are especially important for funding capital expenditure. These are:

- **Land use development charge**. This revenue is directly related to local investments. It is paid by investors who are planning to invest in construction on land within municipal boundaries. The investor is obliged to pay this charge in cases when he is the owner of the specific construction site, but also when he has the right for using it or the right to erect objects on it. The charge is set in accordance with the costs of developing the site, the purpose of the object and the city zone. Setting the base and rate of this charge is under the jurisdiction of local government.
- **Land use charge**. This charge is used to cover the costs of maintenance of local infrastructure and it is set in accordance with the costs of maintenance. This charge is also under the jurisdiction of local government.
- **Revenue from renting the City assets**. Revenues from renting immobile and mobile assets of the local governments are original revenues. They are supposed to be used exclusively for capital investments. But, since this is not strictly prescribed by law, in certain cases they are used for covering costs of current operations.
- **Self-contribution**. Self-contribution is a traditional revenue source of local government that is to be used for capital investment of special local communities needs such as water supply, roads etc. The contribution is raised and set by local referendum.
- **Privatization revenues**. According to the Law on Privatization, 5% of the proceeds received from selling state or socially owned companies on the territory of the municipality is going to the local government budget.
- **National Investment Plan (NIP) funds** The Government of Serbia had by end of the year 2006, for the first time adopted the NIP for the Serbian economy, covering the period the period 2006 – 2011. The NIP covers all vital economic sectors, employing and allocating on a national level the surplus of the funds from the process of privatization. Due to the increase in citizens' savings and the implementation of a number of economic reforms, the budget of the State of Serbia showed a significant surplus, thus making favourable conditions for development of a concise plan on financing public investments. Municipalities were invited to apply for investment funding.
- **Donations**. From the year 2000 donations, especially from international funds, became an important source of funding capital investments at local government level. In the near future, local government is still planning certain financial inflow

from this source, but in mid, and especially in longer period, it is expected that this will decrease. It is expected that accession towards the EU will enable further funding through the EU's new Instrument for Pre-Accession (IPA).

- **Transfers**. Transfers are a relatively new type of revenues for Serbian local government. Until 2005 these transfers were relatively small. It is expected that after the introduction of the new Law on local government finance there will be a considerable increase in transfers. It is expected that this source will become very important for local governments.

  Property tax. From June 23rd, 2007 local government has taken over the control of property tax from the Republican level.
- **Tax on passing the absolute rights**, effective from the same date, the taxation rate for tax on passing the absolute rights is reduced from 5% to 2.5%. However, lowering of the tax rate on passing the absolute rights does not mean that the local government will be less motivated to collect this revenue. Establishment of the local tax administration is considered to be a big change as such and it is expected that this might generally increase fiscal capacity of local government in Serbia.

5.2.3 Municipalities financial operations

5.2.3.1 Municipal Budget Revenues

As elaborated upon above, the revenues of the Serbian municipalities consist of two main groups of revenues: own or so called original revenues (the revenues that local governments control, both in defining its level as well as in collecting it) and the allocated or so called shared revenues that are collected by and than distributed from the central level. The new law on local government finance introduces new types of revenues like transfers which in general could be treated as allocated revenues.

One time transfers for capital investments are apportioned through the National Investment Plan, i.e. if the Municipality presents a well grounded plan to the relevant Ministry, for the investment they wish to be financed.

The budget of municipalities is prepared on the basis of unified budget classification system, that is functional, economic and organizational classification in accordance with the Budget System Law. All the revenues are planned based on the budget realization from previous years, and the plan for current year which is in accordance with the Memorandum on the budget for that year (2007).

The data in the tables below show the limited improvement of the financial autonomy of Serbian local governments, which is the result of Ministry of Finance policy during the last 4-5 years.

Table 5.20 Budget revenues – Municipality of Šabac

No	Type of revenues	2004 a		2005 a		2006 est		2007 plan	
		RSD m	%	RSD m	%	RSD m	%	RSD m	%
1	2	3	4	5	6	7	8	9	10
I	**Original revenues**	**183**	**20**	**368**	**30**	**236**	**17**	**365**	**20**
1.1.	Fees (administrative, communal, tourist)	36	4	39	3	53	4	60	3

1.2.	Land development charge	96	10	272	22	124	9	173	9
1.3.	Property tax		0		0		0	70	4
1.3.	Other	51	5	58	5	59	4	62	3
II	**Allocated revenues**	**748**	**80**	**841**	**69**	**1.054**	**78**	**1.187**	**65**
2.1.	Sales tax	258	28	-	0	-	0	-	0
2.2.	Income tax	350	37	523	43	667	49	667	37
2.3.	Property tax	45	5	54	4	63	5		0
2.4.	Property tax and tax on passing the absolute rights	95	10	124	10	135	10	158	9
2.5.	Transfers	0	0	140	11	187	14	358	20
2.6.	Other	0	0		0	2	0	4	0
III	**Privatization revenues**	**4**	**0**	**13**	**1**	**11**	**1**	**20**	**1**
IV	**Credits**	**-**	**0**		**0**	**50**	**4**	**250**	**14**
V	**Revenue from previous year**	**-**	**0**		**0**		**0**		**0**
VI	**International Donations**	**2**	**0**	**0**	**0**	**1**	**0**		**0**
	TOTAL REVENUES	**938**	**100**	**1.223**	**100**	**1.352**	**100**	**1.822**	**100**

Original revenues

The share of own (original) revenues in the Šabac municipal budget was at the average of 22% in 2004 to 2006.

The plan for 2007 is to keep the share of original revenues at 20%, mainly as a result of the switching of the property tax from allocated to original revenues. In the observing period Land development tax participated with 22% in 2005 as a result of extensive construction activities in the Municipality of Šabac. The plan for 2007 is an increase of 9%.

Allocated revenues

The share of allocated revenues changed from 80% in 2004 to 78% in 2006. This lowering of the share in allocated revenues, as it was mentioned earlier was due to sales tax being replaced by VAT and the introduction of transfers from the Republican level. At the start of 2006 the transfers apportioned for the Municipality of Šabac were set at RSD 187 million. The plan for 2007 recorded further increase of transfers to RSD 358 million or 91% increase compared to 2006. The final amount would depend on the fact that additional revenues can also be approved by the Budget rebalance.

The share of Income tax in 2007 is lower compared to 2006, because of lowering of this tax from 18% to 12% by the Law on income tax.

Allocated revenues for 2007 will, record a 13% increase compared to the previous year. For allocated revenues, the most significant source is income tax which constituted more than 37% of total revenues in a period 2004 to 2006. Sales tax participated with

28% in 2004, fiscal revenues. The sales tax was replaced in 2005 with value added tax (VAT), which also took over its role regarding equalization.

Privatization revenues

Revenues from privatization in the observing years ranged from RSD 4, 0 million in 2004 to RSD 11, 0 million in 2006. Municipality of Šabac has a plan to reach the peak of RSD 20, 0 million in 2007. Many of the industries are still awaiting privatization.

Loans

In respect to loans, the Municipality of Šabac borrowed funds form commercial bank to finance part of their capital expenditures mostly for communal infrastructure. Loans were taken in 2006, and their share in total revenues was 4% in 2006 or RSD 50, 0 million. The plan for year 2007 is a loan of RSD 250, 0 million or 14% (€ 3 million) for investing in the North zone plan.

International donations

In the last few years Šabac municipality had international donations in 2004, approximately RSD 2 million and in RSD 1 million in 2006.

In the last few years municipalities in Serbia did not have legal possibilities to make use of capital markets as a funding source for capital investments, until the new law on budget system was introduced in 2002. Reforms of public finance, especially at the local level, are developing to increased general autonomy of local government, including financing and ability to borrow funds for investments.

5.2.3.2 Municipal Budget Expenditures

All Serbian municipalities are spending their budget predominantly within the following three areas:

- Financing work of local government administration and governmental bodies, i.e. the municipal council, Mayor office;
- Financing social functions that are under local government competency like education, sport and culture. These institutes are financed by means of transfer of funds; and
- Investments, mostly in local infrastructure.

According to Serbian budget laws, there are no legal restrictions to the use of allocated revenues. These revenues have a general nature. However, Serbian municipalities are obliged to fund certain social functions like communal services, funding material costs of educational institutions, provision of cultural and sport activities etc. The level of funding of these services and functions is to be decided by the municipality. So, formally local budget expenditures are discretionary, i.e. local governments can independently decide the level of funding for each function.

Having this in mind, it is understandable that the relative share of certain expenditures vary between different Serbian municipalities. Still, a general standard is that

municipalities are spending around 1/3 of the total budget to each of the three group of expenditures listed above.

The Municipality of Šabac more or less follows this budget spending pattern, during the year 2004 and the plan for 2007, spending of municipal bodies amounted to respectively 14% to 22%. Social functions in the municipality amounted to an average of 30% in the period 2004 to 2007. In the Municipality of Šabac the funds for capital investments are allocated through Land Construction Management public company. In the 2004, 54% was allocated and the plan for 2007 is 44% of available budget or 9% less compared to 2006. (see Table 5.21 below)

Table 5.21 Budget expenditure Šabac Municipality

No	Type of expenditure	2004 a		2005 a		2006 est		2007 plan	
		RSD m	%	RSD m	%	RSD m	%	RSD m	%
1	2	3	4	5	6	7	8	9	10
I	**Municipal bodies and administration**	**131**	**14**	**156**	**13**	**183**	**14**	**405**	**22**
II	**Social functions (education, sport, culture, welfare)**	**265**	**29**	**323**	**28**	**408**	**32**	**539**	**30**
III	**Reserves**	**4**	**0**	**4**	**0**	**7**	**1**	**11**	**1**
IV	**Land Construction Management PC**	**495**	**54**	**622**	**53**	**615**	**48**	**808**	**44**
V	**Subsidies**	**5**	**1**	**24**	**2**	**31**	**2**	**3**	**0**
1	Current subsidies	5	1	24	2	31	2	3	**0**
2	Capital subsidies	-	0	-	0	-	0	-	**0**
VI	**Self-contribution**	**21**	**2**	**30**	**3**	**33**	**3**	**36**	**2**
VII	**Other budget expenditure**	**0**	**0**	**12**	**1**	**14**	**1**	**19**	**1**
	TOTAL EXPENDITURE	**920**	**100**	**1.171**	**100**	**1.292**	**100**	**1.822**	**100**

5.2.3.3 Municipal Investment Expenditures

The above presented data specify at a rather general level budget revenues and spending in relation to different purposes and/or budget beneficiaries. This paragraph provides more details of the capital investment expenditure budget of both observed municipalities.

In Serbian municipalities, four main mechanisms of financing investments can be distinguished. These are:

- Capital subventions to the municipal entity specifically established to deal with municipal investments and development. Most Serbian municipalities have this kind of entity, usually called the Agency for Construction and/or Development. This entity used to be a separate public company, but after the local public finance reform from 2002 was introduced, quite a few were transformed into a budget beneficiary. The scope of work of these departments usually includes spatial planning and development and designing and implementation or monitoring of different municipal investment projects;
- Capital transfers to budget beneficiaries/institutions. Local governments are in accordance with the Law on Local Self Government legally obliged to provide

their citizens with certain services like children welfare, culture, sport, covering the material costs of primary and secondary education institutions, etc. Local government is financing the entities that are providing these services. Both operational as well as capital costs are financed;

- Capital subventions to the public companies, includes direct transfers of operational and/or capital funds to public companies;
- Direct investments. In this case, municipalities are investing directly into certain projects, so that officially the investor is the municipal administration as a whole. De facto, the investor is usually some of the specific municipal administration departments.

The first two mechanisms are strictly speaking the same: the transfers are made to entities or institutions founded by local government and they have the status of budget beneficiaries, since their legal framework is defined by the Law of Budget System. The practical consequence of this is that all of these institutions are from the financial point of view part of the local public finance system, meaning that all of them financially are operating within the local treasury system. The only difference is that in the first case municipalities are transferring capital funds to one specialized entity which is then dealing with different investments, while in the second case, each of the entities is supposed to carry out its own investments.

On the other hand, the third mechanism, subventions to public utility companies, is basically different because the transfers are made to the public companies that do not have a status of budget beneficiaries, although they are users of budget funds. Their legal framework is defined by the Law on Companies/Enterprises, which means that they are not operating within the system of public finance. After the transfer of subventions, the further financial flow to and from the public utility companies is out of the local treasury. In other words, their actual expenditure is not reflected in the local government accounts.

The Municipality of Šabac disburses funds from the local budget to finance capital investments through different channels and institutions.

The table below represent the general overview of Total investments in the Municipality of Šabac, in further calculations data used for the analysis included only Capital expenditures of Šabac municipality budget during the period 2004 to 2007. The table however includes even those investments that were apportioned by the National Investment plan and other funding.

Table 5.22 Capital expenditure – The Municipality of Šabac

No	Type of expenditure	2004 a		2005 a		2006 est		2007 plan	
		RSD m	%	RSD m	%	RSD m	%	RSD m	%
1	2	3	4	5	6	7	8	9	10
I	**Capital subventions**	**489**	**57%**	**620**	**56%**	**619**	**51%**	**998**	**58%**
1	Gasification	70	8%	25	2%	23	2%	15	1%
2	Water system	19	2%	15	1%	8	1%	13	1%
3	Communal infrastructure	392	45%	513	46%	531	44%	843	49%
4	Sewage	3	0%	67	6%	57	5%	118	7%
5	Public objects	5	1%	0	0%	1	0%	9	1%

II	**Capital expenditure of budget beneficiaries**	**376**	**43%**	**495**	**44%**	**593**	**49%**	**724**	**42%**
1	Municipal administration	135	16%	192	17%	226	19%	241	14%
2	Culture	48	6%	67	6%	81	7%	96	6%
3	Children care	61	7%	79	7%	86	7%	111	6%
4	Sport	35	4%	43	4%	53	4%	60	3%
5	Primary education	42	5%	51	5%	67	6%	93	5%
6	Secondary education	28	3%	33	3%	40	3%	48	3%
	Social welfare	9	1%	11	1%	18	1%	28	2%
	Tourism	4	0%	6	1%	7	1%	10	1%
	Public information	6	1%	8	1%	11	1%	8	0%
	Environment	3	0%	1	0%	1	0%	1	0%
	Water system	4	0%	4	0%	3	0%	5	0%
	Healthcare	-	0%	-	0%	-	0%	22	1%
	Fire brigade	-	0%	0	0%	-	0%	1	0%
	TOTAL (I+II)	**865**	**100%**	**1.115**	**100%**	**1.213**	**100%**	**1.722**	**100%**

- In a period from 2004 to 2006 the Municipality of Šabac recorded an increase of capital subventions by 26%. The plan for year 2007 is RSD 998 million (€1, 2 million) or 61% increase compared to 2006. Communal infrastructure with all the types of communal services including land development, construction of business parks, parking lots, maintenance etc., had participated in the observing period with almost 50% of total budget expenditure. The plan for 2007 is to spend RSD 843 million or €10.5 million on communal services.
- Capital expenditure of budget beneficiaries in the period 2004 to 2006 also recorded an increase of 58%. The plan for 2007 is an additional increase of 22%. Municipal administration in the observing period participated with an average of 17%.
- During 2006, the Municipality of Šabac incurred Capital expenditures amounting in total to RSD 1.2 million, equivalent to € 15.2 million. Planned capital expenditure budget for the year 2007 increased considerably to RSD 1.722 million, or € 21.5 million.

Another source of finance is the National Investment Plan. The Municipality of Šabac has applied for funding from the NIP to finance investments for establishing an agro-industrial zone and park and was granted in total of € 1.300 thousands (€ 156 thousands in 2006 and € 1.144 million in 2007). Their plan is also to be realised through building of infrastructure for the agro-Industrial zone and many other facilities that are required for functioning of this area.

These expenditures were financed from the budget revenues and long term loans. As mentioned earlier, the Municipality of Šabac in 2006 has one loan of RSD 50 million and plans to take another loan for RSD 250 million in 2007.

The total investment capacity of the Municipality of Šabac could be increased by attracting external finance from international donors and international banks through loans.

Investment activities of the Municipality of Šabac with financing schedule planned for the improvement of the water supply and sewerage system in 2007:

Table 5.23 2006 Investment funding in RSD '000

No.	Investment	Municipal Budget 2006	Funds/Republic 2006	Total
1	Water supply system	21,000	n/a	21,000
2	WWTP	110,000	110,000	220,000
3	Current maintenance of kennel network	5,000	-	5,000
	Subtotal 2007	**136,000**	**110,000**	**246,000**
4	2006 plan/ citizen's donations	14,608	-	14,608
	Total 2007	**150,608**	**110,000**	**260,608**

The Municipality plans to invest in 2007, a total of RSD 260 million or € 3,2 million, all of which will be used for the projects on water and waste water supply systems. In its financing schedule the municipality had included, apart from its own contribution, funds from the Republic water Directorate for the investments in the water supply system.

For the development of the municipal infrastructure, the Municipality plans to invest RSD 215 million (€ 2,7 million), out of which RSD 120 million or €1,3 million will be the funds from the National Investment Plan, since the Industrial zone planned to be built in the Municipality of Šabac is set as national priority.

According to the current Budget System Law, municipalities could borrow up to 50% of current revenues from the previous' year realized budget revenues. The Ministry of Finance is regularly publishing these limits and they are applied very strictly. According to the last official release from the Ministry of Finance, valid for the year 2007, the municipalities can borrow up to the following limits:

Table 5.24 Borrowing limits for the Municipality of Šabac (2007, exchange rate € 1 = CSD 79)

No	**Municipality**	**Realized revenues 2006**		**Borrowing limit 2007**	
		RSD m	**€ th**	**RSD m**	**€ th**
	Šabac	1,291	16,341	595	7,539

Source: Ministry of Finance Serbia

Because of loans already taken during previous years, the borrowing limit of Šabac municipality as of 2007 is limited to RSD 595 million or € 7, 54 million. The report on the borrowing limits of the municipalities in Serbia is issued every six months by the Treasury Department of the Ministry of Finance.

5.2.3.4 Analysis of the Municipal balance sheets

The balance sheets of Serbian municipalities are burdened with a number of limitations and deficiencies. One of the biggest deficiencies is the fact that during 90-ties, the Republic government took over most of the local government property. This has made a

tremendous impact on Local Government balance sheets. Some of the Local governments continued to keep record of the assets in their balance sheets. Others stopped doing that, only to restart recording these assets again around the year 2000. And another group transferred the bookkeeping of their assets to some of their entities, like the Agency for development. Because of this, balance sheets of Serbian local government cannot be compared in a meaningful way.

Having the above in mind, the analysis of local governments' balance sheets and the possible conclusions should be taken into account more as an illustration of the present situation than as a solid fact.

However the Municipality of Šabac is among the municipalities who did not continue to keep their balance sheets, but recorded all their operations through the municipal budgets, which is a common practice among the Serbian municipalities. The municipalities are, however, not legally obliged to keep their records in the typical financial reports, as required by the International Financial Reporting Standards. They submit their Budget plans, Revaluations and Budget Realization to the Municipal Assembly for approval.

5.2.3.5 Credit history and financial management capacity the Municipality of Šabac

In general, Serbian municipalities do not have a long credit history since the legal framework enabling municipalities to borrow for investments purposes. Major changes were initiated starting from 2002 with the new Budget System Law which introduced the possibility for Serbian municipalities to make use of capital markets, draw loans and issue municipal bonds. However, the practice of taking long term credits to finance large investment projects did not become significant until 2003

Municipalities in Serbia are now changing the practice of applying conservative financial policies of avoiding loans and keeping a relatively high surplus of cash in order to avoid liquidity problems. They are more interested in improving the functioning of their regions, and are assisted in this by a number of international grants being awarded to improve communal services.

Being given legal rights to borrow money from commercial banks, municipalities are entering into these agreements respecting various conditions under which banks are ready to lend money to local communities. Municipalities have equal borrowing rights as any other company in the trade market. The difference lies in providing collaterals. Each municipality has an account with the State Treasury, through which all the transfers from the State budget to the Municipality are directed. In case of borrowing, the bank usually requires signing a letter of authorisation with the municipality to debit their account with the Treasury for any outstanding loan repayment. This proves to be rather firm collateral since the municipalities have regular transfers from the State and loans practically bear very little risk of being repaid.

The Municipality of Šabac, has taken a long term loan of RSD 50 million or € 6 million for the purpose of financing part of the capital investment. However details on the loan contract were unavailable at the moment of writing this analysis.

However, the Municipality of Šabac is eager to build well organized communities, and as many other municipalities in Serbia it is striving to introduce relatively efficiently all of the reforms introduced by the Serbian public finance at local level such as new accounting system (in accordance with international standards), local treasury system and new budget procedures.

5.2.3.6 Creditworthiness assessment of the Municipality of Šabac

5.2.3.6.1 Creditworthiness during the period 2004 – 2007

The Table below summarizes the trends regarding the financial position of the Municipality of Šabac:

Table 5.25 Šabac municipality actual 2004 – 2006 and plan 2007 (RSD '000)

No	Item	2004	2005	2006 estim	2007 plan
I	**Current Revenues (1+2+3+4)**	**831**	**933**	**1.166**	**1.378**
1	Own Current Revenues	81	92	111	191
2	Share of State Taxes	748	702	867	829
3	Other state Transfers	0	140	187	358
4	Donations	2	0	1	-
II	**Current Expenditures**	**544**	**758**	**869**	**1.015**
A	**Current Surplus/Deficit (I-II)**	**288**	**175**	**297**	**363**
5	Capital Revenues	106	289	136	195
6	Capital Expenditures	**373**	**409**	**416**	**794**
B	**Capital Surplus/Deficit (5-6)**	**(267)**	**(120)**	**(280)**	**(600)**
C	**Net Surplus/Deficit Before Financing (A+B)**	**21**	**56**	**17**	**(237)**
7	Borrowing	-	-	50	250
8	Cash brought from previous year	-	-	-	-
9	Debt Service	-	-	-	2
10	Reserves	4	4	7	11
D	**Net Debt Increase/decrease (7+8-9-10)**	**(4)**	**(4)**	**43**	**237**
E	**Net Surplus/Deficit (C+D)**	**17**	**52**	**60**	**(0)**

In the Municipality of Šabac the situation is as follows:

- Municipal current revenues in the period 2004 to 2006 increased by 40%. The plan for the year 2007 is RSD 1.378 million or 18% increase compared to 2006.
- Current expenditures in the same period were growing faster than current revenues at 60% and the plan for 2007 is an increase of 17% compared to 2006.
- Capital expenditures during 2004 to 2006 have increased by 12% and the plan for 2007 is further increase of capital expenditures by 91% compared to 2006.
- Capital revenues in 2005 increased twice and in 2006 have decreased by 47%. The plan for 2007 is to increase capital revenues by 43%.
- Compared to 2005 the current surplus of the municipality recorded in 2006 an increase of 70%.
- The Capital Surplus (capital revenues minus capital expenditures) during these years was consistently negative too.
- Net surplus (Net Surplus before financing + Net Debt increase) during these years was positive and recorded a increase of three times but was insufficient to

fund the capital deficit. The Municipality of Šabac can not manage to finance a investment program without taking the new loans.

Before starting the analysis of the Municipality of Šabac, it should be taken into consideration, that the reports received from the municipality officials, in respect to municipal revenue included not only municipal revenues, but as well funds received from the National Investment plan and other funds that did not originate from the direct municipal budget transactions. Therefore it was necessary to exclude these data from the budget, to get the real picture of what were the actual municipal capital revenues and expenditures.

