

9. Waste water management

9A. Present Situation

Describe the present situation in relation to waste water management, including any relevant disadvantages or constraints resulting from historical, geographical and/or socio-economic factors which may have influenced this indicator area. Where available, information/data should be provided from previous years (5 – 10) to show trends.

Describe the current general features of waste water management according to national requirements and the requirements of the Urban Waste Water Treatment Directive (UWWTD, 91/271/EEC).

Include data for the following specific indicators:

1. Total annual generated waste water load of the city (in p.e.) and provide indication of the fraction (%) coming from population and from industry (also specifying type of industry, when information is available);
2. Proportion (%) of total annual generated waste water load, connected to a) waste water collecting systems (only) and b) waste water collecting system + urban waste water treatment plants (UCWWTPs), specifying the most advanced treatment level (primary treatment, secondary treatment, tertiary treatment);
3. Proportion (%) of total annual generated waste water load, not connected to waste water collecting systems, and explanation of the type of waste water treatment applied to this fraction;
4. If the city is located in an EU Member State include data on waste water treatment obligations according to the UWWTD (based on city's size and nature of the area of discharge);
5. Waste water collecting systems: main type of collecting system (combined/separated) and annual proportion (%) of COD-loads discharged via storm water overflows;
6. UCWWTPs: Organic design capacity (p.e.), most advanced treatment level, annual incoming and discharged loads (t/a) of BOD₅, COD, N_{tot} and P_{tot} and treated waste water amounts (m³/a) of all UCWWTPs serving the city. If the city is located in an EU Member State, indicate whether the UCWWTP complies with the treatment requirements under the UWWTD;
7. Annual amounts of generated sewage sludge (t/a) and description of treatment/disposal pathways (% of total amount).

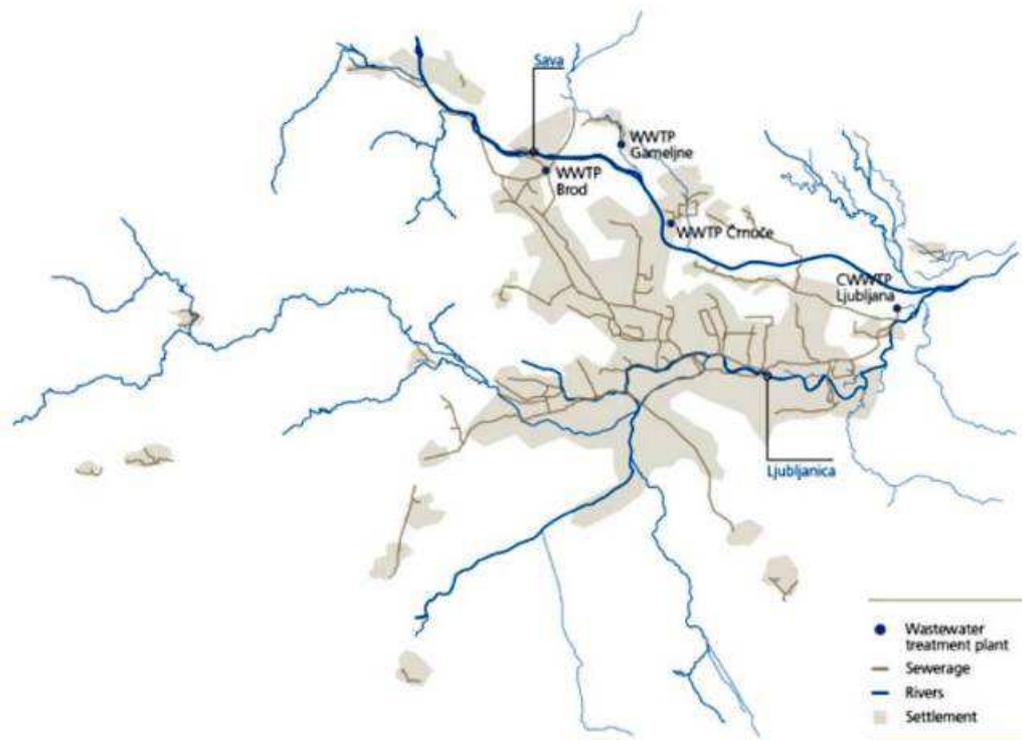
Further information (e.g. on energy efficiency at UCWWTPs, treated waste water re-use, economic sustainability) is highly appreciated.

