8. Water management

8A. Present Situation

Please complete the following table providing the most recent data that is available:

Indicator		Unit	Year of data
Domestic usage - Litres per capita per day	91.6	litres/capita/day	2014
Total Usage - Litres per capita per day	122.8	litres/capita/day	2014
Water loss in pipelines, leakage management and network rehabilitation	16	%	2014

Describe the present situation in relation to water management, including any relevant disadvantages or constraints resulting from historical, geographical and/or socio-economic factors which may have influenced this indicator area, including the situation of your river basin (e.g. if water bodies are in good status, if you are regularly experiencing droughts, scarcity and/or floods and expected future trends). Where available, information/data should be provided from previous years (5 – 10) to show trends.

Detail the present situation regarding water demand of different sectors and describe plans currently in place to reduce water consumption and to improve water status.

Make reference to:

1. Total water consumption (in cubic meters/year and litres/capita/year) including a breakdown for different sectors (households, industry, energy, agriculture, small business, tourism, public sector);
2. Proportion of urban water supply subject to water metering, both for domestic and non-domestic metering;
3. Source of water (surface water, groundwater) – make reference to aquifers and river basin management;
4. Quality of drinking water (e.g. how many days of non-compliance with the Drinking Water Directive);
5. Water loss in pipelines, leakage management and network rehabilitation; please provide data on total unaccounted water in percentage and whereas available, in specific losses (m^3/km/day) and info on leakage management and network rehabilitation;
6. Storm water management and use of natural water retention measures;
7. Compliance with the Floods Directive and link to the relevant Flood Risk Management Plans;
8. How the links between water and energy consumption (water-energy nexus) (e.g. through pumping, treatment, heating) is taken into account; if available provide data on yearly energy consumption (Kwh/m^3 of distributed water)
9. Use of “non conventional resources” and water recycling initiatives (rain water use and grey water or wastewater reuse);
10. Compliance with the EU Water Framework Directive and other EU/national/regional legislation applicable at the city level indicating status of water bodies relevant for the urban area within the city limits and relevance of measures enshrined in the applicable river basin management plans.
11. The scale of River restoration projects planned –e.g. for resurfacing (lost) rivers, naturalising previous channelised rivers
12. Projects to reconnect citizens with waterbodies – eg creation of wetland parks, cleaning up water quality such that swimming is possible.

(max. 800 words & 5 graphics, images or tables)

Tallinn obtains 88% of the water it needs from Lake Ülemiste near the city and the remainder comes from the drill wells of the groundwater body. The area of Lake Ülemiste is 9.8 km^2, but it is connected with a surface water intake system of 1,772 km^2, which consists of rivers connected to each other by canals (Figure 1). The share of groundwater in water consumption has decreased somewhat in the last 10 years, as it comprised19-

20% in 2004 and 2005.