Table 5.26 Municipal financial indicators – Municipality of Šabac

Indicators of revenues	Benchmark	2004	2005	2006 es.	2007 plan
Current revenues / Total revenues		89%	76%	90%	88%
Shared revenues / Total revenues		80%	57%	67%	53%
Original (local) revenues / Total revenues		20%	30%	18%	23%
Revenues from sale of property / Total revenues	2 - 5%	0%	0%	0%	0%
Capital revenues / Total revenues		11%	24%	10%	12%
Operating result / Current revenues		35%	19%	26%	26%
Indicators of expenditures					
Current expenditures / Total expenditures		59%	65%	68%	56%
Operating result / Current expenditures		**53%**	**23%**	**34%**	**36%**
Capital revenues / Capital expenditures		29%	71%	33%	24%
Capital investments / Total expenditures		40%	33%	32%	51%
Indicators of financial state					
Total expenditures / Total revenues	95% - 100%	98%	95%	99%	115%
Total expenditures / Current revenues		110%	125%	110%	131%
Indicators of indebtedness					
Debt / Total revenues from previous year		0%	0%	4%	23%
Debt service / Total revenues from previous year		0%	0%	0%	0%

Revenue indicators:

- The share of current in total revenues is on the average 86% throughout the years; and the plan for the year 2007 is to keep this share at 88%;

- The share of allocated (shared) revenues in total revenues decreased from 80% in 2004 to 67%, in 2006, and according to 2007 plan revenues will be further decreasing to 53%, due to the switch of the property tax and lowering of income tax;
- Original revenues show oscillations from 20% in 2004 to 18% in 2006. The plan for 2007 is to keep these revenues at 23%, again being the result of reclassified property tax collection.
- Also the share of capital revenues in total revenues ranges from 10% to 35%
- The ratio between operating result and current revenues was oscillating from 35% in 2004 to 26% in 2006 and plan for 2007.

Expenditure indicators

- The share of current in total expenditures during the observing period was at the 59% in 2004 to 68% in 2006; the plan for the year 2007 is 56%;
- Capital revenues coverage of capital expenditures ranged from 29% in 2004 to 33% in 2006. The plan for 2007 is to keep capital revenues coverage at 24%;
- Capital investments as a percentage of total expenditures varied between 40% to 32%, in the period 2004-2006, plan for the year 2007 is to increase capital investments to 51%;

Indicators of financial state:

- Total expenditures were lower than total revenues in these years. The plan for 2007 shows that the expenditures will exceed revenues by 15%. The gap will be mainly financed by bank loans.

Indicators of Indebtedness

- During the observed period Debt to Total revenues from previous year was zero in 2004 and 2005, and 4% in 2006, but is expected to increase to 23% during the year 2007.

Conclusion

However, the Municipality of Šabac, has very ambitious investment plans, related to building of the North –Zone, (elaborated more in details in Chapter 2).
Based on the analysis, the Municipality has a capacity to borrow in 2007 (as reported by the Treasury) RSD 595 or €7,54. However favourable borrowing conditions commercial banks are offering to the municipalities, the Municipality of Šabac can only finance part of this plan. They and look for additional funding means attracting investors (either foreign or domestic), donations and funds from the Republic.

The municipalities in general could expand their funding capacity through improved collection of the land development and use charge. Municipal budgets will grow with the new revenue collected from property tax charges, which became efficient as of June 2007 (as elaborated above), and the municipalities have a discretionary right to set the property tax charge within the legally prescribed limits. The Government is also apportioning more funds to the municipalities through the budget transfers, another source of funding; whose share apportioned for capital investments is to be planned carefully by every municipality.

The municipalities are legally obliged to present to the municipal assembly annual budget plan for the year following their approved budgets from the previous year.
There are no obstacles for the municipalities to introduce multiyear planning, using economic forecasts, at least in those sections controlled by them (within the original revenues).
Funding of municipal investment plans by issuance of municipal bonds could be an appealing alternative compared to commercial bank loans. So far, however, this has not been initiated yet in Serbia. Neighbouring countries, including former FRY republics, are preparing (Republic of Srpska), or started (Croatia) projects on municipal bonds issuance.
Many organizational changes will however have to be made in Serbia, prior to addressing the bond issuance, such as instituting a body that will be in charge of controlling the municipal bond market, but also the issue of ownership of assets.

5.3 Financial analysis of the Project and affordability analysis

5.3.1 Introduction

Based on several assumptions as outlined below, this chapter analyses the financial feasibility of both the project and its effect on the finances of the planned new water and waste water treatment Public Utility Company. The analysis and projections for the profit & loss account, balance sheet, cash flow statement of the company as well as the financial cost-benefit analysis will be carried out for 33 years in total (2 year construction and 31 operational years), which coincides with the estimated usable lifetime of the equipment of the waste water treatment plant and is in accordance with international practice for such type of projects. Therefore, the analysis will cover the years 2009 to 2041.

The model uses as an input the water and waste water demand projections elaborated upon in chapter 3. Furthermore, it builds upon the estimated staffing numbers required to operate the scheme as set out in chapter 7 and the priority investment plan detailed in chapter 3.

The financial analysis only takes into consideration the first stage investment and any necessary reinvestment required to sustain operations. This is done in order to be able to clearly identify the financial effects on the company and required tariffs of the first stage construction, and to be able to carry out a financial cost-benefit analysis in line with EU guidelines.
All revenues and expenditures are presented in nominal values.

The appendices contain the full set of outputs of the financial model.

5.3.2 Option analysis

This chapter does not contain a further option analysis, since this has been summarized already in chapter three – technical analysis. The selected technical alternative will be used as a starting point for this chapter. The selected alternative is:

- Staged construction of a central waste water treatment plant using conventional technology (primary and secondary treatment). The short tem investment plan (Stage I) will be able to treat waste water of 126,000 people equivalent (PE);
- Construction of a sewage pumping station at Glavna. SPS Glavna is planned to be constructed close to the existing main sewerage outlet, just downstream of the bridge over the Sava River.

5.3.3 Assumptions

<u>Macroeconomic scenarios</u>
Underlying macro-economic assumptions of the model build upon data used by the EBRD, with some changes to reflect recent actual exchange rates. A base case scenario, with a probability of 50% will be used throughout this chapter. Pessimistic and optimistic scenarios are used to assess the sensitivity of the financial model to changes in these assumptions.

The table below summarizes the three macro economic scenarios:

Table 5.27 Base case scenario

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
RSD Inflation	%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
EUR Inflation	%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
RSD/EUR Nominal Exchange Rate	RSD	81.6	83.2	84.4	85.6	86.9	88.2	89.5	90.8	92.1	111.5	131.0
Real Appreciation RSD vs EUR	%	1.0%	1.0%	1.6%	1.6%	1.5%	1.5%	1.5%	1.5%	1.6%	1.5%	1.5%
Real GDP Growth	%	5.0%	5.0%	5.0%	5.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%	3.0%
Real labour wage increase	%	3.0%	4.0%	4.0%	5.0%	5.0%	5.0%	5.0%	3.0%	3.0%	3.0%	3.0%

Table 5.28 Pessimistic scenario

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
RSD Inflation	%	10.0%	8.0%	7.0%	6.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
EUR Inflation	%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
RSD/EUR Nominal Exchange Rate	RSD	86.4	91.6	96.2	99.1	101.1	102.1	103.1	104.1	105.1	119.3	132.9
Real Appreciation RSD vs EUR	%	0.0%	0.0%	0.0%	1.0%	1.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Real GDP Growth	%	1.0%	2.0%	2.0%	2.0%	2.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Real labour wage increase	%	1.5%	2.0%	2.0%	2.5%	2.5%	2.5%	2.5%	1.5%	1.5%	1.5%	1.5%

Table 5.29 Optimistic scenario

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
RSD Inflation	%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
EUR Inflation	%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
RSD/EUR Nominal Exchange Rate	RSD	80.0	80.0	80.0	80.4	80.8	81.2	81.6	82.0	82.4	87.6	92.1
Real Appreciation RSD vs EUR	%	2.0%	2.0%	2.0%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
Real GDP Growth	%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Real labour wage increase	%	1.0%	1.0%	1.0%	1.0%	1.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%

Investments

In chapter 3, a priority investment plan is elaborated upon. The financial model assumes that the first phase priority investment plan can be completed during the years 2009 to 2010.

Re-investments are required after 15 operational years for the electro-mechanical part of the waste water treatment plant and sewage pumping stations. Phase 2 (WWTP capacity extension) are left outside of this financial analysis. The required tariff adjustment therefore only cover phase I investments. If subsequent phases are implemented, a tariff review will be required.

The estimated investment amounts are summarized in the table below. Individual items include provisions for contingencies and VAT.

Table 5.30 Investments

WWTP (incl. contingencies, incl. VAT)	Units	Tot.	2009	2010
Investigation works & design	€ m	0.35	0.18	0.18
Construction works	€ m	6.91	3.45	3.45
Electro-mechanical equipment	€ m	5.01	2.50	2.50
Additional land acquisition (1,5 ha)	€ m	-	-	-
Trial run, staff training, operation	€ m	0.30	0.15	0.15
Sewerage			-	-
Sabac main sewers	€ m	-	-	-
Sabac SPS - civil works	€ m	1.64	0.82	0.82
Sabac SPS - elctr/mechanical	€ m	0.65	0.32	0.32
Sabac SPS - pipes & fittings	€ m	-	-	-
Supervision			-	-
Supervision WWTP	€ m	0.95	0.48	0.48
Supervision sewer extension	€ m	0.11	0.05	0.05
Total	**€ m**	**15.92**	**7.96**	**7.96**

Table 5.31 Re-investments

	Units	Tot.	2024/25	2039/40
WWTP - electro-mechanical equipment	€ m	33.57	7.15	9.6
Sewerage pumps Sabac suburban	€ m	4.24	0.90	1.2

Apart from the re-investment listed above, no other discretionary investments have been included for the new investments, since the investment program is assessed to capture all required investments for support of the operations of the waste water treatment plant and SPS in Šabac. In addition, sizable allocations are made in the projections for maintenance and repair, which should be sufficient to keep the investments in a proper condition.

The new PUC will also operate the current drinking water supply system and existing sewage collection network in Šabac city. For these current operations, replacement investments have been estimated in such a way that these are equal or slightly higher than the current depreciation charge.

Financing

The first phase priority investment plan is planned to be financed by Šabac municipality, a grant from the Ministry of Agriculture, Forestry and Water, Directorate-General Water and the EU-IPA funds.

At present, the municipality has already allocated in its 2007 budget RSD 67 million (€ 0.84 million) for sewerage projects. The Ministry of Agriculture, Forestry and Water has committed in writing € 4.2 million for the new waste water treatment plant, provided 100% financing is secured (see Annex 5.1). For the purposes of this financial analysis, 1/3 of the total cost of the SPS is assumed to be financed by the Ministry, in line with the Ministries' current policy for this type of investment.

For the purposes of the financial analysis, EU-IPA funds are assumed to amount to 75% of eligible costs (excluding VAT, land acquisition). Actual grant size will depend on the appraisal of this feasibility study, availability of funds and the applicable grant determination mechanism. This is further discussed in paragraph 5.3.10 of this chapter.

Table 5.32 Source of financing phase I/Priority Investment Plan

Financial year ending		Total	2009	2010
EU-IPA	€ m	10.89	5.45	5.45
Min. Agriculture, DG Water	€ m	4.19	2.09	2.09
Municipal contribution	€ m	0.84	0.42	0.42
Loan	€ m	-	-	-
Total	**€ m**	**15.92**	**7.96**	**7.96**

Other potential funding sources are also targeted by the Municipality of Šabac, such as the National Investment Plan. However, none of these are confirmed. Any additional funding can be used to lower the municipal contribution, or to lower funding from EU-IPA.

Revenues

The single main revenue stream for the PUC is tariffs charged to different customer groups. The setting of these tariffs will be elaborated upon in paragraph 5.3.6, but in principle is based on full cost recovery, using straight line historical depreciation and the

polluter pays principle. This will be applied to both existing water system components and proposed new sewage collection and waste water treatment components.

The WWTP sludge treatment process generates electricity, which in principle is a second revenue stream. Since this generated electricity is used for the operations of the WWTP itself, it will be directly deducted from the plant's operational costs, instead of being treated as additional revenues.

A distinction will be made in revenue projections between the "with" and the "without" project situation. This is necessary in order to be able to:

- Estimate total future water and waste water costs and to assess incremental impact on final consumer's tariff and affordability to pay;
- Determine the costs and required tariffs for each component of the water and waste water system;
- Estimate the project's incremental revenue stream for the cost benefit analysis.

The "without" project is comprised of the following components:

- Drinking water production and distribution in Šabac city and villages;
- Sewage collection in Šabac city;
- Management & administration of the PUC (i.e., overhead costs).

In addition to the above two components, the "with" project is comprised of the following additional components:

- Sewage pumping station at Glavna;
- Waste water treatment plant in Šabac municipality.

Allowances for bad debt will reduce the revenue stream of the PUC. Two scenarios for revenue collection rate will be used in the analysis. The Base case assumes that collection rates will improve from the current 90% for all customer groups to 95% by the year 2009. This base case scenario will be used throughout the analysis. A low case scenario, which basically assumes that the collection rate remains constant at 90% during the analysis period, will be used to assess the impact on the required tariffs.

<u>Expenditures</u>

Expenditures are distinguished in two categories:

- Variable costs (electricity, fuel, water, chemicals, sludge transport and effluent discharge fees). These costs directly fluctuate with the amount of drinking water produced and waste water delivered to the sewage collection system;
- Fixed costs (wages, maintenance, insurance, depreciation). These costs do not directly fluctuate with the amount of drinking water produced and waste water delivered to the sewage collection system.

Also for expenditures a distinction will be made between the "without project" situation and the "with project situation"

The following 2007 base prices are assumed for the various expenditure categories:

Table 5.33 Variable operation and maintenance assumptions (2007 prices)

Variable costs		
Electricity	RSD/kwh	5.0
Chemicals - FeCl3/Coagulant	RSD/kg	24
Chemicals - polyelectrolyte	RSD/kg	360
Transport & disposal sludge	RSD/m3	1,600

Table 5.34 Fixed operation and maintenance assumptions (2007 prices)

Fixed costs		
Employee costs (gross salaries)		
Unskilled Labour	RSD/year	360,000
Skilled Labour - high school	RSD/year	480,000
Skilled labour - academic/college	RSD/year	600,000
Management - college	RSD/year	600,000
Management - academic	RSD/year	720,000
Higher Management - academic	RSD/year	840,000
Employee benefits	%	20.0%
Maintenance rates % of investment		
Civil works	%	0.5%
Pipes & fittings - water	%	0.75%
Pipes & fittings - sewerage	%	0.75%
Mechanical equipment	%	3.0%
Electrical equipment	%	2.0%
Insurance costs % of investment		
Civil works	%	0.1%
Pipes & fittings - water	%	0.1%
Pipes & fittings - sewerage	%	0.1%
Mechanical equipment	%	0.7%
Electrical equipment	%	0.7%
Depreciation		
Civil works	years	50
Pipes & fittings - water	years	40
Pipes & fittings - sewerage	years	50
Electro/mechanical equipment	years	15
Average depreciation water infrastructure	years	20
Average depreciation waste water infrastructure	years	20

Depreciation rates are set in accordance with current practice of the PUC Vodovod, Šabac. It should be noted that the depreciation of civil works at 50 years is rather high compared to international practice, although not unrealistic.

Starting from the first year of operations, input prices are adjusted for real and nominal price increases, using the following assumptions:

Wages and salaries: inflation + real wage increase
Employee benefits: inflation + real wage increase
Electricity: inflation + real GDP growth
Transport services: 50% inflation + 50% real wage increase
Repair/Maintenance: 50% inflation + 50% transport services
Other services: 50% inflation + 50% transport services
Taxes & fees: inflation only
Chemicals: inflation only
Other costs: inflation only
This results in the following nominal increases:

Table 5.35 Price escalation O&M costs

Financial year ending	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Wages and Salaries	8.2%	9.2%	9.2%	10.3%	10.3%	10.3%	10.3%	8.2%	8.2%	8.2%	8.2%
Employee benefits	8.2%	9.2%	9.2%	10.3%	10.3%	10.3%	10.3%	8.2%	8.2%	8.2%	8.2%
Electricity	10.3%	10.3%	10.3%	10.3%	9.2%	9.2%	9.2%	8.2%	8.2%	8.2%	8.2%
Transport services	6.6%	7.1%	7.1%	7.6%	7.6%	7.6%	7.6%	6.6%	6.6%	6.6%	6.6%
Repair services	5.8%	6.1%	6.1%	6.3%	6.3%	6.3%	6.3%	5.8%	5.8%	5.8%	5.8%
Other services	5.8%	6.1%	6.1%	6.3%	6.3%	6.3%	6.3%	5.8%	5.8%	5.8%	5.8%
Taxes and fees	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Chemicals	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Other costs	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%

Apart from unit prices and unit price increases, expenditure patterns are estimated based on the following assessment (major items only):

- Staffing follows the schedules as elaborated upon in chapter 7. It is assumed that the new PUC starts operating as from the year 2011;
- Overhead mainly consists of personnel costs. This will increase as from the year 2011 when the new PUC starts to commence operations. Overhead is charged to the four production units pro-rata their share in total salary- and wages costs. Overhead allocated to the new project components (WWTP and SPS) is treated as incremental overhead costs.
- Drinking water supply
    - Planned 2007 costs are used as a basis for estimating future costs;
    - Discretionary investments are estimated at the lower of either realized earnings before interest, tax, depreciation and amortization (EBITDA) or cumulated cash;
- Sewage collection Šabac city
    - Planned 2007 costs are used as a basis for estimating future costs;
    - Discretionary investments is estimated at the lower of either realized earnings before interest, tax, depreciation and amortization (EBITDA) or cumulated cash;
- SPS at Glavna
    - The SPS will be fully operational as of 2011;
- Waste water treatment
    - Start of operations in 2011;
    - Use of poly-electrolyte estimated at 9,500 kg in 2011;
    - Electricity usage in 2011 (net of generated electricity from sludge line) estimated at 1,225 million Kwh;
    - Sludge production estimated at 8,800 m3 in 2011.

Working capital will be calculated assuming:

- Average day of accounts receivable will gradually reduce from the current 210 days to 60 days by the year 2010;

- Average day of accounts payable will gradually reduce from the current 50 days to 45 days by the year 2010;
- Inventories are estimated at 30 days turnover.

Water and waste water demand projection

In chapter 3, demand projections for both water and waste water have been elaborated upon. The main assumptions have been set out in this chapter as well. This analysis is used as an input in the financial model.

In situations where steep hikes in tariffs occur, final consumer demand can be expected to decrease because of price elasticity effects. Especially in situations where actual water usage is high, demand can be expected to fall per consumer, because consumers can easily and at low cost decrease their (excessive) water usage. Water usage per capita in Šabac municipality is however rather low. Although tariff increases are inevitable, price and income elasticity effects on water and waste water demand are not expected to have a major effect on demand per capita and have therefore not been taken into consideration. The sensitivity analysis set out later in this chapter will assess the impact of variations in demand on the financial feasibility of the project.

The tables below summarize the drinking water and waste water demand for Šabac municipality.

Table 5.36 Drinking water demand projection Šabac town and villages

Financial year ending	Units	2006	2007	2008	2009	2010	2011	2012	2017	2030	2041
Water sale total - Sabac town & villages:	m3/y	4,590,044	4,655,218	4,761,391	4,869,691	4,980,157	5,092,828	5,173,484	5,596,780	6,777,960	7,513,694
domestic	m3/y	3,519,790	3,573,288	3,644,686	3,717,278	3,791,081	3,866,112	3,919,203	4,196,058	4,931,519	5,286,693
industry	m3/y	729,910	746,935	761,873	777,111	792,653	808,506	824,676	910,509	1,177,841	1,464,497
institutional users	m3/y	340,344	334,996	354,831	375,302	396,423	418,209	429,605	490,213	668,600	762,504
Losses											
Water losses out of water sold	%	82%	82%	82%	82%	82%	82%	82%	82%	82%	82%
		45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
Water losses out of water produced	%										
Water losses	m3/y	3,785,965	3,839,722	3,927,295	4,016,624	4,107,739	4,200,672	4,267,199	4,616,342	5,590,604	6,197,453
Water production - TOTAL	m3/y	8,376,009	8,494,940	8,688,686	8,886,315	9,087,896	9,293,500	9,440,683	10,213,122	12,368,565	13,711,147

As can be concluded from the table, water demand is expected to increase slightly over the 32 year analyzed period, at about 1.5% per annum. This is the result of a slightly projected increase in population at a constant per capita demand. Water losses as a result of technical and commercial losses have been kept constant at 45% throughout the period. This is done based on the assumption that no major replacement of distribution network or water mains will take place.

Table 5.37 Waste water demand projection Šabac town and villages

Financial year ending	Units	2006	2007	2008	2009	2010	2011	2012	2017	2030	2041
Wastewater Sabac city + villages	m3/y	2,706,612	3,808,942	3,975,606	4,145,299	4,318,068	4,493,958	4,603,635	5,176,826	6,480,941	7,314,520
by type of customer											
domestic	m3/y	2,467,691	2,467,565	2,590,701	2,715,355	2,841,546	2,969,292	3,042,439	3,420,847	4,160,969	4,489,568
Industry -small	m3/y	-	1,103,760	1,125,835	1,148,352	1,171,319	1,194,745	1,218,640	1,345,477	1,740,518	2,164,116
industry - big	m3/y	-	-	-	-	-	-			-	-
institutional users	m3/y	238,921	237,617	259,070	281,592	305,203	329,921	342,556	410,502	579,454	660,837
by location											
Sabac town	m3/y	2,573,430	3,662,118	3,774,695	3,888,881	4,004,694	4,122,153	4,192,895	4,559,705	5,288,554	5,841,238
Sabac suburbs	m3/y	133,182	146,824	200,911	256,419	313,374	371,805	410,740	617,121	1,192,388	1,473,282
Infiltration											
Sabac town	m3/y	1,892,160	1,892,160	1,892,160	1,892,160	1,892,160	1,892,160	1,892,160	1,892,160	1,892,160	1,892,160
Sabac suburbs	m3/y	-	760,321	760,321	760,321	760,321	760,321	760,321	760,321	760,321	760,321
Wastewater delivered to the WWTP	m3/y	4,598,772	6,461,423	6,628,087	6,797,780	6,970,549	7,146,439	7,256,116	7,829,307	9,133,422	9,967,001
Wastewater delivered to the WWTP	m3/d	12,599	17,703	18,159	18,624	19,097	19,579	19,880	21,450	25,023	27,307

Waste water demand is expected to grow significantly up to the year 2041, roughly in line with growth in water demand.

5.3.4 Expenditure forecast

"Without project" expenditures

Based on the assumptions elaborated upon above, a forecast of expenditures of the "without project situation" is made. The "without project situation" consists of the drinking water supply system, sewage collection system in Šabac city and part of the overhead costs. The tables below summarize the projected expenditures of these components. The expenditures include allowances for overhead.