(max. 600 words)

Ljubljana's sewerage system

Drainage and treatment of waste water in Ljubljana is done by public company Vodovod-Kanalizacija (VO-KA). Urban waste water is treated and discharged via a central sewerage system (Ljubljana Central Waste Water Treatment Plant – CWWTP with capacity of 360,000 PE) and three local systems (WWTPBrod: 5,800 PE, WWTPČrnuče: 8,000 PE and WWTPGameljne: 1,500 PE). Urban waste water from three suburban municipalities is also connected to the central sewerage system.

Figure 1: Sewerage systems in Ljubljana



Ljubljana has approximately **730 km of pipes** of various diameters (0.25–2.4 m). The system is predominantly (around 65%) a combined system. It includes 37 waste water pumping stations. Separate sewers are mainly in city's outskirts. They discharge waste water to treatment plant, while rainwater runoff discharges into watercourses or directly into ground.

The backbone of the system consists of collectors. The main were built in the 1960s or 1970s. Surface runoff has increased strongly since then, while distribution of rainfall during the year has altered due to climate change.

The combined-type sewage system includes three **retention basins**, built between 2009 and 2011, which increase the network's transport and dynamic capacities.

Approximately **300 km of pipes** have been built for rainwater runoff discharge.



Figure 2: Interior of a retention basin

The system incorporates 66 overflow structures, some of them fitted with equipment to measure overflows. The estimated annual overflow is 12,000,000 m³.

Connection to sewerage system

Across the entire area of the city, **87.3% of inhabitants** are connected to the public sewerage system, while in high-density areas **up to 91.5%**.

CWWTP serves 81.4% of inhabitants and provides mechanical and secondary treatment, the rest is treated at **local municipal treatment plants**: WWTPBrod and WWTPGameljne with secondary treatment, serving 3.1% of inhabitants; WWTPČrnuče with secondary and **tertiary treatment**, serving 2.8% of inhabitants.

Waste water management where construction of sewerage system is not planned

Small municipal treatment plants (SMTPs) are being installed in new developments. They gradually replace the current septic tanks of existing buildings. Removal of sludge and its processing at CWWTP is provided for both.

Realisation of legal requirements

Our key objective is to meet requirements of the **UWWD** and the **national Operational Programme (OP) for discharge and treatment of urban waste water (2005–2017)** approved in November 2010. On its basis the local OP was adopted in 2011 (please see section 9B).

Effects of treatment of waste water

They are compliant with existing legislation. Furthermore, in compliance with the Danube river basin legislation (removal of nitrogen and phosphorus) CWWTP will be upgraded with **tertiary treatment** by end of 2015.

To ensure openness and transparency, **all data on cleaning effects are available on-line.**

Waste water produced in Ljubljana in 2012 was 31,172,000 m³: from households 268,109 PE and economic activity and industry 300,000 PE. The share of industrial waste water was 7.6%.

In 2012 we treated 29,502,000 m³ of municipal and industrial waste water and rainwater runoff. The level of treatment at CWWTP in terms of COD was **95.3% in 2012**, meaning that the **annual input load of 18,772 tonnes was reduced to 897 tonnes.**

Further details:

- BOD₅ : from 10,143 tonnes to 196 tonnes
- N_{tot} : from 1,224 tonnes to 465 tonnes
- P_{tot} : from 283 tonnes to 120 tonnes



Figure 3: Outflow of treated waste water from Ljubljana CWWTP

Table 1: Quantity of treated wastewater and treatment effect at individual waste water treatment plants (WWTP) in 2012

	Ljubljana CWWTP	Črnuče WWTP	Brod WWTP	Gameljne WWTP
Quantity of treated wastewater (m ³ /year)	28,018,000	709,000	648,000	89,000
Treatment effect – COD	95.3%	94.3%	88.5%	97.4%
Treatment effect – BOD ₅	98.2%	97.1%	92.6%	98.6%
Treatment effect – total phosphorus	58.7%	46.0%	43.3%	59.2%
Treatment effect – total nitrogen	63.1%	82.5%	40.9%	89.5%

Table 2: Reduction of substances before and after treatment, by individual water treatment plants (WWTP)

	Ljubljana CWWTP	Črnuče WWTP	Brod WWTP	Gameljne WWTP
COD [t/year]	Inflow 18,772 Outflow 897	Inflow 401 Outflow 22.0	Inflow 361 Outflow 42	Inflow 101 Outflow 2.4
BOD ₅ [t/year]	Inflow 10,143 Outflow 196	Inflow 214 Outflow 5.7	Inflow 183 Outflow 15	Inflow 44 Outflow 0.6
N _{tot} [t/year]	Inflow 1,224 Outflow 465	Inflow 30 Outflow 4.7	Inflow 32 Outflow 18	Inflow 5.7 Outflow 0.6
P _{tot} [t/year]	Inflow 283 Outflow 120	Inflow 6 Outflow 3	Inflow 6 Outflow 3.6	Inflow 1.3 Outflow 0.5

WWTPBrod is planned to be closed by end of 2015 when the network is connected to CWWTP.

Management of sludge

At CWWTP and WWTPGameljne (4,150 tonnes/year) it is treated anaerobically, condensed and dried to dry matter content of over 90%. It is used in production of cement.

At WWTPBrod (357 tonnes/year) and WWTPČrnuče (497 tonnes/year) it is condensed to dry matter content of over 20% and converted into compost.

9B. Past Performance

Describe the measures implemented over the past five to ten years to improve waste water treatment. Comment on which measures have been most effective. If the city is located in an EU - Member State special reference should be given to non-expired deadlines for compliance with the UWWTD, when applicable.

Particular reference should be given to capacity building, measures for maintenance, management and restoration of waste water collecting systems and UCWWTPs.

A description of further measures for improving waste water treatment (e.g. pollution prevention efficiency, improvement of energy efficiency) is highly appreciated.

(max. 1200 words)

Success of measures to date to improve the situation

The biggest environmental project in the field of the discharge and treatment of waste water in Ljubljana in the past decade has been the **construction of the second phase of CWWTPLjubljana**, which came online in 2005.

CWWTPLjubljana is a mechanical-biological treatment plant designed for carbon compound removal and nitrification. The processing of excess sludge takes place through anaerobic stabilisation in heated digesting plants, mechanical condensation and drying of sludge to a dry matter content of over 90%. The biogas produced during the process is used to dry the sludge and heat the digesting plants.

In 2002, following changes to legislation, we **renovated WWTPGameljne**, which had insufficient capacity and where treatment had been inefficient. As a result, we now achieve all legally required treatment effects without difficulty.

In 2011 we completed construction of **three retention basins**. This project, worth €13 million, was co-financed from EU cohesion policy funds. Within the City of Ljubljana's central sewerage network, retention basins are extremely important in order to increase the network's transport and dynamic capacities, and represent an **essential element of optimisation of the system as a whole**, allowing us to limit uncontrolled and excessive discharge of waste water into the Ljubljanica via overflows, since from the point of view of environmental protection the operation of the sewage system is particularly problematic in the case of heavy rainfall.

At CWWTPLjubljana we dedicate considerable attention to **energy efficiency and the rational consumption of fuel**. We carefully monitor the **use of biogas** produced during anaerobic stabilisation of excess sludge. In 2012 this energy product represented 75.1% of energy self-sufficiency at CWWTPLjubljana in the process of drying excess sludge and heating digestion plants.

In 2011, through installation of a network of additional control probes in the waste water treatment process, optimisation of the parameters of the turbo blowers regulator, and reduction of pressure losses in air intake pipes, we achieved a **significant reduction in the intake of oxygen in the process of biological treatment of waste water**. In 2012 we achieved a 12% reduction in electricity consumption per unit of organic load compared to 2011.

Phase II of CWWTPLjubljana included the installation of modern technological equipment that allows the biological sludge formed to be processed into energy-rich hygienised pellets with a diameter of 2–4 mm and a maximum moisture content of 10% before delivery to the final waste processor.



Figure 4: After processing, the waste contains more than 90% dry matter

In the maintenance and development of the sewerage system we follow the principle of the use of standards, technologies and materials that enable optimal operation of the system **throughout its life cycle**.

Through suitable regular and preventive maintenance and economically justified investment, we ensure an extended life cycle for those parts of the system where the hydraulic loading rate permits this. On the basis of verified guidelines and instructions applying to regular maintenance, and with many years of experience, we carry out the activities necessary to ensure the faultless operation of the system. The emphasis is, above all, on ensuring uninterrupted operation and optimal use of equipment.