Table 5.38 Drinking water expenditures

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Variable costs		**7,328**	**8,139**	**9,044**	**9,987**	**10,959**	**12,028**	**13,206**	**14,399**	**15,702**	**48,488**	**120,771**
Liquid chlorine	000 RSD	217	233	250	266	284	303	323	345	368	840	1,592
Electricity	000 RSD	5,032	5,674	6,397	7,164	7,947	8,816	9,779	10,744	11,804	39,586	103,892
Fuel and lubricant	000 RSD	2,079	2,233	2,397	2,557	2,727	2,909	3,103	3,310	3,531	8,063	15,287
Fixed costs	000 RSD	**125,948**	**133,963**	**124,431**	**133,045**	**142,351**	**152,315**	**163,195**	**173,233**	**183,837**	**422,606**	**885,052**
Wages and Salaries	000 RSD	30,456	33,258	28,284	31,183	34,379	37,903	41,788	45,193	48,877	135,346	320,433
Employee benefits	000 RSD	9,153	9,995	8,500	9,371	10,332	11,391	12,558	13,582	14,689	40,675	96,300
Other materials	000 RSD	11,310	11,875	12,469	13,092	13,747	14,434	15,156	15,914	16,709	31,508	53,890
Transport services	000 RSD	625	670	717	772	831	894	962	1,025	1,093	2,501	5,039
Repair services	000 RSD	2,553	2,708	2,871	3,053	3,245	3,450	3,668	3,880	4,105	8,530	15,839
Other services	000 RSD	8,737	9,266	9,826	10,447	11,106	11,807	12,553	13,279	14,048	29,191	54,203
Taxes and fees	000 RSD	144	151	158	166	175	183	193	202	212	401	685
Depreciation	000 RSD	30,918	31,774	32,629	33,809	35,022	36,172	37,448	38,708	39,892	69,674	114,695
Other costs	000 RSD	1,894	1,989	2,088	2,192	2,302	2,417	2,538	2,665	2,798	5,276	9,024
Overhead costs	000 RSD	30,158	32,279	26,888	28,960	31,213	33,663	36,331	38,784	41,414	99,503	214,944
TOTAL	000 RSD	**133,275**	**142,102**	**133,474**	**143,033**	**153,310**	**164,343**	**176,400**	**187,632**	**199,539**	**471,093**	**1,005,823**

Table 5.39 Sewage collection system Šabac city - expenditures

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Variable costs	000 RSD	**1,287**	**1,455**	**1,644**	**1,841**	**2,041**	**2,263**	**2,509**	**2,755**	**3,025**	**9,772**	**25,248**
Electricity	000 RSD	1,287	1,455	1,644	1,841	2,041	2,263	2,509	2,755	3,025	9,772	25,248
Fixed costs	000 RSD	**12,057**	**15,249**	**11,165**	**13,052**	**15,419**	**17,600**	**19,724**	**21,781**	**23,796**	**51,553**	**89,394**
Wages and Salaries	000 RSD	3,475	3,795	629	693	764	843	929	1,005	1,087	3,009	7,124
Employee benefits	000 RSD	688	751	125	137	151	167	184	199	215	596	1,411
Other materials	000 RSD	31	31	31	31	31	31	31	31	31	31	31
Transport services	000 RSD	47	50	53	58	62	67	72	76	81	186	376
Repair services	000 RSD	24	25	27	28	30	32	34	36	38	80	148
Other services	000 RSD	291	291	291	291	291	291	291	291	291	291	291
Taxes and fees	000 RSD	26	28	29	31	32	34	35	37	39	74	126
Depreciation	000 RSD	3,985	6,544	9,329	11,083	13,303	15,325	17,275	19,175	21,020	44,938	74,876
Other costs	000 RSD	49	51	54	57	59	62	65	69	72	136	233
Overhead	000 RSD	3,441	3,683	598	644	694	748	808	862	921	2,212	4,779
TOTAL costs for existing infrastr	000 RSD	**13,344**	**16,704**	**12,810**	**14,893**	**17,460**	**19,863**	**22,233**	**24,536**	**26,821**	**61,326**	**114,642**

Total overhead costs are set out in the table below. Overhead is allocated to the various production departments pro-rata their share in total wages and salaries costs. Therefore, it is not entirely a "without project" cost.

Table 5.40 Overhead expenditures

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Wages and Salaries	000 RSD	13,899	15,178	16,575	18,273	20,146	22,211	24,488	26,484	28,642	79,315	187,778
Employee benefits	000 RSD	2,819	3,078	3,315	3,655	4,029	4,442	4,898	5,297	5,728	15,863	37,556
Other materials	000 RSD	12,057	12,660	13,293	13,958	14,656	15,388	16,158	16,966	17,814	33,591	57,452
Energy (Electricity)	000 RSD	160	176	194	214	234	255	279	301	326	903	2,137
Transport services	000 RSD	500	535	573	617	664	714	769	819	873	1,998	4,026
Repair services	000 RSD	710	753	798	849	902	959	1,020	1,079	1,141	2,371	4,403
Other services	000 RSD	1,715	1,818	1,928	2,050	2,180	2,317	2,463	2,606	2,757	5,729	10,637
Taxes and fees	000 RSD	230	242	254	267	280	294	309	324	340	642	1,098
Depreciation	000 RSD	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273
Other costs	000 RSD	237	249	261	274	288	302	317	333	350	660	1,129
TOTAL	000 RSD	**33,599**	**35,962**	**38,464**	**41,429**	**44,651**	**48,157**	**51,973**	**55,482**	**59,245**	**142,344**	**307,488**

"With project" expenditures

Expenditures related to the "with project" situation consist of the above expenditures plus new operations for the waste water treatment plant and the SPS at Glavna.

Table 55.41 SPS Glavna: expenditures

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Variable costs		**-**	**2,128**	**3,989**	**4,450**	**4,916**	**5,432**	**6,001**	**6,567**	**7,186**	**22,146**	**56,465**
Use of chemicals	000 RSD											
Electricity	000 RSD		2,128	3,989	4,450	4,916	5,432	6,001	6,567	7,186	22,146	56,465
Fixed costs	000 RSD	**-**	**4,066**	**25,351**	**27,032**	**28,871**	**30,885**	**33,092**	**35,071**	**37,202**	**88,219**	**188,275**
Wages and Salaries	000 RSD			8,034	8,857	9,765	10,766	11,870	12,837	13,883	38,444	91,017
Employee benefits	000 RSD			1,607	1,771	1,953	2,153	2,374	2,567	2,777	7,689	18,203
Other materials	000 RSD											
Transport services	000 RSD											
Repair services	000 RSD		857	1,448	1,540	1,637	1,740	1,850	1,957	2,070	4,302	7,989
Other services	000 RSD		114	193	205	218	232	247	261	276	574	1,065
Taxes and fees	000 RSD											
Depreciation	000 RSD	-	3,095	6,432	6,432	6,432	6,432	6,432	6,432	6,432	8,946	8,946
Overhead	000 RSD	-	-	7,637	8,226	8,866	9,562	10,320	11,016	11,764	28,263	61,054
TOTAL incremental costs	**000 RSD**	**-**	**6,194**	**29,340**	**31,481**	**33,787**	**36,317**	**39,093**	**41,637**	**44,387**	**110,364**	**244,740**

Note that for the new components, the relative share of depreciation is declining as a result of straight line depreciation at historical cost.

The table below summarizes the operational costs of all components and their percentage share. These costs do not include allowances for bad debt.

Table 5.42 Summary expenditures by component

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Expenditure by component												
Drinking water	000 RSD	133,275	142,102	133,474	143,033	153,310	164,343	176,400	187,632	199,539	471,093	1,005,823
Sewage collection Sabac city	000 RSD	13,344	16,704	12,810	14,893	17,460	19,863	22,233	24,536	26,821	61,326	114,642
Waste water treatment	000 RSD	-	-	96,299	97,120	101,838	106,978	112,581	118,024	123,904	277,801	543,231
Sewage collection Sabac villages	000 RSD	-	6,194	29,340	31,481	33,787	36,317	39,093	41,637	44,387	110,364	244,740
Total		**146,619**	**165,000**	**271,923**	**286,527**	**306,394**	**327,501**	**350,307**	**371,830**	**394,651**	**920,584**	**1,908,436**
Drinking water	%	91%	86%	49%	50%	50%	50%	50%	50%	51%	51%	53%
Sewage collection Sabac city	%	9%	10%	5%	5%	6%	6%	6%	7%	7%	7%	6%
Waste water treatment	%	0%	0%	35%	34%	33%	33%	32%	32%	31%	30%	28%
Sewage collection Sabac villages	%	0%	4%	11%	11%	11%	11%	11%	11%	11%	12%	13%
Total	**%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Expenditure by service												
water	000 RSD	133,275	142,102	133,474	143,033	153,310	164,343	176,400	187,632	199,539	471,093	1,005,823
sewage collection	000 RSD	13,344	22,898	42,150	46,374	51,247	56,180	61,326	66,174	71,208	171,690	359,382
wastewater	000 RSD	-	-	96,299	97,120	101,838	106,978	112,581	118,024	123,904	277,801	543,231
Total costs	**000 RSD**	**146,619**	**165,000**	**271,923**	**286,527**	**306,394**	**327,501**	**350,307**	**371,830**	**394,651**	**920,584**	**1,908,436**
going to water	%	91%	86%	49%	50%	50%	50%	50%	50%	51%	51%	53%
going to sewage collection	%	9%	14%	16%	16%	17%	17%	18%	18%	18%	19%	19%
going to wastewater	%	0%	0%	35%	34%	33%	33%	32%	32%	31%	30%	28%
Total	**%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Depreciation												
water services	000 RSD	30,918	31,774	32,629	33,809	35,022	36,172	37,448	38,708	39,892	69,674	114,695
sewage collection	000 RSD	3,985	9,639	15,761	17,514	19,735	21,757	23,706	25,607	27,452	53,884	83,822
wastewater services	000 RSD	-	-	41,543	41,543	41,543	41,543	41,543	41,543	41,543	63,438	63,438
Depreciation	**000 RSD**	**34,903**	**41,413**	**89,933**	**92,866**	**96,300**	**99,471**	**102,698**	**105,858**	**108,887**	**186,996**	**261,955**
going to water	%	89%	77%	36%	36%	36%	36%	36%	37%	37%	37%	44%
going to sewage collection	%	11%	23%	18%	19%	20%	22%	23%	24%	25%	29%	32%
going to wastewater	%	0%	0%	46%	45%	43%	42%	40%	39%	38%	34%	24%
Total	**%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

The project will about double the expenditure of the PUC. New expenditures account for 46% of total expenditure in the year 2011, decreasing to 41% by the year 2041.

Presently, the water supply system accounts for almost 90% of total expenditure. However, this will change considerably as from the year 2011, when the water supply share of total expenditure will drop to 49%.

5.3.1 Unit cost prices

The unit cost price per m3 of drinking water invoiced and waste water delivered to the sewage network is calculated in such a way to cover at least the below mentioned costs. Full cost coverage is achieved if revenues generated by the applicable tariffs equals or exceeds total costs as calculated below.

- Operation & maintenance costs;
- Depreciation;
- (Provision for) bad debt;
- Interest payment;
- Working capital;
- Profit margin.

Depreciation is calculated at historical cost and by using a straight line depreciation methodology. The provision for bad debt is based on an improvement from the current 90% to 95% collection rate in the year 2009 for all customer groups. Since no debt financing is envisaged for this project, interest payment is nil. Finally, the profit level is set at 0%, in line with current practice in Serbia. Although this is not uncommon, it will

constrain the possibility for the PUC to invest in other service improvements or system extensions, such as improvement of quality and quantity of drinking water supply.

Using this methodology, a cost price for each of the PUC's services is calculated as detailed in the tables below. Unit cost prices can be expressed in a number of different ways:

- Drinking water supplied and billed to consumers;
- Waste water delivered to the sewage collection system;
- Waste water delivered to the waste water treatment plant, including infiltration. This is the physical quantity of waste water treated by the waste water treatment plant.

In order to enable a meaningful comparison between the cost prices of each of the different services, prices are expressed in RSD per m3 of drinking water supplied and billed to customers. This does not fully reflect the actual situation, since some clients have their own water source and thus only pay for sewage collection and treatment services. However, the current tariff system is set up in such a way that customers are charged a tariff for sewage collection services for each m3 of drinking water consumed.

Table 5.43 Cost price drinking water

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Cost to cover - water												
operating costs & depreciation	RSD m	133	142	133	143	153	164	176	188	200	471	1,006
increase in working capital	RSD m	0	1	(3)	(5)	(7)	(5)	(5)	(7)	(8)	3	7
bad debt	RSD m	9	6	7	7	7	7	8	9	9	23	50
Interest and fee payment	RSD m	-	-	-	-	-	-	-	-	-	-	-
DSCR over depreciation	RSD m	-	-	-	-	-	-	-	-	-	-	-
Loan repayment over depreciation	RSD m	-	-	-	-	-	-	-	-	-	-	-
Total Water Costs to cover	RSD m	143	150	137	145	153	166	180	189	200	498	1,062
Volume produced	'000 m3	8,886	9,088	9,293	9,441	9,590	9,742	9,897	10,054	10,213	12,369	13,711
Volume billed												
Domestic	'000 m3	3,717	3,791	3,866	3,919	3,973	4,028	4,083	4,139	4,196	4,932	5,287
Institutional users	'000 m3	375	396	418	430	441	453	465	478	490	669	763
Business	'000 m3	777	793	809	825	841	858	875	893	911	1,178	1,464
Total	'000 m3	4,870	4,980	5,093	5,173	5,255	5,339	5,423	5,509	5,597	6,778	7,514
Unit cost of water produced	RSD / m3	16	16	15	15	16	17	18	19	20	40	77
Unit cost of water billed	RSD / m3	29	30	27	28	29	31	33	34	36	73	141

The forecasted unit cost of drinking water billed in the year 2009 is RSD 29/m3. Annual increases are mostly in the order of 6% to 8%, which is above the forecasted dinar inflation rate. In other words, even with a rather modest investment program, the cost price of water is increasing above inflation. This trend also happened during the last several years, but even at a higher rate, mainly because of stagnating water quantities supplied, with an increasing cost base well above actual inflation.

Table 5.44 Cost price sewage collection Šabac city

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Cost to cover												
operating costs & depreciation	RSD m	13	17	13	15	17	20	22	25	27	61	115
increase in working capital	RSD m	(14)	(18)	1	(2)	0	0	(0)	(1)	(1)	0	1
bad debt	RSD m	4	2	2	2	2	2	2	2	2	3	6
Total Waste Water costs to cover	RSD m	4	1	16	15	20	22	24	26	28	65	121
Volume billed (Sabac town + villages)												
Domestic	'000 m3	2,715	2,842	2,969	3,042	3,116	3,191	3,267	3,343	3,421	4,161	4,490
Institutional users	'000 m3	282	305	330	343	356	369	382	396	411	579	661
Business - small	'000 m3	1,148	1,171	1,195	1,219	1,243	1,268	1,293	1,319	1,345	1,741	2,164
Business - large	'000 m3	-	-	-	-	-	-	-	-	-	-	-
Total	'000 m3	4,145	4,318	4,494	4,604	4,715	4,828	4,942	5,059	5,177	6,481	7,315
Unit cost of wastewater	RSD / m3	1	0	4	3	4	5	5	5	5	10	17
Unit cost of wastewater of drinking water supplied	RSD / m3	1	0	3	3	4	4	4	4	5	8	14

The unit cost price for sewage collection services is expressed both in waste water delivered to the sewerage system and drinking water supplied. It is estimated that 84% of the consumed drinking water ends up in the sewerage system. The unit cost of

sewage collection in 2008 is RSD 0.75 per m3 drinking water consumed. This increases to RSD 3 in 2011, as a result of working capital changes.
After 2011, unit prices increase moderately with 6% to 8%, in line with drinking water increases.

Table 5.45 Cost price SPS at Glavna

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Cost to cover												
operating costs & depreciation	RSD m	-	6	29	31	34	36	39	42	44	110	245
increase in working capital	RSD m	-	-	3	9	(1)	(1)	(1)	(2)	(2)	1	1
bad debt	RSD m	-	-	0	2	2	2	2	2	2	5	12
Interest and fee payment	RSD m	-	-	-	-	-	-	-	-	-	-	-
DSCR over depreciation	RSD m											
CAPEX injection	RSD m											
Total Waste Water costs to cover	RSD m	-	6	32	42	35	37	40	42	45	116	258
Volume billed (Sabac town + villages)												
Domestic	'000 m3	2,715	2,842	2,969	3,042	3,116	3,191	3,267	3,343	3,421	4,161	4,490
Institutional users	'000 m3	282	305	330	343	356	369	382	396	411	579	661
Business - small	'000 m3	1,148	1,171	1,195	1,219	1,243	1,268	1,293	1,319	1,345	1,741	2,164
Business - large	'000 m3	-	-	-	-	-	-	-	-	-	-	-
Total	'000 m3	4,145	4,318	4,494	4,604	4,715	4,828	4,942	5,059	5,177	6,481	7,315
Unit cost of wastewater discharged	RSD / m3	-	1	7	9	7	8	8	8	9	18	35
Unit cost of wastewater of drinking water supplied	RSD / m3	-	1	6	8	6	7	7	7	7	15	30

The unit cost price for the new SPS at Glavna amounts to RSD 6 per m3 of drinking water consumed, during the year 2011. During the period after 2010, annual unit cost price growth is with around 4% on average.

Table 5.46 Cost price waste water treatment

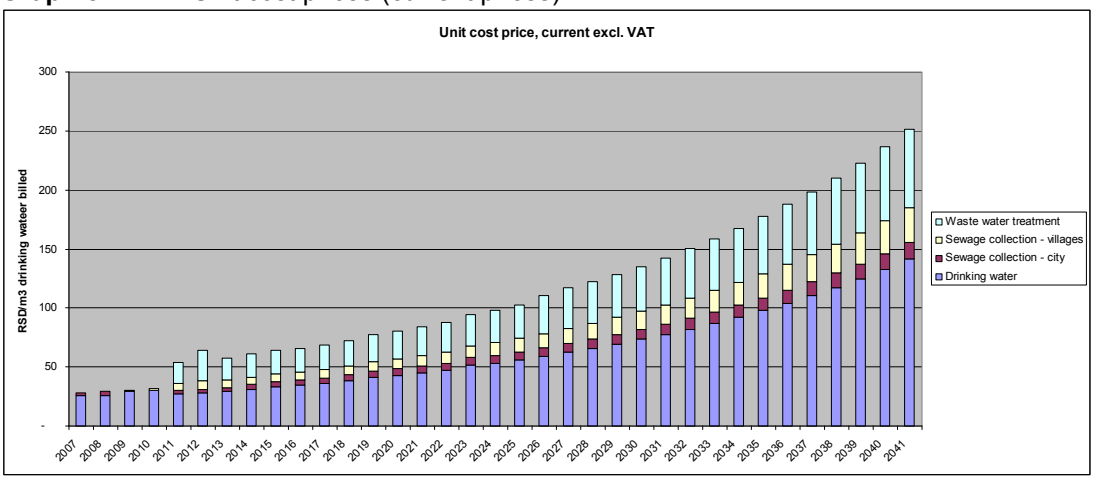
Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Cost to cover waste water treatment												
operating costs & depreciation	RSD m	-	-	96	97	102	107	113	118	124	278	543
increase in working capital	RSD m	-	-	-	40	(5)	(4)	(4)	(5)	(6)	1	3
bad debt	RSD m	-	-	-	5	7	7	7	8	8	14	27
Interest and fee payment	RSD m	-	-	-	-	-	-	-	-	-	-	-
DSCR over depreciation	RSD m											
CAPEX injection	RSD m											
Total Waste Water costs to cover	RSD m	-	-	96	142	104	110	116	121	126	293	573
Volume billed												
Domestic	'000 m3			2,969	3,042	3,116	3,191	3,267	3,343	3,421	4,161	4,490
Institutional users	'000 m3			330	343	356	369	382	396	411	579	661
Business - small	'000 m3			1,195	1,219	1,243	1,268	1,293	1,319	1,345	1,741	2,164
Business - large	'000 m3			-	-	-	-	-	-	-	-	-
Total	'000 m3	-	-	4,494	4,604	4,715	4,828	4,942	5,059	5,177	6,481	7,315
Unit cost of wastewater treated (incl. infiltration)	RSD / m3			13	20	14	15	15	16	16	32	57
Unit cost of wastewater delivered to collection system	RSD / m3			21	31	22	23	23	24	24	45	78
Unit cost of wastewater of drinking water supplied	RSD / m3			18	26	19	19	20	20	21	38	66

The unit cost for waste water treatment during the year 2011, the first operational year of the waste water treatment plant, amounts to RSD 18 per m3 of drinking water supplied. Annual increases thereafter are limited to 2-4% on average.

The graph below summarizes the various cost prices for each of the services supplied by the PUC. The total unit cost price in 2007 per m3 of drinking water supplied amounts to RSD 28/m3 (€ 0.33/m3). This increases to RSD 54/m3 (€ 0.64/m3) during the year 2011, when the investments become operational. By the year 2020, unit cost prices have increased to RSD 80/m3 (€ 0.83/m3).

As can be clearly seen, the introduction of waste water treatment in the year 2011 causes the total unit cost price to increase with about 50%, compared to the previous year. Thereafter, unit cost prices increase with about 5% to 6% annually, which is slightly above inflation.

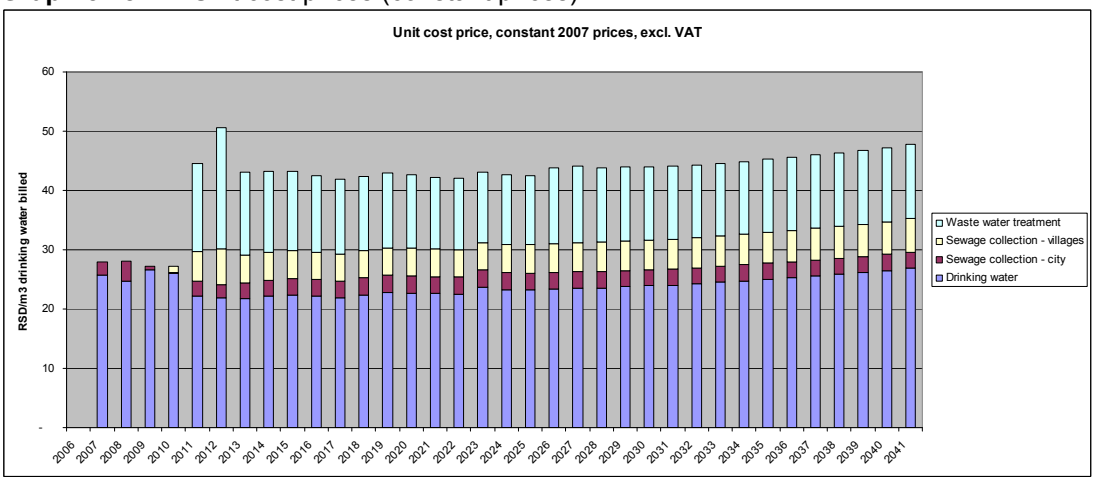
Graph 5.47 Unit cost prices (current prices)



The graph below summarizes the unit cost prices, however expressed in constant 2007 prices. By doing so, real increases in prices can be easily analyzed.

Not surprisingly, the introduction of waste water treatment in the year 2011 causes the real unit cost price to increase. Compared to the year 2007, the introduction of both waste water treatment and SPS at Glavna, as well as increases in the current drinking water and sewage collection system causes the total unit cost price to increase with 60% in real terms, from RSD 28/m3 during 2007 to RSD 54/m3 in 2011. Thereafter, real unit cost prices increase with about 0% to 1.5% annually. This latter increase is however driven by existing services, where real increases of the unit cost price amount to about 1.5 – 2.5% annually.

Graph 5.48 Unit cost prices (constant prices)



5.3.5 Tariffs

Having calculated the cost price for all different components for the water and waste water, a tariff and tariff policy for each client group can be proposed. The following principles, will serve as a basis for determining a suitable tariff and tariff policy:

- Tariffs are based on full cost coverage as defined above;

- Tariffs will be based on the polluter pays principle;
- Tariffs should not exceed maximum affordability levels;
- Tariffs should ensure financial sustainability;
- Steep tariff increases should as much as possible be avoided.

Furthermore, the current Government policy of regulated tariffs, which does not allow tariffs to increase more than estimated inflation levels, should be taken into consideration as well. It is expected that at least in the short term, this policy will be continued. Only in case of new services, like waste water treatment, a separate tariff can be introduced.

For this reason it is proposed to introduce, as from the year 2011, a new tariff for waste water treatment. Thus, the following tariffs will have to be determined for each user group:
- Drinking water;
- Sewage collection;
- Waste water treatment.

In order to be able to make a meaningful comparison, all tariffs are recalculated in m3 drinking water equivalent, in line with the current tariff methodology. Obviously, a tariff based on actual waste water discharged into the sewage collection system will have to be set, instead of a drinking water based tariff. This separate waste water discharge tariff will be clearly disclosed in the summary at the end of this paragraph.

Furthermore, all tariffs are expressed in constant 2007 prices, to allow a meaningful comparison of tariff adjustments over time. Information on the effect of the proposed tariff policy on the current tariff – the tariff which clients will actually see on their invoice, will be outlined at the end of this paragraph.

Drinking water tariff
The current 2007 drinking water tariff structure is as follows:

Table 5.49 2007 drinking water tariffs (without VAT)

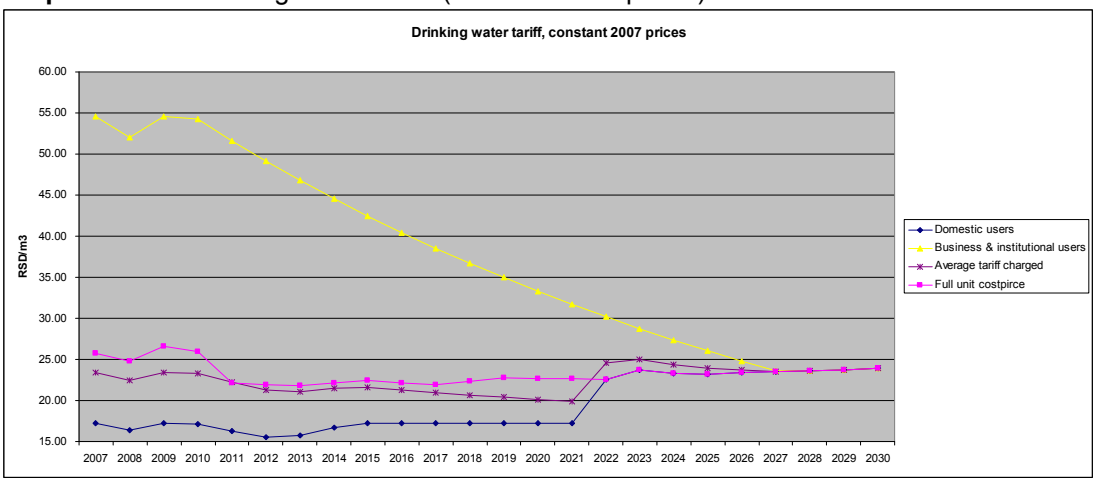
Customer group	**RSD/m3**
Domestic	17.21
Institutional	20.42
Business	54.59

The tariff for business is twice as high as those for other user groups. This is not based on higher costs for delivery of drinking water services to businesses. Therefore, domestic and institutional tariffs are cross subsidized by business tariffs. The overall level of cross subsidy is limited, since businesses only account for less than 15% of total drinking water quantity invoiced. Therefore, it is proposed to gradually abolish the cross subsidy, starting from the year 2009, so that by the year 2028 the drinking water tariff is the same for all customer groups.

The real unit cost price of drinking water fluctuates until the year 2011, after which it increases with about 1.5% annually. For this reason and taking into consideration current Government policy, it is proposed to increase the current drinking water tariff

with inflation only until the year 2011. From 2012, the average tariff will be based on the full unit cost price. The result of this policy is illustrated in the graph below.

Graph 5.50 Drinking water tariffs (2007 constant prices)



Sewage collection tariff

The current 2007 collection tariff is fixed at 40% of the drinking water tariff. The table below summarizes the current sewage collection tariffs.

Table 5.51 2007 Sewage collection tariffs (without VAT)

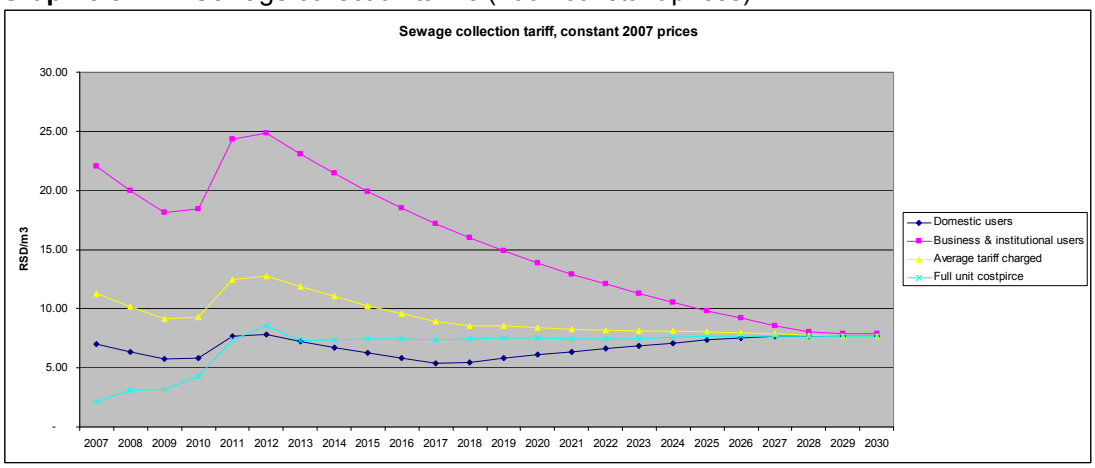
Customer group	RSD/m3
Domestic	7.02
Institutional	8.34
Business	22.05

Again, the business tariff is more than twice as high as those for domestic and institutional users, without a clear cost justification. Therefore, the business tariff is cross subsidizing the domestic/institutional tariffs. The cross subsidy is diminished gradually from 2012 onwards. Tariffs are expected to be equal after 2028. The result of this policy is depicted in the graph below.

This policy has as an intended effect that as from the year 2014, *average* tariff charged is equal to average unit cost price.

Note that as a result of this policy, the *average* tariff charged up to the year 2014 exceeds the full unit cost price, with the exception of the year 2010.

Graph 5.52 Sewage collection tariffs (2007 constant prices)



Wastewater treatment tariff

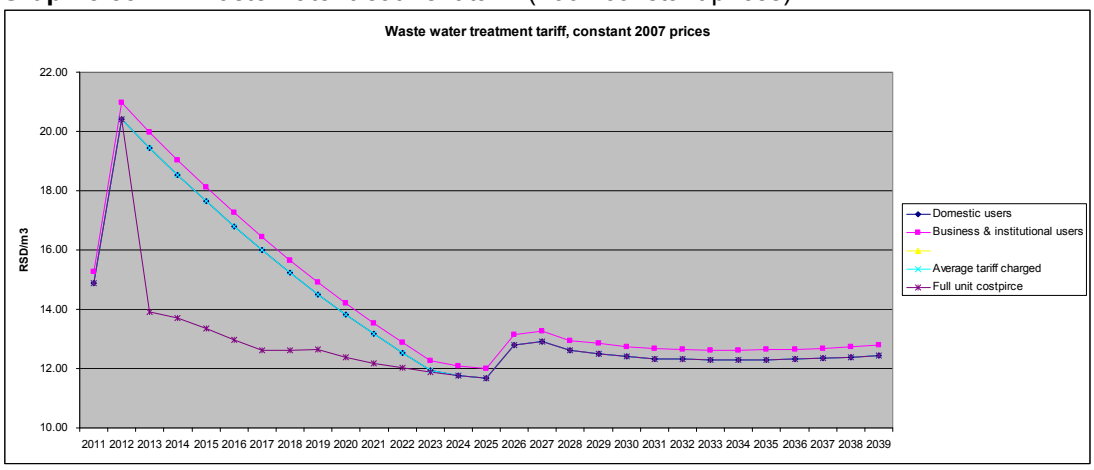
The treatment of waste water is a new service in Šabac municipality. It is expected that this service becomes operational as from the year 2011. Therefore, it is proposed to introduce a completely new tariff for waste water treatment, which also should be clearly distinguished on invoices sent to customers. The introduction of a new tariff would enable the PUC to cover its costs and would be in line with current Government policy, which allows the introduction of new tariffs for new services. A separate tariff for waste water treatment is not uncommon for those Serbian municipalities who have operational waste water treatment plants. The municipality of Subotica charges its customers a separate tariff for waste water treatment.

When analyzing the development of the unit cost price of waste water, it can be concluded that after the first operational year 2011, the real unit cost price decreases with around 0.5% to 1.0% until the year 2026. In the year 2025, large re-investment in mechanical and electrical equipment is required, which causes the real unit cost price to increase with 10% during the next year. After this year, real unit cost prices fluctuate at around 0%.

It is proposed to set the waste water tariff from the start at the full unit cost price at the same level for all customer groups.

Furthermore, it is proposed to set the tariff right from the year 2011 at full cost recovery level, without a gradual introduction. Although this will cause the overall tariff for domestic users to increase with about 50% during the year 2011, this is still well within average affordability levels as will be shown later on. Furthermore, it will have as an added advantage that real tariff increases are not required thereafter. Tariffs would only have to be adjusted for inflation.

Graph 5.53 Waste water treatment tariff (2007 constant prices)



Summary tariffs

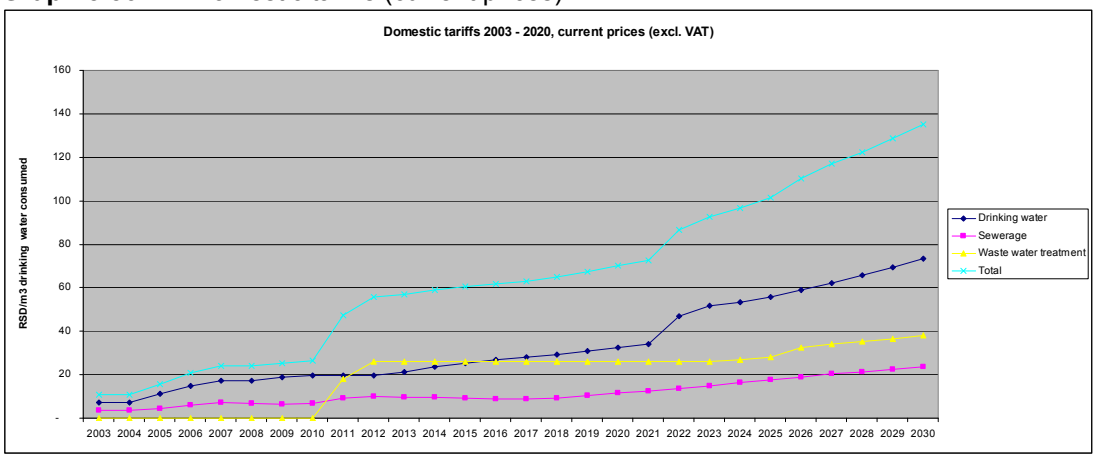
The effect of the proposed tariff policy is summarized in the table below. The mentioned tariffs in this table are however expressed as current values. Thus, apart from real increases, tariffs are also corrected for inflation. This will be the tariff charged to customers. The base case macro economic scenario projects an inflation rate of 5% as from the year 2008 onwards. Therefore, if a tariff increases with 5%, no real increase in tariffs is proposed, but only an adjustment for inflation.

Table 5.54 Summary proposed tariff structure (current prices)

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Tariff summary (excl. VAT)												
Drinking water												
Domestic	RSD / m3	19	20	20	20	21	24	25	27	28	73	141
Institutional users	RSD / m3	23	24	25	26	27	29	30	32	33	73	141
Business - small	RSD / m3	60	63	63	63	63	63	63	63	63	73	141
Waste water treatment												
Domestic	RSD / m3	-	-	18	26	26	26	26	26	26	38	66
Institutional users	RSD / m3	-	-	19	27	27	27	27	27	27	39	68
Business - small	RSD / m3	-	-	19	27	27	27	27	27	27	39	68
Sewerage												
Domestic	RSD / m3	6	7	9	10	10	9	9	9	9	24	44
Institutional users	RSD / m3	8	9	18	21	21	21	21	21	21	24	45
Business - small	RSD / m3	20	21	30	32	31	30	29	29	28	24	45
Total W&WW (RSD)												
Domestic	RSD / m3	25	27	47	56	57	59	61	62	63	135	251
Institutional users	RSD / m3	30	33	62	74	75	76	78	79	81	137	254
Business - small	RSD / m3	80	84	111	121	120	120	119	118	118	137	254
Total W&WW (€)												
Domestic	€ / m3	0.31	0.32	0.56	0.65	0.65	0.67	0.68	0.68	0.68	1.21	1.92
Institutional users	€ / m3	0.37	0.40	0.73	0.86	0.86	0.87	0.87	0.87	0.88	1.23	1.94
Business - small	€ / m3	0.98	1.01	1.31	1.42	1.39	1.36	1.33	1.30	1.28	1.23	1.94
Tariff summary - % increase year-on-year avg												
Drinking water												
Domestic	%	10%	4%	0%	0%	7%	12%	8%	5%	5%	6%	6%
Institutional users	%	5%	5%	5%	5%	5%	5%	5%	5%	5%	6%	6%
Business - small	%	10%	4%	0%	0%	0%	0%	0%	0%	0%	6%	6%
Waste water treatment												
Domestic	%				44%	0%	0%	0%	0%	0%	4%	6%
Institutional users	%				44%	0%	0%	0%	0%	0%	4%	6%
Business - small	%				44%	0%	0%	0%	0%	0%	4%	6%
Sewerage												
Domestic	%	-5%	6%	38%	7%	-3%	-3%	-3%	-2%	-2%	5%	6%
Institutional users	%	-5%	25%	93%	15%	-1%	1%	0%	0%	0%	5%	6%
Business - small	%	-5%	7%	39%	7%	-3%	-3%	-2%	-2%	-2%	5%	6%
Total W&WW												
Domestic	%	6%	5%	78%	18%	2%	4%	3%	2%	2%	5%	6%
Institutional users	%	2%	10%	86%	20%	1%	2%	2%	2%	2%	5%	6%
Business - small	%	6%	5%	32%	9%	-1%	-1%	-1%	-1%	-1%	5%	6%

The effect over time of the proposed domestic tariff is depicted in the graph below. Note that this concerns current fees, including inflation.

Graph 5.56 Domestic tariffs (current prices)



5.3.6 Affordability

Domestic users/household

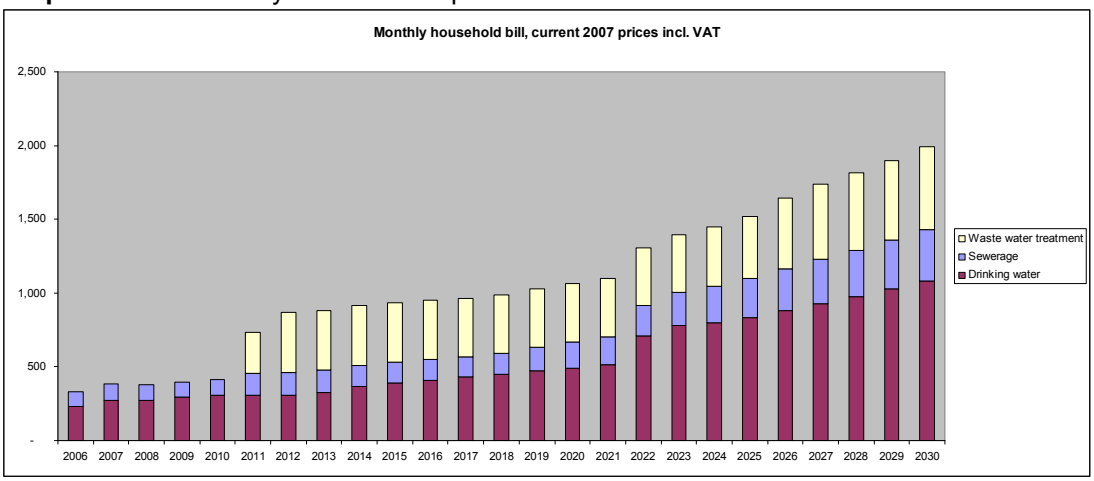
The proposed tariff policy causes the tariffs to increase substantially, especially during the year 2011. This is of course not very surprising given the scale of investments required. The question of affordability to domestic consumers is usually assessed by estimating the share of expenditures on water and waste water out of total available income in a single household. Chapter 2 of this report has elaborated on the household income trend as well as the maximum affordability, using a 4% maximum affordability ratio. In doing so, a maximum affordable household bill of RSD 1,518/month was calculated, for the year 2007. This is much higher than the actual 2007 bill for a household, which is estimated at RSD 382/month or 1.0% of household income.

In assessing future affordability, the following factors are taken into consideration:

- Consumption per capita will increase in accordance with the demand analysis elaborated upon in chapter 3. This will increase the overall household bill;
- The size of the households will decline with a rate similar to that realized during the period 1991 to 2002, i.e. with 0.3% per annum down to a minimum of 2.80 members per household. This will decrease the average household bill;
- Value added tax will be fixed at 8% throughout the analyzed period;
- Household income will grow with inflation and projected real wage increase;

The monthly average household bill, including VAT based on the proposed domestic tariffs is shown in the graph below.

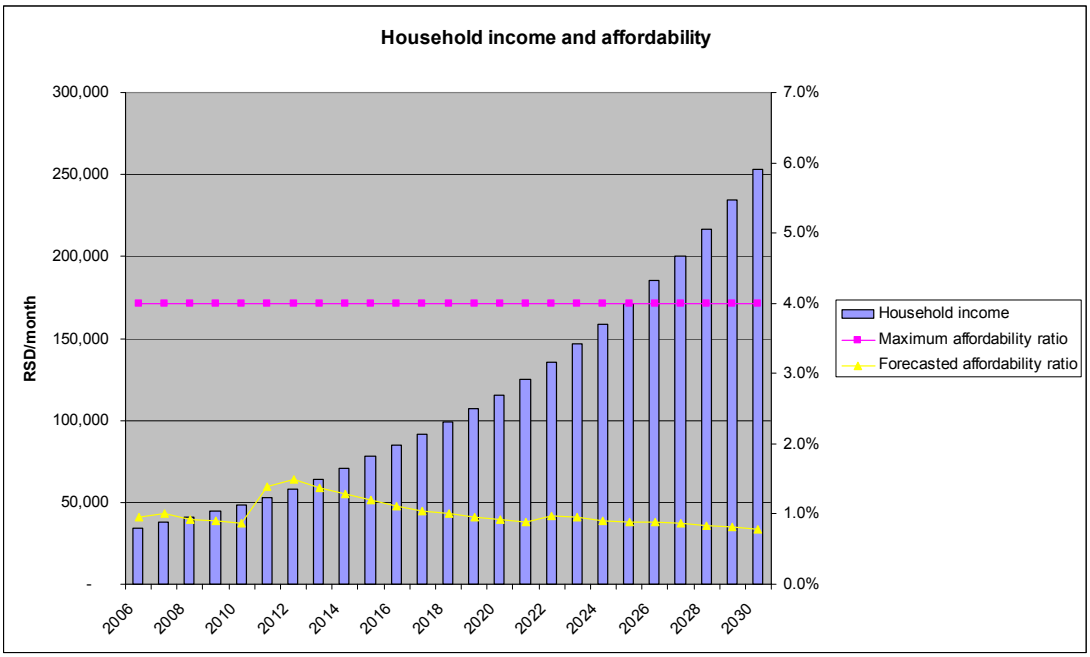
Graph 5.57 Monthly household expenditure on water & waste water



Next, the growth in household income is compared with both the forecasted and maximum affordability ratios. As can be seen in the graph below, the affordability ratio will peak during the year 2011 to 2013 at 1.5%, as a result of the introduction of a waste water treatment tariff. This increase, however, is well below the maximum affordability ratio of 4.0%. Conclusion therefore is that the proposed tariffs are on average affordable to domestic users. It should be realized however, that the calculations are based on average consumption patterns and average household income. A large low income family with above average consumption per capita will face a higher total monthly bill, while at the same time household income will be lower. On the other hand, pensioners are a recognized vulnerable group, but will most likely have smaller households and consequently lower consumption patterns and lower monthly bills to pay.

In any case, this could cause affordability constraints. It is suggested to identify cases where this might occur and build upon the existing social support program of Šabac municipality.

Graph 5.58 Household income and affordability



5.3.7 Revenue forecast

After setting the tariffs, total revenues for the company can be calculated. A distinction will be made between “without” and “with” project revenues, which later on will be used in the cost benefit analysis.

The following revenue streams can be distinguished:

- Drinking water revenues;
- Sewage collection revenues;
- Waste water treatment revenues.

Drinking water revenues is entirely a “without” project revenue stream, whereas waste water treatment is entirely an incremental “with” project revenue stream. The sewage collection revenue stream consists of both “with” and “without” parts. To distinguish between the two, an incremental demand analysis is made, based on which revenue is differentiated.

<u>Drinking water revenues</u>
Drinking water revenues are estimated based on the tariff policy elaborated upon above. As can be seen from the table, revenues from domestic consumers are by far the largest source of revenues. There are no incremental revenues from this activity.

Table 5.59 Drinking water revenues

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Water services - Revenues from sale												
Tariffs												
Domestic	RSD/m3	19	20	20	20	21	24	25	27	28	73	141
Business	RSD/m3	60	63	63	63	63	63	63	63	63	73	141
Institutional users	RSD/m3	23	24	25	26	27	29	30	32	33	73	141
Water charged (Sabac town + villages)												
Domestic	'000 m3	3,717	3,791	3,866	3,919	3,973	4,028	4,083	4,139	4,196	4,932	5,287
Business	'000 m3	777	793	809	825	841	858	875	893	911	1,178	1,464
Institutional users	'000 m3	375	396	418	430	441	453	465	478	490	669	763
Revenue												
Domestic	RSD m	71	75	77	78	84	95	104	111	118	362	747
Institutional users	RSD m	8	9	10	11	12	13	14	15	16	49	108
Business	RSD m	47	50	51	52	53	54	55	56	57	86	207
Total	**RSD m**	**126**	**134**	**138**	**141**	**149**	**162**	**173**	**182**	**191**	**498**	**1,062**

Sewage collection revenues

Sewage collection revenues increase rapidly until the year 2011. Revenues do not grow substantially after the year 2011. There are no incremental revenues from this activity.

The tariffs mentioned in the table are expressed in waste water discharged in the sewer system. This is done for calculation purposes. The actual sewage collection fees are charged as a function of drinking water supplied.

Table 5.60 Sewage collection revenues

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Tariffs												
Domestic	RSD/m3	8	8	11	12	12	11	11	11	10	28	52
Institutional users	RSD/m3	9	11	21	24	24	24	24	24	24	28	52
Business - small	RSD/m3	23	25	34	37	36	35	34	33	32	28	52
Business - large	RSD/m3	8	8	8	8	8	8	8	8	8	8	8
Wastewater discharged												
Domestic	'000 m3	2,715	2,842	2,969	3,042	3,116	3,191	3,267	3,343	3,421	4,161	4,490
Institutional users	'000 m3	282	305	330	343	356	369	382	396	411	579	661
Business - small	'000 m3	1,148	1,171	1,195	1,219	1,243	1,268	1,293	1,319	1,345	1,741	2,164
Business - large	'000 m3	-	-	-	-	-	-	-	-	-	-	-
Revenue												
Domestic	RSD m	20	23	33	36	36	36	36	36	36	116	233
Institutional users	RSD m	2	3	7	8	8	9	9	10	10	16	34
Business - small	RSD m	27	29	41	45	44	44	44	44	43	49	112
Busniess - large	RSD m	-	-	-	-	-	-	-	-	-	-	-
Total	**RSD m**	**49**	**55**	**80**	**89**	**89**	**89**	**89**	**89**	**89**	**181**	**379**

Waste water treatment revenues

Waste water treatment revenues are considered to be entirely incremental, since this is a new service. Without the project, this tariff would not be charged at all. The tariffs mentioned in the table below are again expressed as waste water discharged into the sewer system for calculation purposes.

Table 5.61 Waste water treatment revenues

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Wastewater services - Revenues from sale												
Tariffs												
Domestic	RSD/m3	-	-	21	31	31	31	31	31	31	45	78
Institutional users	RSD/m3	-	-	21	31	31	31	31	31	31	45	78
Business - small	RSD/m3	-	-	21	31	31	31	31	31	31	45	78
Business - large	RSD/m3	-	-	32	46	46	46	46	46	46	68	117
Wastewater charged												
Domestic	'000 m3	-	-	2,969	3,042	3,116	3,191	3,267	3,343	3,421	4,161	4,490
Institutional users	'000 m3	-	-	330	343	356	369	382	396	411	579	661
Business - small	'000 m3	-	-	1,195	1,219	1,243	1,268	1,293	1,319	1,345	1,741	2,164
Business - large	'000 m3	-	-	-	-	-	-	-	-	-	-	-
Revenue												
Domestic	RSD m	-	-	64	94	96	99	101	103	106	188	351
Institutional users	RSD m	-	-	7	11	11	11	12	12	13	26	52
Business - small	RSD m	-	-	26	38	38	39	40	41	42	79	169
Business - large	RSD m	-	-	-	-	-	-	-	-	-	-	-
Total	**RSD m**	**-**	**-**	**96**	**142**	**146**	**149**	**153**	**156**	**160**	**293**	**573**

5.3.8 Profit & loss, balance sheet and cash flow statement

This paragraph presents one of the final outputs of the financial model: forecasted financial statements of Šabac PUC water & waste water. Full printouts of the model, both in RSD as well as Euro, are included in the annexes.