Complete renovation for a better quality of life

On the basis of the national OP, the **local Operational programme for the discharge and treatment of urban waste water in the City of Ljubljana** was drawn up in 2011. This document identifies all settlement areas (agglomerations) and contains project documentation, timetables and financial frameworks for construction of the missing sewerage infrastructure.

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According to the local OP there are 58 agglomerations in the City of Ljubljana, 7 above 2.000 PE (one among them above 100.000 PE) and 51 below 2000 PE.

In two agglomerations above 2.000 PE connection of 95% of the load to the public sewerage system is reached.

The agglomeration above 100.000 PE (Ljubljana) at present registers a connection of 91,5%. By 31 December 2015 the objective of 95% connection will be reached there and in other 4 agglomerations above 2.000 PE. The other 51 agglomerations below 2.000 PE will achieve the target by 2017.

Completion of the sewerage network **in inhabited areas** where a sewerage system is still not present is one of our **priority environmental tasks**. An example of this is the completion of sewerage arrangements in **Rakova Jelša neighbourhood**, which is a specific problem owing to the numerous buildings built without planning permission 50 years ago. We are unable to connect water supply and sewerage pipes to illegal buildings, and therefore these buildings first needed to be legalised. At the

same time we have carried out renovations to prevent sewage flowing directly into the Ljubljanica, in this way protecting the river.

The first phase of construction (2008–2010) included the construction of utilities infrastructure. The following were built: a vacuum sewer system and a temporary small municipal treatment plant, gas and telecommunications infrastructure, street lighting and a new roadway with cycle path and pavement. The first phase was valued at **€5.3 million**.

The **second phase** envisages the regulation and equipping of streets – construction of secondary sewerage pipelines along side streets and construction of a municipal treatment plant. The sewerage system is planned as a vacuum sewer, since the marshy structure of the underlying soil and the presence of a high water table, slightly falling terrain and existing buildings do not permit the realisation of a traditional sewerage system with gravitational drainage of waste water. The municipal treatment plant will provide adequate waste water treatment for 8,500 people. Treated water will discharge into the Ljubljanica. Development is planned to begin after 2014. **We estimate the costs of the second phase at €10 million**, with part of the costs expected to be covered by European funds.



Figure 5: Works in the Rakova Jelša neighbourhood

9C. Future Plans

Describe the future short and long term objectives for waste water management and the proposed approach for their achievement. Emphasise to what extent plans are supported by commitments, budget allocations, and monitoring and performance evaluation schemes.

Refer to:

1. Improvement / maintenance / management of collecting systems;
2. Improvement of connection to collecting systems;
3. Improvement of design capacity, treatment level and treatment performance of UCWWTPs;

4. Improvement of connection to UCWWTPs;
5. Improvements of further environmental and economic aspects of waste water treatment (e.g. removal of micropollutants, energy efficiency at UCWWTPs, sludge treatment and disposal, treated waste water re-use).

Emphasise to what extent plans are triggered by the demands of EU and national regulations.

(max. 800 words)

Short-term and long-term goals regarding the discharge and treatment of waste water

We **plan to implement one of the priority projects in Slovenia** in terms of the provision of drainage and treatment of waste water, which will ensure operation in conformity with national legislation and European directives. The project title is "***Drainage and treatment of waste water in the area of the Ljubljansko Polje aquifer – phase I and II (Construction of phase III of the CWWTP Ljubljana)***".

It consists of:

- phase I with the project "Upgrading of the urban waste water discharge system in the municipalities of Medvode and Vodice and construction of the C0 connection channel in the City of Ljubljana",
- phase II with the project "Construction of phase III of the CWWTP Ljubljana" and "Completion of public sewerage infrastructure in agglomerations of the City of Ljubljana and Vodice greater than 2,000 PE".

The project includes addressing the problems of discharge and treatment in the area of the *Ljubljansko Polje* aquifer and is also included in the indicative list of projects of the *Operational Programme for Environmental and Transport Infrastructure Development 2007-2013 (OP ETID)*.

Upgrading of the urban waste water discharge system in two municipalities, construction of the C0 connection channel and upgrading of CWWTP are projects that follow the objectives of OP ETID 2007–2013 for the Environment Protection – Water Sector development priority:

- the construction of adequate infrastructure for the drainage and treatment of urban waste water in areas defined in the national programme as areas that must be equipped with a sewerage system in accordance with European Directives in the field of waste water drainage and treatment and with the pre-accession agreement,
- reduction of impact on environment (water, soil),
- improvement of the health of the population.