The following statements are presented and briefly discussed:

- Profit & loss statement;
- Balance sheet;
- Cash flow statement.

These financial statements include the financial effects of the project on the company. Thus, it helps to assess whether the project can be carried out in a financially sustainable way, i.e. without jeopardizing the financial viability of the company.

<u>Profit & loss statement</u>

With the proposed tariff policy, the company breaks even for most of the years during the analyzed period. Towards the end of the analyzed period, minor losses are forecasted. The next to zero profit is a direct result of the tariff setting policy, which does not include a margin above costs.

Table 5.62 Profit and loss statement (RSD million)

Financial year ending	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Revenue											
Drinking water	126	134	138	141	149	162	173	182	191	498	1,062
Sewerage service	49	55	80	89	89	89	89	89	89	181	379
Waste water treatment	-	-	96	142	146	149	153	156	160	293	573
Other	-	-	-	-	-	-	-	-	-	-	-
Subsidies	-	-	-	-	-	-	-	-	-	-	-
Total	**175**	**189**	**314**	**372**	**383**	**400**	**414**	**427**	**440**	**972**	**2,014**
Expenditure											
Variable costs	9	12	45	45	50	55	60	65	71	211	513
Chemicals	0	0	4	4	4	4	5	5	5	12	22
Electricity	6	9	27	26	29	33	36	40	43	141	364
Fuel & lubricant	2	2	2	3	3	3	3	3	4	8	15
Sludge transport	-	-	11	12	14	15	16	18	19	51	111
Effluent discharge fee	-	-	-	-	-	-	-	-	-	-	-
Fixed costs	103	112	137	148	160	173	188	201	215	522	1,134
Wages and Salaries	34	37	40	45	49	54	60	65	70	194	458
Employee benefits	10	11	11	12	13	15	16	17	19	52	124
Other materials	11	12	12	13	14	14	15	16	17	32	54
Transport services	1	1	1	1	1	1	1	1	1	3	5
Repair services	3	4	18	19	20	22	23	24	26	53	99
Other services	9	10	14	15	16	17	18	19	20	41	75
Taxes and fees	0	0	0	0	0	0	0	0	0	0	1
Other costs	2	2	2	2	2	2	3	3	3	5	9
Overhead costs	34	36	38	41	45	48	52	55	59	142	307
Operating costs	**112**	**124**	**182**	**194**	**210**	**228**	**248**	**266**	**286**	**734**	**1,646**
Depreciation	35	41	90	93	96	99	103	106	109	187	262
Bad debt	9	9	16	19	19	20	21	21	22	49	101
Total costs	**155**	**174**	**288**	**305**	**326**	**347**	**371**	**393**	**417**	**969**	**2,009**
Net Operating Income	**20**	**15**	**27**	**67**	**58**	**52**	**43**	**34**	**24**	**2**	**5**
Interest charges	-	-	-	-	-	-	-	-	-	-	-
FX loss (gain)	-	-	-	-	-	-	-	-	-	-	-
Net Income before Tax	**20**	**15**	**27**	**67**	**58**	**52**	**43**	**34**	**24**	**2**	**5**
Income tax	2	1	3	7	6	5	4	3	2	0	0
Net Income after Tax	**18**	**13**	**24**	**60**	**52**	**47**	**39**	**30**	**21**	**2**	**4**

Balance sheet

The balance sheet is healthy, with a high share of equity out of the balance sheet total and a slow conversion of fixed assets into cash. By the end of the analyzed period, the company will have build up substantial cash reserves available for necessary re-investment in infrastructure. The quick ratio is well above minimum standards.

Table 5.63 Balance sheet (RSD million)

Financial year ending	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Fixed assets	2,425	3,789	4,673	4,649	4,616	4,581	4,541	4,496	4,445	4,535	5,028
Current assets											
Inventories	1	1	1	2	2	2	2	2	2	4	8
Receivables	80	82	129	117	107	98	85	70	63	156	323
Cash	76	(612)	(1,511)	(1,407)	(1,307)	(1,208)	(1,112)	(1,016)	(933)	(911)	(1,463)
Total	**157**	**(529)**	**(1,381)**	**(1,289)**	**(1,197)**	**(1,109)**	**(1,024)**	**(944)**	**(868)**	**(751)**	**(1,132)**
Non-operating	-	-	-	-	-	-	-	-	-	-	-
Total assets	**2,582**	**3,260**	**3,292**	**3,359**	**3,418**	**3,472**	**3,517**	**3,552**	**3,577**	**3,784**	**3,896**
Equity bf	1,903	2,572	3,249	3,276	3,343	3,400	3,452	3,496	3,529	3,721	3,756
Retained earnings	20	15	27	67	58	52	43	34	24	2	5
Grants	649	662	-	-	-	-	-	-	-	-	-
Equity cf	**2,572**	**3,249**	**3,276**	**3,343**	**3,400**	**3,452**	**3,496**	**3,529**	**3,553**	**3,723**	**3,761**
Long term liabilities											
Equity	2,572	3,249	3,276	3,343	3,400	3,452	3,496	3,529	3,553	3,723	3,761
Long-term liabilities	2	2	2	2	2	2	2	2	2	2	2
Total	**2,574**	**3,251**	**3,278**	**3,344**	**3,402**	**3,454**	**3,497**	**3,531**	**3,555**	**3,725**	**3,763**
Current liabilities											
Payables	8	9	14	15	17	18	20	21	23	59	134
Overdraft	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-
Total	**8**	**9**	**14**	**15**	**17**	**18**	**20**	**21**	**23**	**59**	**134**
Non-operating	-	-	-	-	-	-	-	-	-	-	-
Total liabilities	**2,582**	**3,260**	**3,292**	**3,359**	**3,418**	**3,472**	**3,517**	**3,552**	**3,577**	**3,784**	**3,896**

Cash flow

Cash flow generation of the project is sufficient to finance all necessary investments after the initial investment. This means that no further capital subsidy from either the municipalities or state level is required, so that the PUC finances are sustainable.

The most substantial follow on investments are required during the years 2024/25 and 2039/40 when the electrical-mechanical equipment of the waste water treatment plant and sewage pumping station will need to be replaced. Although this will cause the cash flow to become negative, accumulated cash flow from previous years is sufficient to finance the total required investment. The cumulative cash flow is positive for each of the years during the analyzed period. Thus, at company level, the project is financially sustainable.

Table 5.64 Project cash flow statement (in RSD million)

Financial year ending	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Cash bf	73	76	59	75	178	279	377	474	570	598	45
Overdraft bf	-	-	-	-	-	-	-	-	-	-	-
Net cash bf	**73**	**76**	**59**	**75**	**178**	**279**	**377**	**474**	**570**	**598**	**45**
Revenue											
Water sales	126	134	138	141	149	162	173	182	191	498	1,062
Sewerage service	49	55	80	89	89	89	89	89	89	181	379
Waste water treatment	-	-	96	142	146	149	153	156	160	293	573
Less bad debt	(9)	(9)	(16)	(19)	(19)	(20)	(21)	(21)	(22)	(49)	(101)
Total	**166**	**180**	**299**	**353**	**364**	**380**	**394**	**406**	**418**	**923**	**1,913**
Costs											
Variable costs	9	12	45	45	50	55	60	65	71	211	513
Chemicals	0	0	4	4	4	4	5	5	5	12	22
Electricity	6	9	27	26	29	33	36	40	43	141	364
Fuel & lubricant	2	2	2	3	3	3	3	3	4	8	15
Sludge transport	-	-	11	12	14	15	16	18	19	51	111
Effluent discharge fee	-	-	-	-	-	-	-	-	-	-	-
Fixed costs	103	112	137	148	160	173	188	201	215	522	1,134
Wages and Salaries	34	37	40	45	49	54	60	65	70	194	458
Employee benefits	10	11	11	12	13	15	16	17	19	52	124
Other materials	11	12	12	13	14	14	15	16	17	32	54
Transport services	1	1	1	1	1	1	1	1	1	3	5
Repair services	3	4	18	19	20	22	23	24	26	53	99
Other services	9	10	14	15	16	17	18	19	20	41	75
Taxes and fees	0	0	0	0	0	0	0	0	0	0	1
Other costs	2	2	2	2	2	2	3	3	3	5	9
Overhead costs	34	36	38	41	45	48	52	55	59	142	307
Total	**112**	**124**	**182**	**194**	**210**	**228**	**248**	**266**	**286**	**734**	**1,646**
Working capital required	17	(1)	(42)	13	10	11	14	17	8	(6)	(12)
Operating cash flow	**72**	**55**	**75**	**172**	**164**	**163**	**160**	**156**	**141**	**184**	**254**
Capex subsidy	34	35	-	-	-	-	-	-	-	-	-
Capex	649	662	-	-	-	-	-	-	-	-	-
Discretionary capex	68	73	59	69	63	65	63	61	58	107	177
Investment cash flow	**684**	**700**	**59**	**69**	**63**	**65**	**63**	**61**	**58**	**107**	**177**
Credit / overdraft interest											
Debt drawdown	-	-	-	-	-	-	-	-	-	-	-
Grants	615	627	-	-	-	-	-	-	-	-	-
Financing cash flow	**615**	**627**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Cash for debt service	**3**	**(18)**	**16**	**103**	**101**	**98**	**97**	**96**	**83**	**76**	**78**
Capital repayment	-	-	-	-	-	-	-	-	-	-	-
Interest and fee payment	-	-	-	-	-	-	-	-	-	-	-
Total debt service	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Net change in cash	**3**	**(18)**	**16**	**103**	**101**	**98**	**97**	**96**	**83**	**76**	**78**
Cash cf	76	59	75	178	279	377	474	570	652	675	122
Overdraft cf	-	-	-	-	-	-	-	-	-	-	-
Net cash cf	**76**	**59**	**75**	**178**	**279**	**377**	**474**	**570**	**652**	**675**	**122**

5.3.9 Financial cost benefit analysis

A financial cost-benefit analysis has been carried out based on the assumptions set out in previous paragraphs. The purpose of the financial cost benefit analysis is to assess the financial feasibility and viability of the project and to determine the maximum possible EU grant assistance. The analysis is carried out in accordance with the "Guide to cost-benefit analysis of investment projects" (EC DG Regio, 2002). The output of the analysis is:

- Calculation of the project financial net present value (FNPV/C) and internal rate of return (FIRR/C) of the total investment, in order to assess financial feasibility and need for (grant) assistance;
- Assessing the financial sustainability of the project by calculating the projects' financial and cumulative cash flow, including financing;
- Calculating the financial net present value of invested capital (FNPV/K) and internal rate of return of invested capital (FIRR/K). This analysis calculates financial

feasibility from the viewpoint of the recipient and only takes into consideration the total invested public capital;

- Sensitivity and risk analysis. This analysis identifies and assesses the sensitivity of the project to key input variables;
- Economic cost benefit analysis. Assessment of the economic feasibility of the project from the viewpoint of society as a whole.

EU grant assistance

The EU grant assistance is calculated using the so called funding gap method calculate by means of the "modified formula". The rationale behind this methodology is to identify the financial needs of a project (funding gap) and to provide grant assistance in order to make them financially feasible.

The formula used is defined as:

Grant rate = DIC / (DIC + DNR)

Where DIC = discounted investment cost and DNR is discounted net revenues. Under the current ISPA regulation, this grant rate can be up to 75% and in exceptional cases 85%. This study assumes that the maximum grant rate under IPA is 75%.

Subsequently, the maximum EU grant can be calculated by multiplying the grant rate with the total eligible investment cost (excluding amongst others VAT and land acquisition costs).

It should be noted however, that the methodology to determine the level of grant assistance of ERDF and Cohesion fund assistance projects for the 2007 – 2013 programming period differs from the "modified formula" elaborated upon above. A special methodology is developed for revenue generating projects, such as projects in the water & waste water sector.[1] This methodology leads to substantially lower grant amounts. For the sake of completeness, this different grant calculation methodology is also applied. The methodology is as follows:

Step 1: determination of funding gap rate (R):

R = Max EE/DIC

Where

Max EE is the maximum eligible expenditure = DIC-DNR
DIC is the discounted investment cost
DNR is the discounted net revenue = discounted revenues – discounted operating costs + discounted residual value

Step 2: calculating the "decision amount" (DA):

DA = EC*R

Where

[1] *Council regulation (EC) 1083/2006 dated 11 July 2006, article 55 "revenue generating projects"*

EC is the eligible cost

Step 3: find the (maximum) EU grant:

EU grant = DA*Max CRpa

Where

Max CRpa is the maximum co-funding rate fixed

Discount rate

In the absence of a national Serbian discount rate, a discount rate as applied in EU-ISPA financed projects in neighboring countries is used, which is also recommended by the EU guide to Cost-Benefit Analysis of Investment Projects[2]. This discount rate amounts to 6% in real terms. Since the analysis is carried out in current prices, a nominal discount rate of 8% is applied, after adjusting the real rate for 2% inflation.

It is recognized that the most recent guidance from the EU concerning ERDF and Cohesion Fund financed projects during the programming period 2007 – 2013 recommends a lower real discount rate of 5%[3]. However, this is to be applied for countries which have acceded into the EU already and which have more advanced financial markets and a lower financial risk profile than Serbia. For this reason, a slightly higher discount rate is used which reflects this higher cost of capital.

Assumptions

As elaborated upon in the previous paragraphs, a distinction between the “without” and “with” project is made. Incremental costs and revenues are defined as the difference between “with” and “without” cost and revenue estimate. These incremental costs are a direct result of the project intervention.

In doing so, consultants have made the following assumptions:

- Drinking water and sewage collection revenues and costs can be entirely contributed to the “without project” situation;
- Waste water treatment revenues and costs are entirely incremental, since this is considered to be a new service. Thus, waste water treatment tariffs charged to both new and existing customers is considered to be incremental revenue.

Further considerations are:

- Net present values and internal rate of return are calculated back to base year 2009, with a project period starting in 2009 up to the year 2041 (33 years);
- Only phase I investments and related re-investments are included in the financial cost benefit analysis;
- Non-eligible costs for EU financing are included in the discounted cash flow analysis, since these present a real outflow for the company. Thus, non-reimbursable value added tax and land acquisition costs are included in the

[2] *EU guide to Cost-Benefit Analysis of Investment Projects (EU Commission 2002), available at http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide02_en.pdf*
[3] *Working document 4: Guidance on the methodology for carrying out Cost-Benefit Analysis, available at http://ec.europa.eu/regional_policy/sources/docoffic/2007/working/wd4_cost_en.pdf*

investment cost. However, in calculating the potential EU grant, these non-eligible costs are excluded;

- Residual investment value is included at the end of the project period. The residual value is calculated simply as the remaining book value at the end of the year 2041. The calculation ignores exchange rate losses. The residual value thus calculated has been compared with the net present value of future cash flows generated by these remaining assets, assuming the same trend in net cash flow continues for the remaining useful lifetime and disregarding any new reinvestments (although these would be required for the proper functioning of the WWTP). The net present value of future cash flows does not materially differ from the remaining book value of the project.

Full printouts of the financial cost-benefit analyses are included in the annexes.

The results of the analysis are, assuming a base case macro – economic scenario:

Financial cost benefit analysis total invested capital

- During the 33 year analysis period, the nominal internal rate of return (FNPV/C) is 0.3%;
- The financial net present value (FNPV/K) is negative and amounts to € -8.728K
- Therefore, EU grant assistance is required to make the project financially feasible, which is calculated below.

Table 5.65 Financial cost benefit analysis total invested capital

	CF	NPV 0.0%	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Sewage collection	€ 000		-	74	385	494	498	502	507	511	517	1,044	1,970
Waste water treatment	€ 000		-	-	1,141	1,661	1,676	1,691	1,706	1,721	1,736	2,626	4,371
Residual value	€ 000		-	-	-	-	-	-	-	-	-	-	14,131
Incremental revenues	**€ 000**		**-**	**74**	**1,526**	**2,155**	**2,174**	**2,193**	**2,213**	**2,232**	**2,253**	**3,670**	**20,471**
Sewage collection	€ 000		-	41	291	317	340	364	390	413	438	962	1,898
Waste water treatment	€ 000		-	-	706	732	778	826	879	928	981	2,054	3,881
Incremental operational costs	**€ 000**		**-**	**41**	**996**	**1,050**	**1,117**	**1,190**	**1,269**	**1,342**	**1,419**	**3,016**	**5,780**
Sewage collection	€ 000		1,144	1,144									
Waste water treatment plant	€ 000		6,284	6,284									
Supervision	€ 000		532	532									
Subtotal investment costs	€ 000		7,959	7,959	-	-	-	-	-	-	-	-	-
Re-investment costs	€ 000		-	-	-	-	-	-	-	-	-	-	-
Incremental investment costs	**€ 000**		**7,959**	**7,959**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Net cash flow	**€ 000**		**(7,959)**	**(7,926)**	**529**	**1,105**	**1,057**	**1,003**	**943**	**891**	**834**	**654**	**14,692**
Cumulative cash flow	€ 000		(7,959)	(15,885)	(15,355)	(14,250)	(13,194)	(12,191)	(11,247)	(10,357)	(9,522)	(9,066)	843
Discount rate (nominal)	%	8.0%											
FNPV/C	€ 000	(8,728)											
FRR/C	%	0.3%											

The maximum EU grant, using the modified formula, is calculated to amount to € 11,724K (current prices) as set out in the table below. The calculated grant rate is 73.7% and does not exceed the assumed maximum of 75%.

Table 5.66 EU grant calculation, modified formula

NPV incremental revenues		
Sewage collection	€ 000	6,202
Waste water treatment	€ 000	17,233
Residual value	€ 000	-
Subtotal incremental revenues	**€ 000**	**23,435**
NPV incremental operational costs		
Sewage collection	€ 000	5,230
Waste water treatment	€ 000	11,365
Re-investment	€ 000	2,138
Subtotal incremental operational costs	**€ 000**	**18,733**
Discounted net revenues (DNR)	**€ 000**	**4,702**
NPV investment costs (DIC)		
Sewage collection	€ 000	1,889
Waste water treatment plant	€ 000	10,375
Supervision	€ 000	878
Subtotal investment costs (DIC)	**€ 000**	**13,142**
Grant rate, calculated DIC/(DIC+DNR)	%	73.7%
Grant rate, applied (max 75%)	%	73.7%
Eligible investment cost (current prices)	€ 000	15,918
EU grant (maximum)	**€ 000**	**11,724**

The funding gap methodology applicable to ERDF/CF financed project during the programming period 2007 – 2013 leads to a substantially lower maximum grant level of € 7,668K, assuming a maximum co-financing rate of 75%. In case the discount rate would be set at 5% in real terms (7% current) as required for ERDF/CF financed projects during the programming period 2007 - 2013, the maximum EU grant would amount to € 7,396K.

Table 5.67 EU grant calculation, ERDF/CF 2007-2013

Step 1: funding gap rate		
Discounted net revenues (DNR)	€ 000	4,702
Discounted investment costs (DIC)	€ 000	13,142
Eligible expenditure EE (DCI-DNR)	€ 000	8,440
Funding gap rate R (EE/DIC)	**%**	**64.2%**
Step 2: decision amount		
Eligible investment costs EC (current prices)	€ 000	15,918
Decision amount DA (R x EC)	**€ 000**	**10,223**
Step 3: maximum EU grant		
Maximum co-funding rate Crpa	%	75%
EU grant (maximum)	**€ 000**	**7,668**

Financial sustainability

The cash flow statement of the company as set out in paragraph 5.3.9 already showed that at company level no cash flow problems arise. Cumulative cash is in any single year positive. Large reinvestments in especially the electrical-mechanical equipment of the

waste water treatment plant can be completely financed from internally generated cash, i.e. from the tariffs charged to customers.

In order to assess financial sustainability of the project as such, a separate calculation is made which only includes incremental costs, revenues, investments as well as the all financing sources available.

The table below shows that the project is also financially sustainable, since in any one year cumulative cash flow is positive. Although cash flow in the years 2024/25 and 2039/40 are negative as a result of large reinvestments, accumulated cash during previous years is sufficient to finance this.

Table 5.68 Project financial sustainability

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Total financial sources	7,959	7,959	-	-	-	-	-	-	-	-	-
Revenues	-	74	1,526	2,155	2,174	2,193	2,213	2,232	2,253	3,670	6,341
Total inflows	**7,959**	**8,034**	**1,526**	**2,155**	**2,174**	**2,193**	**2,213**	**2,232**	**2,253**	**3,670**	**6,341**
Total operating costs	-	41	996	1,050	1,117	1,190	1,269	1,342	1,419	3,016	5,780
Total investment costs	7,959	7,959	-	-	-	-	-	-	-	-	-
Interest on loans	-	-	-	-	-	-	-	-	-	-	-
Retirement bonus	-	-	-	-	-	-	-	-	-	-	-
Loan principal repaymenrt	-	-	-	-	-	-	-	-	-	-	-
Taxes	-	-	-	-	-	-	-	-	-	-	-
Total outflows	**7,959**	**8,000**	**996**	**1,050**	**1,117**	**1,190**	**1,269**	**1,342**	**1,419**	**3,016**	**5,780**
Total cash flow	**-**	**33**	**529**	**1,105**	**1,057**	**1,003**	**943**	**891**	**834**	**654**	**561**
Cumulative cash flow	**-**	**33**	**563**	**1,668**	**2,725**	**3,728**	**4,671**	**5,561**	**6,396**	**6,852**	**2,630**

Financial cost benefit analysis invested capital

A third analysis is made to determine the net present value and rate of return of the public funds invested on the project. In this project, the national contribution consists of funds provided by:

- Municipality of Šabac;
- Ministry of Agriculture, Forestry and Water, DG Water

The analysis reveals that:

- Financial internal rate of return of invested capital (FIRR/K) is 10.9%, above the discount rate of 8%;
- Financial net present value (FNPV/K) is positive and equals € 983K.

Therefore, it can be concluded that with the EU grant, the project is financially feasible from the perspective of Serbia, without creating excessive returns on national capital invested.

Table 5.69 Financial cost benefit analysis invested national capital

			2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
Revenues			-	74	1,526	2,155	2,174	2,193	2,213	2,232	2,253	3,670	6,341
Residual value			-	-	-	-	-	-	-	-	-	-	14,131
Total revenues			**-**	**74**	**1,526**	**2,155**	**2,174**	**2,193**	**2,213**	**2,232**	**2,253**	**3,670**	**20,471**
Total operating costs			-	41	996	1,050	1,117	1,190	1,269	1,342	1,419	3,016	5,780
Re-investment financed from internal cash flow			-	-	-	-	-	-	-	-	-	-	-
Interest on loans			-	-	-	-	-	-	-	-	-	-	-
Retirement bonus			-	-	-	-	-	-	-	-	-	-	-
Loan principal repaymenrt			-	-	-	-	-	-	-	-	-	-	-
Private equity			-	-	-	-	-	-	-	-	-	-	-
Total national public contribution			2,513	2,513	-	-	-	-	-	-	-	-	-
Total expenditures			**2,513**	**2,554**	**996**	**1,050**	**1,117**	**1,190**	**1,269**	**1,342**	**1,419**	**3,016**	**5,780**
Net cash flow			**(2,513)**	**(2,480)**	**529**	**1,105**	**1,057**	**1,003**	**943**	**891**	**834**	**654**	**14,692**
Cumulative cash flow			**(2,513)**	**(4,993)**	**(4,464)**	**(3,359)**	**(2,302)**	**(1,299)**	**(356)**	**535**	**1,369**	**1,825**	**11,734**
Discount rate	%	8.0%											
FNPV/K	€ 000	983											
FIRR/K	%	10.9%											

5.3.10 Sensitivity analysis

A sensitivity analysis is conducted to analyze the impact of:
- Variations in the macro-economic environment;
- Identify the sensitivity of the model to changes in some key input factors.