In the realisation of these objectives we'll achieve the following results defined by OP ETID 2007–2013 indicators:

- enlargement of the existing CWWTP by 195,000 PE (from 360,000 PE to 555,000 PE),
- upgrading of the existing CWWTP with tertiary treatment.

Investment documentation has been drawn up for both phases and Cohesion Fund applications submitted. A decision on the allocation of funds is imminent for both applications. Funds for the implementation are guaranteed assuming Cohesion Fund resources are obtained. The value of investments is €85 million. We're also building the new 20 km sewerage network.

A public procurement procedure is under way for the selection of a contractor for the phase I project. Project documentation has been drawn up in order to obtain planning permission and the procedure to obtain planning permission is under way.

A public procurement procedure for the selection of a contractor for the project "Construction of phase III of the Ljubljana Central Treatment Plant" has been carried out and the selection decision is now final. A contract will be concluded after a decision on the allocation of Cohesion Fund resources has been obtained.

In addition to **greater accessibility to the sewerage system**, construction of the C0 collector will enable **improved management of the sewerage system**:

- **relieving the pressure on the central sewerage system**

We'll reduce the inflow of waste water that is currently pumped from lower-lying areas along the river Sava into the central sewerage system and flows into collector A0 in the city centre, on the left bank of the river Ljubljana.

- **optimisation and reduction of operating costs** of the central sewerage system. As a result of the gravitational discharge of waste water through the C0 collector and the consequent decommissioning of currently operating facilities (WWTPČrnuče and WWTPBrod and 5 smaller pumping stations, and, in part, the A2 pumping station), the **operating costs of the system will fall**. Treatment in a single location will be even more rational, at the same time ensuring better management and control.

Implementation of the project will also involve optimisation of processes and efficient use of the capacities of all facilities and installations. This will ensure greater energy self-sufficiency of CWWTP. Implementation of the project is planned in the period 2013–2015.

At the same time we're cooperating in the **European project CC-WARE**, which is a continuation and enhancement of the concluded project CC-WaterS, which used climate models to assess the impacts on sources of drinking water in the future.

The CC-WARE project will involve an identification of the vulnerability and threat to water sources based on climate indicators, which will evaluate extreme weather events such as drought and catastrophic precipitation events. The test area in Slovenia is the *Ljubljansko Barje* wetland, as a major source of drinking water and an ecosystems that need water to exist. The project will address the issue of availability of water sources in extreme weather events while ensuring the necessary quantities of water for ecosystems. The project started in December 2012 and will finish on November 2014. It is valued at €65,000.

9D. References

List supporting documentation, adding links where possible. Further detail may be requested during the clarification phase. Documentation should not be forwarded at this stage.

(max. 400 words)

Documentation of information:

- Operational monitoring reports (for each municipal treatment plant with a capacity of more than 50 PE), prepared in accordance with legislation (written document),
- Discharge and Treatment of Urban Waste Water and Rainwater Runoff Programme for 2013, prepared in accordance with legislation (written document),
- Report on the provision of municipal environmental protection services under a public service obligation (document in electronic form) for 2012,
- Operational Programme for the discharge and treatment of waste water in the City of Ljubljana, No 3214 K, October 2011,
- Operational Programme for Environmental and Transport Infrastructure Development 2007-2013 (OP ETID)
- Decree on the emission of substances and heat in the drainage of waste water into waters and the public sewerage system, UL RS 64/2012
- Decree on the drainage and treatment of urban waste water and rainwater, UL RSE 88/2011
- Vision of Ljubljana 2025, including 93 main projects (in English):

<http://www.ljubljana.si/en/municipality/vision-ljubljana/>,

- Sustainable Urban Infrastructure – Ljubljana – outlook to 2050:
http://www.ljubljanapametnomesto.si/files/1220/Trajnostna_mestna_infrastruktura-Ljubljana_pogled_do_leta_2050.pdf,
- Website of Javni Holding Ljubljana (in English): <http://www.jhl.si/en>,
- Website of Vodovod-Kanalizacija (in English): <http://www.vo-ka.si/en>,
- Outline project for the construction of phase III of the Ljubljana Central Treatment Plant, Aqua Consult Ingenieur GmbH, Hanover, Germany, project No 110306, October 2012,
- European project CC-WARE (in English): <http://www.ccware.eu/>