Macro-economic scenarios
The table below summarizes the results of the sensitivity analysis for changes in the macro-economic environment. Revenues have been fixed at the level as proposed for the base case scenario.

Table 5.70 Sensitivity analysis macro-economic assumptions

Description	FIRR/C	FNPV/C (€ '000)	Remarks
Base case	0.3%	-8,728	Cashflow negative 2024/25 + 2039/40, cumulative cashflow positive
Optimistic case	1.1%	-7,992	Cashflow negative 2024/25 + 2039/40, cumulative cashflow positive
Pessimistic case	0.3%	-8,914	Cashlfow negative 2025, cumulative cashflow negative 2025 to 2030

Conclusion is that the project is not very sensitive to changes in the macro-economic environment: the internal rate of return varies between 0.3% and 1.1% for respectively the pessimistic and optimistic macro economic scenario. PUC operations would be financially sustainable under all cases of macro economic scenarios, since cumulative cash flow is positive in every single year of the analyzed period.

Key input variables
A number of key input variables are identified and varied with respectively +/- 1%, 2%, 3% and 5%, in order to assess the sensitivity of the project to such changes. If a change of 1% in an input leads to an increase of more than 5% of the net present value (FNPV/C), the variable is considered to be a key risk factor and a more in depth risk analysis is required.

The following key input variables are identified:
- Discount rate
- Demand: unit consumption of water/waste water
- Investment cost (total)
- Operation & maintenance cost (total)
- Revenues: water & waste water tariff

The discount rate is changed with 1% percentage in *absolute* terms. For example, +1% would mean a discount rate of 8% + 1% = 9%.

The other variables are changed *relative* to the base value, while keeping the other input variables fixed. Variations are only added to the base value of a single year, so that changes are *not* cumulative. The tariff is also fixed at the base level, although underlying costs would change as a result of variations, which in turn would prompt a different level of tariffs, following the full cost price setting policy proposed in this study.

Variations will be carried out assuming a base case macro economic scenario.

Table 5.71 Sensitivity analysis key input variables

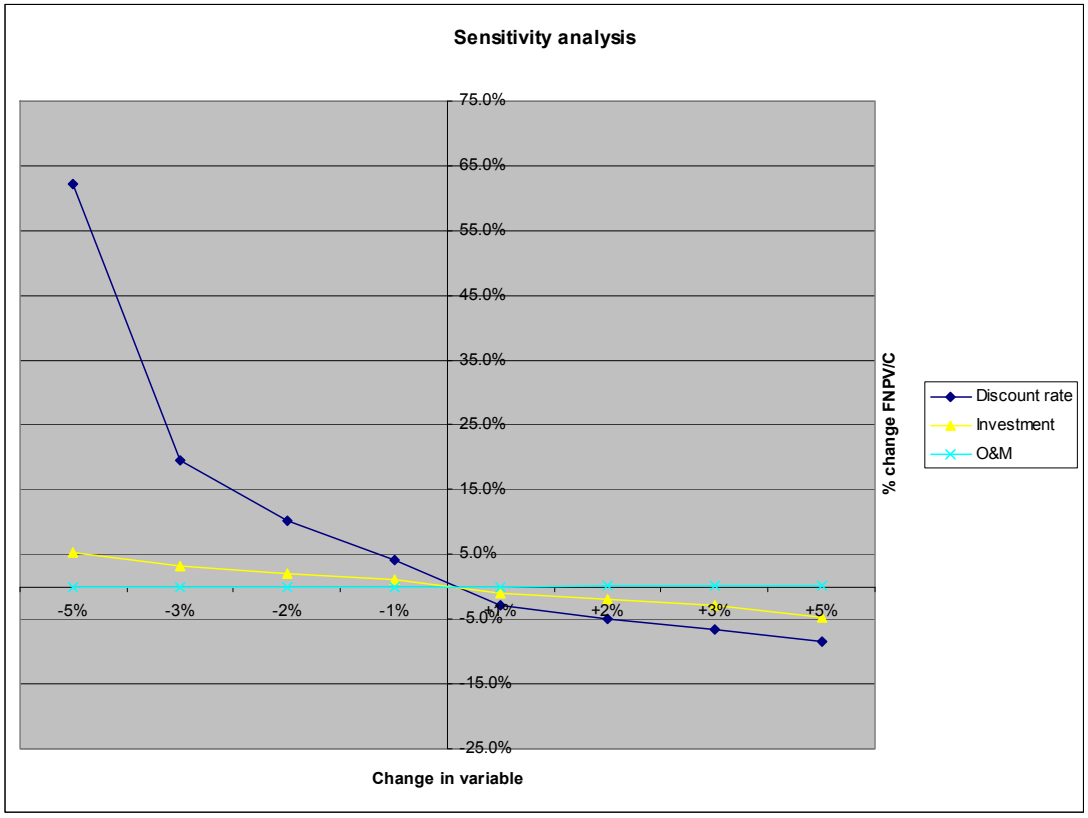
		Change in value FNPV/C		
Description	**Change in variable**	**Discount rate**	**Investment**	**O&M**
Change in variable of	+5%	-8.4%	-4.8%	0.2%
Change in variable of	+3%	-6.5%	-3.0%	0.1%
Change in variable of	+2%	-5.0%	-2.0%	0.1%
Change in variable of	+1%	-2.9%	-1.0%	0.0%
Change in variable of	-1%	4.2%	1.0%	0.0%
Change in variable of	-2%	10.3%	2.1%	-0.1%
Change in variable of	-3%	19.5%	3.1%	-0.1%
Change in variable of	-5%	62.1%	5.4%	-0.2%

A change of +/- 1% of any of the identified key input variables does not cause the FNPV/C to change with more than 5%. Therefore, none of the key input variables are critical to the financial outcome, although of course they do impact the financial result. Therefore, no further risk analysis of these variables will be carried out.

The FNPV/C value is clearly most sensitive to changes in the discount rate and in particular to lower discount rates. A lower discount rate would rapidly increase the financial net present value of the project. The level of the discount rate has been discussed and justified already in paragraph 5.3.10.

Changes in tariff and costs of investment also cause considerable variations in the FNPV/C value, as shown in the graph below.

Graph 5.72 Sensitivity analysis key input variables



5.3.11 Economic cost benefit analysis

In this paragraph, an economic analysis of the Šabac sewerage and waste water treatment plant is carried out. The analysis builds upon the financial analysis and model as elaborated upon in the previous paragraph. The analysis is conducted following the methodological guidelines as presented in the Guide to cost-benefit analysis of investment projects (European Commission - Evaluation Unit, DG Regional Policy, & European Commission, Brussels 2002)

Approach and methodology

The main objective of an economic analysis is to analyze the cost and benefits of the proposed project to society as a whole. It differs from a financial analysis, which only takes actual money flows into consideration, accruing to or to be paid by the investor of the project. However, the financial analysis and specifically the financial cost-benefit analysis, forms the basis on which the economic analysis is conducted.

An economic analysis usually consists of:

- A qualitative assessment of the external benefits and costs of a project to society as a whole;
- A quantitative economic analysis, in which first external effects are quantified and subsequently monetized. However, environmental, social, health and economic external benefits are often difficult to quantify, let alone monetize. Usually, only part of all identified benefits and costs can be quantified and monetized. For that reason, the

qualitative assessment complements the quantitative analysis and improves the overall quality of the analysis. The main output of the quantitative economic analysis is an estimate of the economic internal rate of return (EIRR), the economic net present value (ENPV) and the Benefit-Cost ratio, all of which are to be judged against certain minimum thresholds. The minimum threshold of the Benefit-Cost ratio is 1, which means that the overall benefits to society are higher than its costs.
The analysis is carried out in nominal terms during the 33 year project period, i.e. from 2009 to 2041, equivalent to the financial analysis referred to above.

In the absence of an official Serbian economic discount rate, a nominal rate of 7% is used, comprised of 5% real and 2% inflation. This social discount rate is commonly used to evaluate EU-ISPA co-financed projects and is also proposed to be used in the Guide to cost-benefit analysis of investment projects. It is recognized however, that this rate differs from the social discount rates to be used by ERDF/CF financed projects during the 2007-2013 programming period[4]. The latter proposes a social discount rate of 5.5% for cohesion countries (meaning most regions in Eastern European EU countries) and 3.5% for other countries within the EU.

For the quantitative analysis, the following steps are carried out:

- ***Fiscal corrections***. All financial prices in the financial analysis should be net of all indirect taxes/subsidies and other transfers, like value added tax. Direct taxes (income taxes) however, are to be included in the analysis;
- ***Corrections for externalities***. External costs and benefits which are not priced in the financial are to be quantified and valued. Waste water treatment plants usually have large external benefits, such as increased health benefits;
- ***Conversion of market prices to accounting prices***. Market prices are distorted because of imperfect markets. An example of market distortions, which is also valid for this study, is legally enforced minimum wages in countries with high unemployment figures. To convert market prices to accounting prices or economic prices, corrections are made by means of:
    - Standard conversion factors to estimate marginal cost. Standard conversion factors are calculated as follows:

      (M + X) / ((M + Tm) + (X – Tx)), where:

      M = total imports
      X = total exports
      Tm = import taxes
      Tx = export taxes
    - Shadow wages. The shadow wage is calculated to assess societies' true marginal cost of labor. This is especially relevant in Serbia, where high unemployment exists. The shadow wage is calculated as follows:

      SW = FW*(1-u)*(1-t)

      SW is the shadow wage
      FW is the financial (market) wage
      u is the regional unemployment rate

[4] *Working document 4: Guidance on the methodology for carrying out Cost-Benefit Analysis, available at http://ec.europa.eu/regional_policy/sources/docoffic/2007/working/wd4_cost_en.pdf*

t is the rate of social security payments and relevant taxes

This shadow age will only be applied to unskilled labor, since this is in abundant supply. Skilled labor, however, is assumed to be properly priced, since the market for this is competitive.

Qualitative economic analysis
In summary, the project would generate the following economic benefits:

Health
Waste water and sewerage projects have major health benefits due to the prevention of water borne diseases caused by pollution of surface and groundwater. Economic benefits arise from prevention of medical costs, but also prevention of lost production hours due to illness and improved work efficiency. These benefits not only accrue to people living in the municipality of Šabac, but also extend to downstream municipalities, including the city of Belgrade. In the absence of detailed medical statistics, it is difficult to quantify these benefits in the case of Šabac, but is clear that:

- Construction and operation of the waste water treatment plant will significantly reduce the pollution of the river Sava of untreated waste water originating from the Šabac city (123,000 residents), which is currently being discharged directly into the surface water.

Resource benefits, costs and savings

- Improvement of groundwater and surface water quality would lower the cost of treatment or enable the use of these sources for drinking water or agricultural or industrial (cooling water) purposes;
- Improvement of the water quality increases the potential of the river as a fishing resource, and transportation;
- Improvement of the water quality would increase the value of property in the city of Šabac, particularly at the river banks;
- The waste water treatment plants' sludge treatment process generates electricity, which means a saving on the costs of primary electricity generation. This saving is already included in the financial analysis. However, the current electricity price is significantly below regional electricity prices, suggesting that prices are set at below market prices. This study uses a 2007 price of € 0.06/kwh, while regional prices are closer to € 0.11/kwh. This of course also depends on the cost electricity generation in each country, so the real resource saving is difficult to estimate;
- Related to the above, conversion of methane gas into electricity and reduction of methane gas emissions by properly storing sludge reduces the adverse effects of these gases on global warming due to the greenhouse effect;
- Use of land for the waste water treatment plant would mean loss of agricultural production.

Social and development benefits

- Improved water quality of the river Sava will extensively diminish the untreated effluent discharge into the river Sava, and prevent further polluting of the river downstream towards other larger settlements and the city of Belgrade. Due to high pollution levels the river Sava is unsafe for major transportations.
- A related, but different value is increased bio-diversity and nature preservation;

- Reduced levels of bad smells and odours in Šabac city will significantly improve the quality of life;
- Construction of the project will generate significant employment opportunities, especially for unskilled labor;
- Amenity benefits: improvement of the water quality of the river Sava would increase the value of property on the river banks in the Šabac town);
- Disamenity costs are minimal, since there are no houses near the waste water treatment plant.

Quantitative economic analysis
Starting from the financial cost benefit analysis and using the economic analysis methodology elaborated upon above, the following corrections are made:

Fiscal corrections.
A correction is made for value added tax included in the investment cost estimate of the project.

Furthermore, the financial analysis includes costs related to effluent discharge fees payable to Water Directorate of the Republic of Serbia. Despite significantly improved effluent quality, greatly reduced but still sizable fees will need to be paid, since part of the current tariff setting formula is related to design capacity and hydraulic load of the installation in use by the polluter. The waste water treatment plant produces significant quantities of treated waste water, which will be discharged into the River Sava. It is assumed that these fees are needed to offset costs of the Water Directorate of the Republic of Serbia, incurs for operation and maintenance of the DTD canal system, and thus are in addition to other identified (economic) costs and benefits. Therefore, this cost is not eliminated in the economic analysis.

External corrections
Although many external benefits have been identified in the qualitative assessment, proper quantification and monetization of these effects is difficult or very time consuming. Different techniques are available to estimate external benefits, such as:

- Willingness to pay studies (contingent valuation). A survey is conducted in which people are asked what they would want to pay in order to achieve certain results, for example reduced odour levels, better recreational/swimming/angling opportunities because of improved surface water quality etc. This method is time consuming and beyond the scope of this study;
- Direct estimation of reduced health costs as a result of the project. In order to be able to estimate these effects, detailed statistical information of the project area on incidence of illness and associated costs would be required. Furthermore, a precise dose-response relation would need to be researched, i.e. what is the relation between effluent quality improvements caused by the project on improved water quality and ultimately reduced illnesses and associated costs. The detailed statistical information is not available, nor is a primary study on dose-response relations within the scope of this project;
- A simpler approach is to use existing (primary) studies or approaches which resemble project circumstances: the benefits transfer method. This method is selected to estimate external benefits for this project.

In several Eastern European countries, national guidelines exist to estimate external environmental effects of water quality improvement projects. These guidelines are specifically used for the preparation of ISPA and CF financed projects.

The Czech Republic uses as a proxy for estimating environmental external benefits € 35 for each person connected to a waste water treatment plant (2006 prices). Social benefits are estimated at CZK 0.064 to 0.142 per household connected to the sewer system per kilometre of river per year.

Poland's National Fund for Environmental Protection and Water Management uses a different approach. It provide guidelines for estimating external benefits for each unit quantity of pollutant not discharged into the environment as follows:

- € 0.84 for each kg of BOD removed;
- € 0.34 for each kg of COD removed;
- € 0.11 for each kg of suspended solids removed.

In Romania, a similar approach is used in ISPA financed projects, although at a lower rate: € 0.60/kg BOD removed.

This study uses an amount of € 0.60/kg BOD removed (2007 prices), as is done in Romania. It should be noted that this results in significantly lower estimates of environmental benefits compared to the approaches used in the Czech Republic and Poland. It is recognized that the absolute valuation of external benefits in Poland and Czech Republic will be higher than those in Serbia, since price levels will be higher. However, even after this correction, net benefits are still higher. An estimate of € 0.60/kg BOD removed is therefore on the low side, something which should be taken into consideration when evaluating the results of the economic analysis.

Conversion of market to economic prices

Based on National Bank of Serbia statistics for the year 2006, the standard conversion factor for Serbia is 0.97, assuming an export tax rate half of the average import tax rate. Conversion of market prices to economic/accounting prices is summarized in the table below:

Table 5.73

Description	SCF
(Re) Investment – domestic costs	0.97
(Re) Investment – foreign costs	1.00
Revenues	0.97
Operation & Maintenance	0.97
Residual value (mainly civil works)	0.97
Operation & Maintenance	0.97

Finally, a large benefit to society is the creation of additional jobs, assuming these would be recruited from the ranks of the unemployed. This is a likely assumption, especially in light of high unemployment in the project area of 20%.

During the construction phase, large civil works are carried out which are labor intensive. It is estimated that 30% of the value of civil works is spent on labor. Total incremental employment generated during operation of the sewage collection and waste

water treatment is limited to 15 new jobs (10 staff for the waste water treatment plant and 5 for the new sewage collection system).

Economic net present value

As elaborated upon above, the project will have high environmental, social and economic benefits. After correction for some of the external benefits, as well as fiscal adjustments and conversion of market to economic prices, the project gives a return of 17.0%, generates a positive economic net present value of € 16,789K and a benefit cost ratio of 1.51. The conclusion therefore is that the project is feasible from the point of view of society as a whole. It should further be noted that the overall benefit to society will probably be higher, since not all external benefits have been monetized.

Table 5.74 Economic cost benefit analysis

	CF	NPV 0.0%	2009	2010	2011	2012	2013	2014	2015	2016	2017	2030	2041
correction VAT on investment		-	-	-	-	-	-	-	-	-	-	-	-
Fiscal corrections		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Environmental effects of BOD reduction		12,976	-	-	839	878	915	978	1,019	1,062	1,107	1,765	2,462
Prevention of transport costs of septic tanks		9,221	213	266	322	363	406	451	499	549	602	1,504	2,311
External benefits		**22,198**	**213**	**266**	**1,161**	**1,240**	**1,321**	**1,429**	**1,518**	**1,611**	**1,709**	**3,269**	**4,773**
Revenues	0.97	27,222	-	74	1,526	2,154	2,173	2,193	2,212	2,232	2,253	3,704	20,136
Residual value	0.97	-	-	-	-	-	-	-	-	-	-	-	13,707
Operational costs	0.97	(19,779)	-	(42)	(1,013)	(1,067)	(1,136)	(1,210)	(1,291)	(1,364)	(1,443)	(3,070)	(5,885)
Investments, domestic	0.97	(9,579)	(5,669)	(5,669)	-	-	-	-	-	-	-	-	-
Investments, imported	1.00	(3,573)	(2,115)	(2,115)	-	-	-	-	-	-	-	-	-
Reinvestment, domestic	0.97	(994)	-	-	-	-	-	-	-	-	-	-	-
Reinvestment, imported	1.00	(1,471)	-	-	-	-	-	-	-	-	-	-	-
correction unskilled labour during construction		1,233	730	730	-	-	-	-	-	-	-	-	-
correction unskilled labour during operations		1,533	-	-	68	74	81	88	95	101	108	247	498
Conversion from market to economic prices		**(5,409)**	**(7,054)**	**(7,022)**	**580**	**1,162**	**1,118**	**1,070**	**1,017**	**969**	**918**	**882**	**28,456**
Total cash flow		**16,789**	**(6,840)**	**(6,755)**	**1,741**	**2,402**	**2,439**	**2,499**	**2,535**	**2,580**	**2,627**	**4,151**	**33,229**
Cumulative cash flow			(6,677)	(13,432)	(11,691)	(9,289)	(6,850)	(4,350)	(1,816)	764	3,391	38,572	110,703
Discount rate	7.0%												
ENPV	16,789												
EIRR	17.0%												
B/C ratio	1.51												

6 INSTITUTIONAL AND LEGAL ANALYSIS

6.1 Introduction

In this chapter, the following issues have been outlined and addressed:

- The overall regulatory framework including: I) roles and responsibilities of city and state authorities in the respective sector, ii) how is supervision and enforcement involved in the respective sector, and iii) description of how fees are determined and approved;
- An analysis of the relationship between the W/WW Company and the city. This analysis shall include a specification of the rights and responsibilities of the company and to what extent it operates at an "arms-length" basis from the city. A description of the legal status of the company and its statutory documents; and
- A proposal of measures for improvement/strengthening the institutional position of the company.

6.2 Regulatory Framework

6.2.1 Legislative framework

General background

In 2004, Serbia has launched an ambitious program to modernise its environmental management and harmonise its environmental legislation with EU Directives. In addition, there are a number of water sector specific regulations which are also in the process of being amended.

Legislative, executive and judicial powers are mostly practiced through the legally prescribed scope of competencies of the Authorities of the Republic. According to the law, certain competences are delegated to the Autonomous Province of Vojvodina and the Local Government.

Environmental legislation includes laws and regulations on planning and construction; mining; geological survey; water, soil and forest protection; flora and fauna; national parks; fishery and hunting; waste management; production and trade of chemicals; trade and transport of explosive and hazardous materials; protection of ionizing and non-ionizing radiation; nuclear safety etc. A list of relevant legislation is given in Annex 6.1.

Environmental Protection Law (OGRS No. 135/04)

This Serbian Environmental Protection Law was adopted in December 2004. Its content was harmonized with the relevant EU legislation. It provides:

- Protection of soil, water, air, forest, biosphere and biodiversity, plants and animals;
- Mandatory environmental monitoring: the programmes have to be adopted and performed every second year (including air monitoring);
- Responsibility of the Serbian Government to establish criteria for environmental measurements and regular reporting of the results to the Serbian Parliament annually;

- The important obligation to pay tax amounting to 1% of the value of the investment on all new facilities that could possibly be the sources of environmental pollution, and which shall be used for environmental protection and promotion.

Water Law (OGRS No. 46/91, 53/93, 67/93, 48/94 and 54/96)

The Water Law of the Republic of Serbia is the most important legal basis for the protection of water bodies, water use, and water management. It governs the conditions for design, construction, operation and financing of water management activities. The law applies to all surface water and groundwater, including drinking water and thermal/mineral waters (Art. 1). The Law on Water of the Republic of Serbia regulates the protection of waters; the protection from the detrimental effects of waters such as flooding, utilisation of and management of water; the conditions and ways of carrying out the water management and inspection over the implementation of regulations of this law. The regulations of this law address all surface and ground waters, including drinking water, thermal and mineral water, as well as the boundary and trans-boundary water courses between the Republic of Serbia and other countries in the vicinity. The law stipulates that waters can be used only in a way that does not threat their natural characteristics, does not endanger the life and health of people, does not peril the wild plant and animal species, natural wealth and immobile cultural wealth.

Water management permits have to be obtained for the construction, modification and enhancement of sewage disposal facilities (collection, channelling, treatment, and discharge of wastewater). Water management permits are not required for discharge of unpolluted rainwater and domestic household wastewater (Art.15). The prerequisite for a water management permit is a “Declaration of Consent”, which is granted by the public authority that sets the requirements, i.e.:

- The Ministry responsible for water management, or
- The Municipality for small structures and properties.

The Declaration of Consent from the Ministry of Health and the Ministry of Environment is also necessary for sewage disposal facilities. Construction of the facility must begin within two years after the receipt of the Declaration of Consent. The permit also confirms that water management requirements are complied with.

The funding of water-related activities is outlined in Paragraph IX of the Water Law. Funding is provided through the following: fees for use of water, protection of waters, drainage, irrigation, fees for material extracted from water flows and fees for use of water management facilities and other services as well as the means of the budget of Republic of Serbia allocated for operations of public interest.

Funds acquired from fees for use of waters, fees for water protection and fees for material extracted from water flows shall be paid to a dedicated account of the Ministry in charge for water management issues while funds acquired form drainage fees, irrigation fees and other services shall be the revenues of a water management company.

In line with the Water Law, a Decree on level of fees for use of waters, protection of waters and fees for material excavated from water flows is issued annually by the Ministry of Agriculture, Forestry and Water Management. The Decree for 2007 envisages incentives ranging from 20% to 70% for decrease of pollution achieved by

primary treatment and 50% to 90% for decrease of pollution achieved by secondary treatment.

Fees set by the Decree are paid to a dedicated account of the Ministry in charge for water management issues. Fees collected in the territory of Vojvodina are revenues of the budget of Autonomous Province of Vojvodina.

Communal services

Water supply and waste water collection are defined as a communal activity (Law on Local Self-government) which belongs in the realm of the Municipality. The Municipality may create to this purpose either a Public Utility Company (PUC) or entrust the activity to another enterprise. However, there are no examples of the latter in the Serbian water and waste water sector.

The exploitation and development of public utility activities are financed from the sales of the products and services of the public utility. Other possibilities include compensations for the development and utilisation of construction land, voluntary local taxes, and other legally possible sources (grants and subsidies).

Public utility activities may be organised for two or more municipalities together. In this case the municipalities will regulate their internal rights and commitments in a separate agreement.

Public Companies

The set-up of a PUC is regulated in the Law on Public Companies and Activities of Common Interest ("Official Gazette of the RS", no. 25/2000, 25/02, 107/05). The Law deals with the establishment, the internal organisation, and the operation of Public Companies. A Company shall be established by a Founding Act and duly registered with the Serbian Business Registers Agency. Company regulations shall be defined in the Articles of Association/Company Statute and any other documents required by Law.

Management is assured by a Manager who reports to the Management Board, which is the highest decision making body in the Company. The Management Board is supervised by a Supervisory Board who monitors the functioning of the Company, in particular the financial documents such as the annual report and proposals for the allocation of profits, and advises the Founders (the Municipality) accordingly.

The Law contains a numbers of provisions to protect the general interest in a Public Utility Company. The Municipality, in practice the People's Assembly, must approve the statute (and eventual changes) and major policy issues, i.e. tariffs, disposal of company assets, capital investments, etc, and nominates the Management of the PUC, i.e. Supervisory Board, Management Board, and the Manager.

The Ministry of Finance may send instructions to limit the annual increase in salary mass and tariffs. The annual accounts are submitted to the National Bank of Serbia and audited by external auditors. The Ministry of Finance through its Treasury sector controls financial aspects of the work of Public Utility Companies, which are indirect budget users.

The collection fees are set to cover for operational expenditures yet do not provide for full cost recovery which would enable investments. There is no tariff setting formulae and the increase of tariffs has been under Governmental control as of 2006 and the PUC's are obliged to set tariffs upon the projected increase in prices and salaries as determined by the Government of Serbia for the following year. Tariffs are also subject to the approval of the Municipality. The maximum annual increase for communal services is limited by the following acts: the Law on Public Companies and Performance of Operations of Public Interest, Article 22, and 22a and 22b; the Decree on Temporary Discontinuation of Proceedings regarding the Transfer of Budgetary Funds of the Republic of Serbia to Local Self-government Units, (Official Gazette 06/2006, from 23 January 2006); and the Decree on manner and control of calculation and payment of salaries in public companies (Official Gazette RS 5/06). According to the instruction no. 023-0263/2006, issued by the Ministry of Finance on 6th February 2006, the fees could be increased by 9.3% cumulatively for the whole year of 2006. In year 2007, the limit is set at 7.5% for tariffs and 9% for salaries. In the event of introducing new activities, the salaries for the newly recruited staff must not exceed the average salary levels in the Municipality.

The limitation on tariff increase is still present even in the event of additional investments. A possible solution for this limitation is to charge separately for waste water treatment and to have the increase of this amount subsequently limited at annual level, or to partially use tax for environmental protection, which in line with the Law on Environmental Protection (RS Official Gazette, 135/04) can be introduced by municipalities.

6.2.2 Policy framework

National level

National environmental strategy and action plan

The draft National Environmental Strategy (NES) and the corresponding National Environmental Action Plan (NEAP) were prepared by the Directorate for Environmental Protection in 2005. The most relevant elements of the NES and NEAP which have a bearing on Šabac WWTP Project comprise amongst others:

- **Legislative**: the harmonisation of National water and waste water legislation with the EU Water Framework Directive (2000/60/EC) and the Urban Wastewater Treatment Directive(91/271/EEC);
- **Economic instruments**: to adjust wastewater charges to reflect full cost recovery; introduction of volumetric charges;
- **Monitoring:** to review a monitoring plan with optimum design of the network of a station dealing with water quality analysis;
- **Financing:** to ear-mark environmental and water revenues, allocate state and municipal funds, provide loans from commercial banks;
- **Institutional:** to establish an inter-ministerial coordination group, to increase the HR capacity in water management and water protection;
- **Infrastructure:** to provide primary and secondary wastewater treatment in agglomerations above 100,000 population equivalent[5] and to extend sewerage

[5] Šabac WWTP project is in the range of 126,000 – 193,000 equivalent

systems to cover 90% of their population; to upgrade or renew the operation of existing municipal wastewater treatment plants;

- **Industry:** to expand treatment of industrial wastewater by rehabilitation or building of new industrial WWTP's.

Water Management Master Plan

The Water Management Master Plan, in 2001 developed by the Ministry of Agriculture, Forestry and Water Management, stipulates three levels of priority activities which are in compliance with the Šabac project. These are:

Level 1:

- Rehabilitation of existing WWTP for industrial and municipal wastewater;
- Construction of wastewater treatment plant at industries to pre-treat their toxic waste waters, regardless of the type of recipient (these being water flows or sewers);
- Construction of facilities for large polluters which have a bearing on the quality of waters in "sensitive areas" , and
- Construction of WWTP's for large and medium size sources of pollution (population equivalent >15,000) whose wastewater has a major impact on downstream waters.

Level 2:

- Construction of WWTP's for polluters whose wastewater has a considerable impact on direct recipients.

Level 3:

- Construction of all other WWTP's for settlements larger than 5,000 and all smaller settlements that have centralised water supply and a constructed sewer system.

In line with the aforementioned priorities, Šabac is listed in the Water Management Master plan as 1st level source of pollution.

Local level

The Local Environmental Action Plan (LEAP) was developed in the Municipality of Šabac in 2005. The first priority listed in the plan is to build sport and recreation facilities on the part of Šabac. Steps leading to fulfilment of the first priority are fully in compliance with those described in the provincial Action Plan developed with the PUC Vode Vojvodine. Implementation of LEAP is coordinated and monitored by the LEAP Office which operates with the Department for Urbanism and communal, housing and environmental affairs of the Municipality of Šabac.

6.2.3 Institutional Framework

National Level

The Ministry of Agriculture, Forestry and Water Management is responsible for the entire water sector in Serbia. The Directorate for Water is part of the Ministry, and consists of the following departments:

- Department for Analytical Studies and Administrative Tasks in Water Management;
- Department for Water Supply and Protection;
- Department for Water-Related Inspections.

Supervision of the disposal of industrial wastewater is a task of the Ministry of Agriculture and Water Management. The Ministries of Health, Capital Investments, Energy and Mining, and Administration and Local Self-Government are also indirectly involved in water supply and treatment: The Directorate for Environmental Protection, within the new Ministry of Environment, is responsible for environmental protection in connection with water bodies and water management activities.

The Public Companies and State Aid Sector of the Treasury Department (Ministry of Finance) monitor the performance of the PUC's. The PUC's are monitored for salary levels and are given instructions on their annual plans.

Investments can be provided through the Ministry of Agriculture, Forestry and Water Management with their Directorate for Waters and Wastewater. In 2006, the Ministry of Finance launched the National Investment Fund that is coordinated by line Ministries and the Ministry of Local Governments with its Municipal Infrastructure Agency in the sector of municipal infrastructure.

The Standing Conference on Towns and Municipalities (SCTM) serves as a Professional Association for all municipalities in the country. The members pay an annual fee in accordance with their size and their budget. The SCTM acts as a platform for exchange of best practices and advocacy. Municipal Water and Wastewater operators are united in professional associations, namely the Association for water technology and sanitary engineering and Waterworks Association.

Regional level
The role of the Government at Regional Level is mainly coordinative and very limited. At country level, there is only one regional water supply system "Rzav" in the region of Uzice, encompassing 5 municipalities. The system is operated by a regional Public Utility Company founded by the participating municipalities.

Local level
Municipalities are headed by elected Mayors and controlled by an elected Municipal Council. The Municipality is responsible for communal services and usually handles this by founding Public Utility Companies (PUC's), which may offer combined or sector-specific services. The PUC's usually are able to cover their costs of direct operation and maintenance, but have to rely on funding from the Municipality for investments. The Council will need to ratify the major decisions of the PUC, most notably the tariffs of services.

6.2.4 The roles and responsibilities of Public Administration in the Water and Wastewater Sector

Planning
Policy development by its very nature is the prerogative of the National Government. This applies for legislative and regulatory activities. The Ministry of Agriculture and Water Management is responsible for the Republic of Serbia Water Resources Development Master Plan and specifies water-related requirements by identification of

main water resources in the Country and allocation of water recources to the areas with limited water resources. Planning of water supply and wastewater services to and from the consumers is the responsibility of municipalities in their respective territories. The Government may participate in investments in the sector through their Directorate for Waters by 50% while Municipalities provide for the other 50%, however, the republican funds are rather limited.

Operations

Municipalities are responsible for the provision, operation, maintenance and investment for water supply and sanitation services. Municipal water supply and wastewater systems are operated and maintained by the local Public Utility Companies (PUC's). PUC's are basically state-owned companies, founded and managed by the Municipalities. The Public Utility Companies are responsible to the Municipalities for their performance.

Supervision and enforcement

The Republican Directorate for Waters has its inspectorate with 4 field offices covering the total of 19 regions with 18 inspectors. Authorities of water management and sanitary inspectors are defined in the Water Law. While sanitary inspectors are in charge of the control of potable water, water management inspectors are responsible for supervision and control of existing and new water management facilities including functioning and efficiency of wastewater treatment facilities, as well as the inspection of polluters. In the event that hazardous elements exceed limits set by the Rule book on hazardous elements in water (RS Official Gazette 31/82), inspectors may order closure of enterprises until the limits are met. The latter one is not a popular measure due to economic reasons and is applied only in event of accidents.

In the municipality of Šabac, Republican water management inspectors monitor primary treatment in industries and main gravity sewer while communal inspectors are in charge of small enterprises and collection network. Presently there are no water management inspectors at provincial level.

Conclusion

The Consultant has concluded that the project and its institutional setting are in line with the relevant legislative framework in Serbia, in compliance with national strategies and policies and involves institutions that will continue to exercise their legal rights and duties in respective sectors such as the water sector, the wastewater sector, environmental protection and provision of communal services. Compliance of environmental and technical documentation with legal requirements is reflected in chapters 3 and 4.

However, due to lack of funds for investment, implementation of action plans and policies may be delayed. In event of substantial provision of funds for construction of WWTP's, enforcement could be properly executed to make the system sustainable.

6.3 PUC's legal status and relations with the Municipality

Public Utility Company Vodovod Šabac, was founded in 1989 by the Municipality of Šabac and is 100% state owned. Therefore, the Founder exercises its rights in line with those described in paragraph 6.2.1 section Public Companies. The Treasury

Department at local Level is in charge of controlling its performance on behalf of the Ministry of Finance.

The PUC provides services related to water supply and wastewater management. For the purpose of the project, no mayor changes are envisaged in the organisational setup of the water supply and wastewater departments of the existing PUC (see chapter 7). Changes in roles and responsibilities of the PUC are described in chapter 7.

Statutory documents of a Public Utility Company

The Law on Public Utility Companies (Official Gazette of the RS No. 25/2000, 25/2002 and 105/1005) envisages that PUC's must have a Founding Act and Statutes and defines its contents.

The **Founding Act** shall be the agreement to establish and operate the W/WW System by which the company rights and obligations to the Founder are defined. The Founding Act shall define (i) the purpose of the Company, (ii) the resources (capital) put at the disposal of the Company, (iii) the rights and obligations of and to the Founder, (iv) decision making, and (v) eventual profit sharing (vi) measures for environmental protection

The **Statutes** are more detailed and determine roles and responsibilities of the governing bodies of the PUC, and list the general enactments of the Company such as Rule books, books on procedures and the role of labour unions.
The statutory documents have to be ratified by the municipal parliament.

Agreements on PUC operations

The set of abovementioned documents is prescribed by law, and is prerogative for the company's operations, however it does not set targets for operational performance of the company for which the company would be responsible to its Founder. Legal background that may enable introduction of additional agreements relevant for the PUC's operations is stipulated in the Law on Public Utility Companies (Official Gazette of the RS, no. 25/2000, 25/2002 and 105/1005, hereinafter: the Law) which states in Article 8 that in addition to the Founding Act and the Statutes a contract may be concluded between a Public Utility Company and a local self-government unit. The Contract may contain specifically provisions regarding:

1. Work and operations of the company;
2. Rights and obligations regarding utilizing of the funds in state ownership for performing of the activities of common interest, in accordance with the Law;
3. Company obligations regarding provision of conditions for continuous, tidy and quality satisfying of the consumers' needs for products and services;
4. Mutual rights and obligations in case that economic and other conditions for performing of the activities of common interest have not been met;
5. Rights and obligations in case of disturbances in company operations;
6. Other rights and responsibilities deriving from the provisions of the Law regulating performance of individual activities of common interest and of this Law;
7. Other questions important for resolving and protection of the common interest.

Although there is a legal possibility for this type of contracts to be prepared, this is not common practice in Serbia. Internationally, defining financial, operational and managerial requirements in a contract is usually done through a management contract or a Service Level Agreement (SLA). Experience with a SLA has been gained in Serbia with the PUC of Subotica for drinking water and wastewater.

Contractual relations with the industries

Implementation of the project shall enable (major) industries in the Municipality of Šabac to get connected to the main collector and thus to the WWTP,

Recommendation

The Consultant recommends that individual contracts are prepared with the industries. The contracts should include conditions of acceptance of wastewater, planned dates, level of tariffs and terms and conditions of payment.

Municipal Decisions

Communal activities are further specified in municipalities by a set of municipal Decisions which define duties, responsibilities and authorities of communal services providers as well as their users. The municipal Decisions are in line with National legislation and are legally binding documents in municipalities in which they are endorsed.

Recommendation on Municipal Decisions

To ensure project sustainability, it is recommended that the municipal Decisions are amended in a way to ensure:

1. Obligation to use the WWTP;
2. Define conditions by which users may be connected to the sewage system and the WWTP;
3. Define penalties and authorities of inspectors.

Municipal Decision on sanitary-technical conditions for discharge of wastewater

The Municipal Decision on sanitary-technical conditions for discharge of wastewater in the sewer system endorsed on June 14th 2007, sets conditions that have to be met before wastewater is discharged into the sewer system. The obligation of all real estate owners and tenants (legal entities and natural persons) to connect to the public sewer system was included at the request of the Consultant (Article 2 of the Decision, see Annex 3-4)

Municipal Decisions on Communal Activities

The Decisions on Communal Activities (hereinafter: the Decisions) form legal grounds for implementation, supervision and inspection of all communal activities in the territory of municipalities in which they are enacted by municipal parliaments.

Recommendation

It is recommended that the existing Municipal Decision of Communal Activities (MoV Official Gazette 23/2001) is amended so as to include the following:

- To enforce connection to the sewage system within 6 months from the construction of the sewage for both legal and physical persons;
- To define authorities of inspectors and penalties

Conclusion and follow up

In order to assure appropriate follow-up of activities in between preparation of the feasibility study and start of operations, the Consultant recommends a Project Implementation Unit to be set up by the Municipality of Šabac which follow up implementation of the aforementioned recommendations. A proposed institutional development plan is given in chapter 8.

7 OPERATIONAL EFFICIENCY ASSESSMENT

7.1 Introduction

In this chapter an assessment is made of the operational performance of the PUC Vodovod Šabac in performing the tasks related to providing drinking water to and collecting wastewater from consumers in their service area. Furthermore, an assessment was made of the organizational structure and the capabilities of staff and management. This included, among others, number and skills of employees, operational planning and control, administrative systems and procedures, accounting practices and record keeping, customer services and management information systems, and general human resources policies.

A few identified operational indicators have been compared with international indicators from countries in the near region.

In the light of the proposed construction of a new wastewater pumping station, the construction of a new wastewater treatment plant, and the interconnecting mains pipe, recommendations have been formulated for improvement of services and enhanced capacities.

7.2 Assessment of operational performance of the PUC Vodovod Šabac

This section gives the results of the assessment of the financial and operational performance of the PUC Vodovod Šabac in the current situation, and an overview of the future situation with additional responsibilities. For the financial data reference is made to chapter 5, where the complete financial analysis is presented.

In the last section, the conclusions and recommendations of this paragraph are presented.

7.2.1 Current situation

7.2.1.2 Operational performance of the PUC Vodovod Šabac

In 2006, total coverage of water supply services in the service area of PUC Vodovod Šabac (supplied settlements: the town of Šabac and suburbs: Pocerski Pricinovic, Misar, Jevremovac, Jelenca and Majur) is 75,6%. Total coverageof wastewater services in the same area is 72,7%. The PUC has a reported number of 14,131 household water connections and 12,841 wastewater connections.
In chapter 3 an assessment has been made of the operational performance of the PUC Vodovod Šabac. In the table below a set of benchmarks is presented in order to compare the performance of the PUC with water/wastewater companies in neighbouring countries.

Table 7.1 Comparison between operational indicators in the PUC Vodovod Šabac with some \national indicators from neighbouring countries

	EU recommendations	Bosnia Herzegovina*	Czech Republic CZE*	Croatia HRV*	Romania ROM*	Šabac Municipality / Service area
Collection ratio (drinking water and wastewater bills)%	> 95	N/A	98	60	106	87,4 / NA
Drinking water coverage%	100	72	91	93	93	75,6 / 45,8
Sewerage coverage %	100	8	77	76	73	72,7 / 43,0
Wastewater Treatment (at least primary treatment) %	-	97	97	54	98	-
Non revenue drinking water %	< 25	62	20	19	40	45,4 / NA
Residential water consumption (l/c/d)	120 – 150	134	102	261	112	170 / NA
Staff/1000 DW&WW connections	2	NA	8,3	6,6	3,9	6,2 / NA

* Data from website: ww.ib-net.org, the World Bank benchmarking programme, National averages 2004; na = not applicable, outside the service area there are no services to smaller settlements

If we compare the indicators for the Šabac Service area and Municipality with national indicators for some surrounding countries we can draw the following conclusions:

- For the collection ratio the percentage is nearing 90% for the Municipality as a whole (figures for service area as a whole were not given) which is relatively high for Serbian PUC's. Nevertheless, it has be mentioned there is still room for improvement;
- The connection rates to the drinking water and wastewater networks are lower than in surrounding countries and also lower than in other municipalities of the same size. There is need to further extend towards the smaller villages and settlements of the services area. No plans have been prepared so far to connect settlements from outside the service area;
- There is no treatment of collected wastewater before discharge into the receiving water body (Sava River). This stands out in comparison with the national indicators of neighbouring countries. This omission will be addressed in the near future;
- Non revenue water is relatively high: 45,4 %, both in comparison with surrounding countries as with Serbian cities of the same size. This needs to be reduced;
- In the service area, the average residential water consumption is 170 l/person/day, and which is relatively high and out of the recommended range of 120-150 l/c/d;
- The number of staff per 1000 connections of drinking water and wastewater is relatively high, although not extremely high. If it is taken into consideration that no wastewater treatment plant is in operation (and thus no personnel is working there), the number can be considered slightly high. From a technical point of view the PUC is slightly overstaffed.

The responsibilities of the PUC are the following:

Drinking water provision:

- Operation and maintenance of the Mali Zabran and Tabanovic DWTP (aeration, rapid filtration and disinfection);
- Maintenance of the drinking water distribution network: repair of the pipes of the transport and distribution network;
- Design and development of new projects (extensions, new buildings), preparation of tender procedures for selection of suitable contracting companies, construction supervision, and rehabilitation of the existing infrastructure;
- The operation and maintenance of two well fields: the Mali Zabran well field consisting of 12 shallow groundwater wells with total capacity of 220 l/s. And the Tabanovic well field consisting of 5 shallow groundwater wells with a total capacity of 400 l/s;
- Drinking water quality sampling and laboratory analysis;
- Replacement and repair of failing water meters;
- Reading of water meters and fee collection.

Wastewater:

- Maintenance and operation of existing sewer network. Currently up to 72,7% of households of Šabac service area (including suburbs) are connected to the existing sewer system. The smaller villages are without sewers;
- Operation and maintenance of one large pumping station at a site earlier reserved for a WWTP for discharge of wastewater into the receiving water body (Sawa river), and one small station to pump collected wastewater into the general sewer. The remainder of the collected wastewater is transported under gravity;
- Collection of septic tank sludge and other cleaning services does not fall under the responsibility of the PUC but under another one (for street cleaning etc.);
- Wastewater quality sampling and analysis.

Other tasks

The technical responsibilities and activities consist mainly of civil works: repair and extension of sewers (concrete) and water pipes (Asbestos, PVC) and mechanical-electrical works: well pumps, booster pumps, filter and chlorination units.

The PUC consists currently of four sectors (11 departments) falling under the direction of the General Manager. The tasks of these departments are described in more detail in section 7.3.

7.2.2 Future situation

7.2.2.1 Expected changes for operations

In this study the assets of the wastewater system are concerned and the extension and construction and extension of the assets currently in use. The WWTP, the pumping station and the connecting transport main between those two will be constructed.

While presently reactive activities are recognized practice in wastewater/water companies, the PUC Vodovod Šabac will have to develop plans for the operation and maintenance strategies covering also proactive activities. The activities shall include operational efficiency control, proactive maintenance, residue quantity and quality of treatment plant(s), troubleshooting and development of documentation. The documentation may include job descriptions, operating instructions, test records and records of maintenance.

In the previous section the activities of the Operational units for water supply are described. With the proposed rehabilitation and extension the work load of the units will be the following:

Drinking water:

- No changes in the work load are foreseen under the scope of this study.

Wastewater:

This study foresees the construction of a WWTP, a pumping station and the interconnecting main. Staff will have to be trained, in specific cases new staff with required qualifications will have to be contracted. Reference is made to chapter 4 for details.

7.2.3 Conclusions and recommendations

Based on the assessment made of the operational activities of the PUC, we have formulated the following conclusions and recommendations:

Operational activities:

The changes in work load are the direct consequence of the operational changes on the short and middle-long term. In brief it can be concluded that:

- Requirements for technical qualifications of technicians working in the field of wastewater will change in function of selected technologies and techniques for the WWTP. On-the-job training should be provided as part of the construction and rehabilitation contract, in order to prepare the staff for the operation of the new plant.
- Requirements for staff responsible for the collection, pumping and treatment of wastewater and maintenance of the network will have an extension of their responsibilities and of a physical service area;

7.3 Assessment of organization and management of PUC Vodevod Šabac

This section gives an overview of the organisational structure of the PUC Vodovod Šabac. It assesses the organisation and the capabilities of management and staff, in relation to the future developments of the PUC. Furthermore, required changes in both organisation and management are discussed and in the last paragraph recommendations have been formulated.

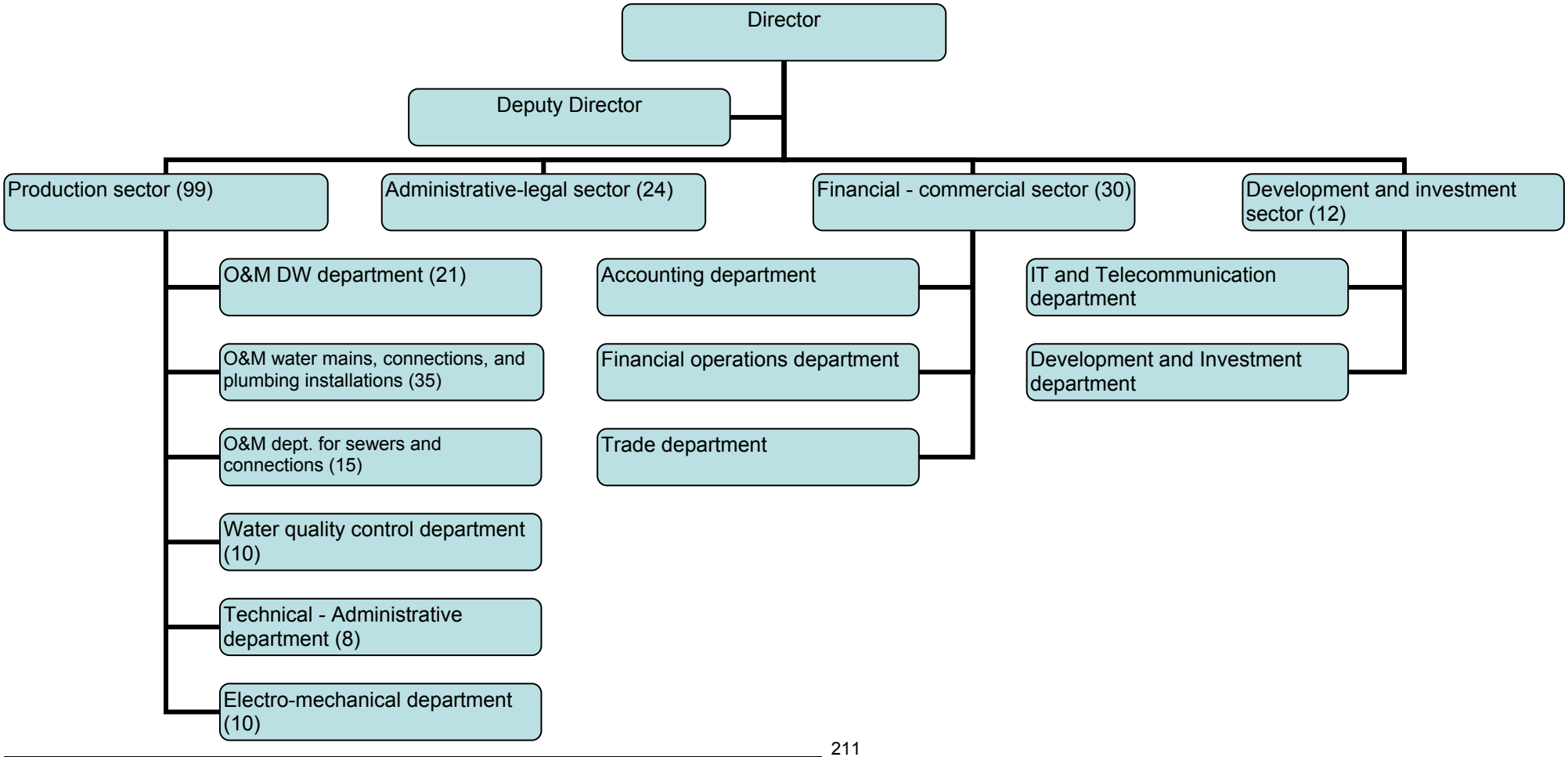
7.3.1 Current situation

7.3.1.1 Organization of PUC Vodovod Šabac

Management of the PUC Vodovod Šabac has provided the organization chart as presented below in figure 7.1. The Sectors currently responsible for drinking water production and distribution, for wastewater collection and discharge into river Sava and for maintenance of constructed the water supply and the sewerage systems has been indicated. The PUC is managed by the General Manager (director) and one deputy manager (deputy director) who are responsible for four sectors (see Figure 7.1 below):

- The Production Sector;
- The Administrative-legal Sector
- The Financial-commercial Sector; and
- The Development and investment Sector.

Figure 7.1 Organisation chart of PUC Vodovod Šabac



By management of the PUC there are no changes foreseen in the organisational setup of the company as no mayor restrictions or weaknesses are felt in the current situation. Although staff training is indicated in the year plans, no activities have been developed in this field.

The different sectors (in their turn consisting of (operational) departments) of the PUC have the following duties:

1. Production sector

The production sector consists of 6 departments:

The Department for water production and maintenance of WTP has the following duties: Operation and maintenance of production facilities; distribution of water; maintenance of mechanical facilities, chlorination system, potable water storage tanks, and water tower; reading piezometric water levels; protection of water winning area; monitoring of water production, proposals on measures for water losses reduction.

Water network maintenance department : maintenance of supply network; additional services for maintenance of in-house installations; construction works on water/sewerage network; registration, installation and maintenance of water meters

Wastewater system maintenance department: repairs on sewers, de-blocking, booster station maintenance, tanks maintenance, cleaning of residential connections and piping.

Water quality control department: monitoring and analysis of biological and physical quality of water; disinfection of network, tanks and wells; network cleaning. Collection and processing of data on water quality; proposing measures on water quality improvement.

Technical - Administrative department: analysis costs of plumber services (connections, construction and repairing of plumber installation of client, etc); analysis of plumber's daily, weekly and monthly log books; surveys, administration and billing of plumber works; preparation of lay out of water mains and sewers and compliances for design of plumber installations and connections, according request of clients; managing water supply system and sewerage system data base.

Electro-mechanical department: vehicle repair workshop, metal workshop, boiler room and water meter repair and calibration office.

2. Administrative-legal sector

The administrative-legal sector has the following duties: contracting, preparation of the PUC legal acts, health and social protection, human resources data base, professional assistance to the union, general administrative work

3. Financial-commercial sector

The Financial-commercial sector has the following duties: financial-economic analysis, procurement, preparation of annual and other reports, payroll, collection of fees, investment preparation and monitoring

4. Development and investment sector

The development and investment sector consists of two departments:

4.1 the Development and Investments department has the following duties: planning and implementation of water supply and wastewater systems; demand analysis; organization of research work; preparation of documentation; organizes and manages probation period of new facilities; approvals of designs prepared by the companies and citizens (users); prepares standards and rule books

4.2 The Information technology and telecommunication department has the following duties: preparation of conditions for introduction of modern technologies, prepares integrated information system of the PUC, performs maintenance of software, analysis of PUC needs, organizes use of computers and computer systems in the PUC, and organizes training.

Employee Skills

In order to assess the qualifications and structure of the PUC's workforce, management of the PUC provided the information given in the tables below.
The staff distribution by age is given in Table 7.2.

Table 7.2 Staff age structure in PUC, 2006

	Total personnel		
	Number	**%**	**Cum %**
Younger that 25 years	2	1,1	1.1
Between 26 and 30 years	15	9,0	10,1
Between 31 and 35 years	15	9,0	19,1
Between 36 and 40 years	27	16,2	35,3
Between 41 and 45 years	26	15,6	50,9
Between 46 and 50 years	29	17,4	68,3
Between 51 and 55 years	25	15,0	83,3
Between 55 and 60 years	21	12,6	95,9
Over 60 years	7	4,1	100
Total	**167**	**100**	

Source: PUC Vodovod Šabac

The staff distribution by academic qualifications in PUC Vodovod Šabac is currently as indicated in the following tables:

Table 7.3 Education Level of PUC Vodovod Šabac, 2006

Education Level	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**Master degree/ PhD**	**Total**
General Management	0	0	0	0	0	0	2	0	2
Administrative/financial	17	4	41	20	4	4	9	0	99

Water and wastewater Mains	5	2	6	7	0	2	2	0	24
Investment and Construction	1	0	4	20	0	2	3	0	30
Water production	0	0	2	4	0	1	4	1	12
Numbers	23	6	53	51	4	9	20	1	167
Total %	**13,8**	**3,6**	**31,7**	**30,5**	**2,4**	**5,4**	**12,0**	**0,6**	**100%**

Source: PUC Vodovod Šabac, legend: I = Primary school/unskilled workers; II = Semi-skilled; III = Artisans; IV = 4 years of secondary school; V = 5 years of secondary school; VI =(technical) college; VII = Tertiary/University education.

The following general observations can be made:

It can be observed that 19% of the employees are younger than 35 years of age, while 32% of the staff are older than 50 years, employees that will be entitled to retirement the coming 10 years or so. It can be concluded that currently there is an overrepresentation of older staff. Specifically looking at the two categories of youngest staff, respectively representing 1.1 and 9 % of the total staff, one can observe there has been in recent years a tendency of recruiting less new staff. This will lead on the middle long term (next 10 years) to a smaller work force of the PUC, thus reducing the size of the work force. With an extension in the number of house connections this will lead to a lower number of employees per 1,000 connections.

The observed inequality in age distribution means probably that possibilities for young staff to make promotion to management levels are still limited as a considerable number of older, and more experienced colleagues are available.
When new techniques and technologies (advanced treatment, automation, remote sensing) are introduced management should be alert to loss of young, well trained staff as result of demoralisation.

A management team of 2 Directors and 4 Sector Heads, supervising 11departments \with a total of 167 employees seems to be appropriate. This means an average of about 15 staff per department, which is a reasonable size for operational units.

Analysing the distribution of academic qualifications, it can be observed there is a percentage of about 12.5 % with college or university degree employed by the PUC. Although it is not known if staff members with academic degrees are equally distributed over the age categories, the given percentage indicates that enough academically qualified staff is available to run the operations and its related administration.

With future changes in the wastewater sector, the academic staff should be capable to prepare and organise new procedures, new technologies and new responsibilities. Also preparation and on-the-job training of staff will be the responsibility of the academically qualified staff.

7.3.1.2 Management of PUC Vodovod Šabac

Presently, PUC Vodovod Šabac is managed by the General Manager, one deputy Director, 4 Sector Heads and support staff, making up a Management Team of 6 persons. Departments of the PUC and their authorities are described in the previous section. So far, the PUC works under direct responsibility of the Municipal Assembly (the Founder). The position of the General Manager (Director) is mainly executive and partly advisory to the Municipal Assembly. His position is linked to the political party in charge of the Municipality.

The Governing organs in the PUC comprise the Management Board, the Director (General Manager), and the Supervisory Board. The management of the Company is ensured by the General Manager and the Management Board (the Administration). The Statutes clearly define the mandates of both the General Manager and the Management Board. Day-to-day management, including personnel management is handled by the General Manager. The Management Board decides among others on general policies, approves financial reports, budgets, investments, and tariffs, decides on the allocation of profits, coverage of losses (considering the advice of Supervisory Board), and strategic planning (long term as well as medium term). The Management Board comprises members nominated by the Municipality and could also include a representative of the Employees.

The General Manager is appointed under the responsibility of the Municipal Assembly based on the procedures for the appointment of new staff (the rule book). This will include a detailed job description.

The Supervisory Board monitors on behalf of the Founders the general functioning of the Company and ensures that the Company operates within the Law. The Board advises on the allocation of profits. The decision of the Management Board, however, is binding. Major decisions, i.e. annual report, budgets, and tariff revisions have to be ratified by the Assembly of Municipality.

In the PUC, management is ensured by the General Manager, appointed with the support of the political party in charge of the Municipality. He is supported by his deputy Director who directs the four Sectors.

1. General Manager (Director): responsible for general management, external relations, corporate planning, will be appointed by the Municipal Assembly (and Mayor);
2. Deputy Director: deputy to the General Manager, responsible for the daily operation of the four Sectors;
3. Sector Heads: responsible for their respective Sector and the Departments the sectors consist of.

7.3.2 Future situation

The main objective of this project is to improve the water quality of the Sava River, to improve living conditions for the people of Šabac and to reduce health risks resulting from discharging untreated wastewater. This main objective is realised by constructing a waste water treatment plant near the Sava River and to cease the discharge of

untreated industrial and communal waste water on the Sava River. Furthermore a new pumping station will be constructed and an interconnecting main pipeline.

7.3.2.1 Expected changes for PUC Vodovod Šabac organisation

Management of the PUC doesn't foresee changes in the organization. There is willingness to make progress but tariff level and legal framework are consisted to represent too many bottlenecks and obstacles for management by its own. Local political support will be necessary for these kind of decisions.
The legal framework enables recruitment for the new WWTP.

The PUC will remain the responsible operator of all infrastructural assets for the raw water intake, drinking water production and distribution, and collection and treatment of wastewater.

In analysing the existing organisation set-up of the PUC the Consultant does not have mayor recommendation for change. The company proves that procedures and organisational matters are well under control. From a technical point of view there might be a certain overstaffing, but there is no immediate need for downsizing of staff.
From a financial point of view there might be possibilities to reduce operational costs. By means of trials management might consider to look into possibilities for outsourcing certain specific tasks. We mention here: outsourcing of water meter replacement, repair and calibration; outsourcing of repair of leaking pipes.

The introduction of a so-called Service Level Contract between the Municipality and the PUC is a possibility to further develop the independent position of the PUC, while giving at the same time an instrument to the Municipality to monitor performance and improvements of the PUC. It would also assist in defining with increasing degree of detail the level of service to be provided by the PUC, as gradually stricter operational criteria can be achieved. The latter one refers to higher efficiency of the processes and stricter quality criteria of both drinking water and treated wastewater in the future.

7.3.3 Conclusions and recommendations

The consultant assessed the existing organisation and management structure and staffing of PUC Vodovod Šabac and concluded that it was characterised by an competent company with a slightly overstaffed work force. The latter point is recognized by management, but cannot be solved at PUC's level alone.
The Consultant has furthermore concluded that mayor changes in the organisational structure of the PUC Vodovod Šabac are not needed. The Consultant has nevertheless made some (minor) recommendations that might lead to higher efficiency and lower staffing (costs). The issue of downsizing cannot be raised without the approval of the local authorities and strict adherence to legal procedures. This would include preparation of a social programme and reimbursement to the redundant staff. Therefore, this issue may be addressed at some point in the future. Meanwhile, the recommendation would be to slow down filling the positions which become vacant due to retirements.

7.4 Assessment of administrative systems and procedures

This section gives a brief overview of record keeping and the management information system in use in the PUC Vodovod Šabac. In relation to the future developments of the PUC and the required changes in the last paragraph some recommendations have been formulated.

7.4.1 Actual situation

7.4.1.1 Administrative systems and procedures of the PUC Vodovod Šabac

Management Information System and Planning

Several departments are responsible for data collection and processing. The following data are regularly registered:

- Authorized, billed consumption per category of Customer (residential, commerce, institution);
- Customer water meters (registration number, status, year of installation);
- Meter reading and consumption by customer;
- Billing;
- Fee collection;
- Water production and water quality;
- Employee Attendance record (no indication of coverage given).
- The following information is not (completely) collected:
- Other consumption categories (fire fighting, flushing, etc.);
- Losses;
- Remedial maintenance of water mains and connections (no complete log books are available);
- Water O&M costs (cost accounting system).
- The Consultant has concluded that the level of collecting and processing of data is only partly sufficient. Data on:
- quality and quantity of water produced,
- water consumption (reading, invoicing and collection)
- is readily available. But general financial, legal and administrative data are more difficult to get.
- Specific information on water losses and other consumption categories and costs for O & M and remedial maintenance can be found but are neither complete nor reliable.

The used program has been developed by PUC staff and is based on accounting software mainly. It is not specific management software for water companies.
The information collected and processed is especially used by the Customer services department and management. An abstract of relevant (customer) information can be found on the simple but accessible website with the following web-address: www.vodovod-Šabac.co.yu) till this year. The opening page is shown in the figure below.

Figure 7.2 Opening page of PUC Šabac website

JKP VODOVOD - ŠABAC
ul. Oslobođenja bb
15000 Šabac, Srbija, SCG
tel: +381.15.347.611
fax: +381.15.369.541

Provera računa. **Cenovnik**. **Proverite potrošnju**. **Kvalitet vode**.

VAŽNO OBAVEŠTENJE: **U TOKU JE AKCIJA ISKLJUČIVANJA NEREDOVNIH PLATIŠA.**

Korisnički servis
Uputstva
Regulativa
Infrastruktura
Kvalitet vode
Merenje potrošnje
Gubici vode
Razvoj

Aktuelnosti i reagovanja

O nama
Izveštaji o poslovanju
Trgovina

Kontakt

Linkovi

Poštovani potrošači, vašim redovnim uplatama direktno utičete na kvalitet i efikasnost poslovanja našeg preduzeća.

Optimizovano za *Microsoft Internet Explorer* i rezoluciju ekrana 1024x768 tačaka, karakter set *Central European* (*Windows*-1250)
www.vodovod-Šabac.co.yu www.Šabac-waterworks.com Administrator domena

© 2004 JKP VODOVOD-ŠABAC. Sva prava zadržana.
E-mail: **vodovod@ptt.yu**

Quality Control Systems

The PUC has its own water quality control system in place and analysis are done in the well maintained laboratory at the WTP in Šabac. In addition, occasional check analyses are done by the Institute for Public Health Protection. The sampling is done at several points in the town of Šabac. Control intervals are 15 days in Šabac.
The quality of the Water is controlled according to the Rulebook on hygienic soundness of drinking water for human consumption.

According to the law, the laboratory sends the results of the analysis to the sanitary inspectors and to the water supply company which takes further actions depending on the analysis results. If any irregularity is found, the Institute suggests how to solve it. Samples are taken by the Institute representatives and by the laboratory technician from the PUC Vodovod Šabac.

Sanitary inspectors can ask for supplementary controls.

In September 2007, the PUC did not extend the ISO 9001/2001application.

No official Management Information System is used.

7.4.2 Future situation

In the future situation the PUC will be responsible for all activities related to the provision of drinking water and the collection and treatment of wastewater.

7.4.2.1 Expected changes for record keeping and management information system

Management Information System and Planning
In an improved PUC organisation the responsibility for the preparation of the planning (investments, year plans) and for the development and maintenance of the information system will remain with the Financial-commercial Sector. A staff of about 15 people will remain responsible for billing and collection for the services.

The Management Information System should ideally combine financial, technical, and commercial information, both short-term and long-term. It should be structured as a Business Plan with clearly defined operational targets and monitored regularly (monthly) for its realisation. The system should allow (future) benchmarking and should facilitate the application of performance-based schedules for staff members.

The Sector will have to develop and apply adequate models for financial planning which will be able to cope with capital planning as well as revenue planning. Development of multi-year financial plans is required. All information shall have to be prepared by management to both the Supervisory Board and the Management Board.

Quality Control Systems

It can be foreseen that the volume of sampling will have to be increased, as incoming wastewater quality will be a operation parameter for the new WWTP. Not only more intensive sampling of wastewater in an extended network is to be foreseen, but it can

also be foreseen that at the National level requirements for quality control will be tighter in the future. Also wastewater sampling at different points between treatment steps will be required for process monitoring and operation. The volume of analytical will therefore increase. A laboratory for wastewater analysis is foreseen at the site of the new WWTP.

7.4.3 Conclusions and recommendations

Based on the assessment made of the administrative systems and procedures of the PUC, we have formulated the following conclusions and recommendations:

Record keeping and management information system:

- Build up a data base system available for the whole PUC with updating links to the existing data base, with included options for Business Plan uses and performance indicators;
- Improve financial planning, in order to pursue on the (middle-) long term full cost recovery and financial independence from the Founder.

Quality Control Systems

- Improve the laboratory facilities both in terms of facilities and in human capacity.

8 IMPLEMENTATION SCHEDULE

8.1 Sub projects

The following sub-projects have been identified:

- SPS Glavna and a main sewer from the SPS to the location of the WWTP;
- Wastewater treatment plant Sabac to cater for all collected communal wastewater and pre-treated industrial wastewater;
- Technical Assistance.

SPS Glavna and a main sewer from the SPS to the location of the WWTP

Apart from the future wastewater treatment facility, other key components that must be implemented to make the overall wastewater collection and treatment system in Šabac fully operational and functional, include the following:

- Sewage pumping station called Glavna – to be located close to the existing outlet structure
- Sewage forcemain from SP Glavna to the WWTP

In order to be able to proceed with implementation of these components, due to their nature – typical civil engineering/hydraulic structures, it is necessary to arrange for preparation of corresponding detail project designs.

These detail project designs should be developed fully in line with the relevant local regulation – Law on construction and other acts, and with the prescribed design criteria and conditions issued by the competent authorities.

The abovementioned detail project designs should be fully compatible with the proposed features and capacities of the WWTP, as described earlier in the report. In other words, these detail designs should fully take into account characteristics and applicable boundary conditions related to the prepared, and already approved technical proposal of the WWTP.

Estimate total preliminary investment cost (excluding VAT) for these components is 2,4 M€.

Construction of the WWTP Sabac

Construction of the WWTP Sabac should ensure that collected communal and pre-treated industrial wastewater is treated in accordance with the prescribed local criteria (set by the relevant authority) and also in accordance with the relevant EU regulation – Wastewater Treatment Directive.

The WWTP design capacity recommended in this study for the ultimate design horizon is 130.000 PE.

At this stage it has been assumed that the complete WWTP would be constructed at once, as a single contract lot.

The construction could be planned as soon as the technical documentation and tender are finalized, all permits necessary for construction are acquired, and the financing secured.

At this stage it has been assumed that the construction could start in early 2010, and be completed by the end of 2011.

In this light it is recommended to include clear milestones in the project planning/phasing. The achievement of such milestones should be the prerequisite for further interrelated investments and construction activities. Such an approach will ultimately result in optimisation of investment and O&M costs.

Table 8.1 Overview of Investments

WWTP (incl. contingencies, incl. VAT)	Units	Tot.	2009	2010
Investigation works & design	€ m	0.35	0.18	0.18
Construction works	€ m	6.91	3.45	3.45
Electro-mechanical equipment	€ m	5.01	2.50	2.50
Additional land acquisition (1,5 ha)	€ m	-	-	-
Trial run, staff training, operation	€ m	0.30	0.15	0.15
Sewerage			-	-
Sabac main sewers	€ m	-	-	-
Sabac SPS - civil works	€ m	1.64	0.82	0.82
Sabac SPS - elctr/mechanical	€ m	0.65	0.32	0.32
Sabac SPS - pipes & fittings	€ m	-	-	-
Supervision			-	-
Supervision WWTP	€ m	0.95	0.48	0.48
Supervision sewer extension	€ m	0.11	0.05	0.05
Total	**€ m**	**15.92**	**7.96**	**7.96**

Technical assistance
The Feasibility Study has identified the following Technical Assistance (TA) elements:

Table 8.2 - TA elements identified in MIASP Feasibility Study

Project	**Time frame**	**Assessed costs (€x1000)**
Sabac WW Project Detail Design SPS Glavna and main sewer Financing unidentified	February 2009 – August 2009	200
Sabac WW Project Tendering and Supervision of the scheme Financing unidentified	June 2009 – December 2011	1.064
Sabac WW Project Financial Operation and Performance Improvement Program (FOPIP) Financing unidentified	April 2009 – April 2010	250

8.2 Time schedule

A preliminary time schedule of the above sub-projects is given in Annex 8.1.

As shown in the attached Project Implementation Schedule the works, are grouped in the following major contracts:

- Construction of SPS Glavna and the main sewer;
- Construction of WWTP Sabac;

9 RISK ANALYSIS

9.1 Risk Analysis

Table 9.1 summarizes the most important financial, environmental, operational, institutional and socio-economic risks associated with the project and the project implementation. The probability that these risks will occur has been assessed, the severity of the effects has been indicated and mitigation measures have been proposed.

Table 9.1: Risk matrix

Risk	**Category** Financial, Environmental, Operational, Institutional Socio-economic Human	**Probability** H: High M: Moderate L: Low	**Adverse effect** From: 1 (Severe) To: 5 (None)	**Mitigation measures** (for effects 1, 2 and 3 only)
PROJECT PREPARATION				
No agreement on use of the property for pumping station and pipeline	Institutional/ Socio-economic	Low	3	Enforcement by municipality
PUC / Municipality fail to allocate funds for the project	Financial	Moderate	1	Apply for funding from sources other than national funds
Limited management capacity available	Operational/ Institutional	Low	4	Capacity enhancement programs
PROJECT IMPLEMENTATION				
Delay due to construction of pipeline	Operational	Moderate	2	Technical and organizational support
Delay of works due to winter weather conditions	Operational	Moderate	2	Technical and organizational support
Zorka _US Steel fails to treat its industrial discharge	Operational/ Institutional	Moderate	3	Close follow up with Ministry of Waters and provide support to Municipality in legal/contractual enforcement
OPERATION				
Occurrence of streams of industrial waste water.	Operational	High	1	Implement waste water management strategies. Increase control on the treatment process

Enforcement of industrial waste water treatment fails	Institutional	High	2	Enforcement by municipality
Inadequate tariff policies and payment discipline	Institutional	Moderate	2	Ensure adequate tariff policy in agreements.
Low HSE standards	Human	Moderate	1	Draw up a HSE plan and live up to it. Apply control measures
Quality standards of treated wastewater not met	Operational / environmental	Moderate	3	Provide TA support to set up appropriate plans and measures