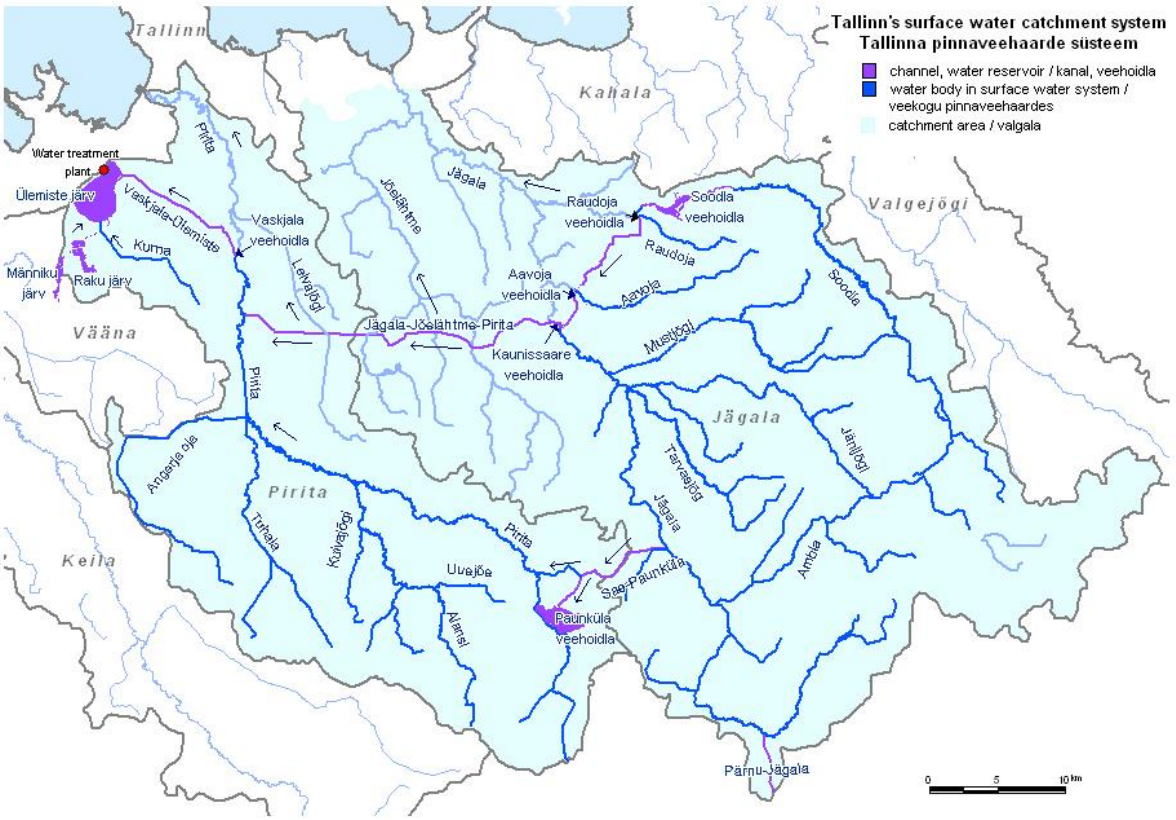

Figure 1. Surface water intake system of Tallinn

Tallinn is divided into 10 operating regions of water enterprise. The main and biggest water undertaking in Tallinn is AS Tallinna Vesi, in which the city is one of the shareholders. There are also three smaller regional water undertakings operating in Tallinn. Tallinna Vesi has two water treatment centres – the Ülemiste water treatment plant and the Paljassaare wastewater treatment plant. In addition, there are 78 drill wells and pumping stations for supplying groundwater to Tallinn.

The city has prepared the Public Water Supply and Sewerage Development Plan for 2004-2015 and 2010-2021. **Construction of the water supply network** in Tallinn was completed in 2010 and 99.5% of consumers are connected to the network. The total length of water pipes in Tallinn is 980 km.

All (100%) of the companies and private consumers connected to the public water supply network have had **water meters** installed. 19.335 million m^3 of water was consumed in Tallinn in 2014, which is 53.0 thousand m^3 per day (according to the Environment Agency). Water consumption has decreased considerably over a period of ten years and has stabilised in the last four years (Table 1).

A quarter of all water is consumed by the **consumer sector** (households, companies, public sector, etc.) and a quarter by the industrial sector. The shares of the remaining sectors (agriculture, irrigation, cooling) are marginal. In the last five years, the consumer sector has consumed 14.2-14.4 million m^3 per year and the industrial sector 4.7-4.9 million m^3 per year. The average water consumption per day per resident is 122.8 litres (Table 1).

Table 1. Water consumption (l) per resident in Tallinn

Year	Total	incl. consumer sector	Total	incl. consumer sector
	l/day		l/year	
2005	233.6	179.7	85 264	65 590.5
2006	176.8	105.9	64 532	38 653.5
2007	152.4	130.2	55 626	47 523
2008	151.3	134.5	55 224.5	49 092.5
2009	124.2	91.2	45 333	33 288
2010	128	95	46 720	34 675
2011	127.8	95.2	46 647	34 748
2012	127.3	94.1	46 464.5	34 346.5
2013	122.8	91.1	44 822	33 251.5
2014	122.8	91.6	44 807	33 423.5

Water loss from public water supply pipes has remained between 15% and 17% in recent years, while 10-15 years ago it was 21-28%.

The quality requirements for drinking water in Estonia are determined with Regulation No 82 of the Minister of Social Affairs 'Requirements for Quality and Inspection of Drinking Water and Methods of Analysis' of 31 July 2001, which proceeds from the Estonian Water Act and the Drinking Water Directive 98/83/EC. According to analyses, the inspected indicators of the **water that passes into the water pipelines** comply with the requirements of the Drinking Water Directive 98/83/EC **every day** (Table 2). The quality of treated water has improved constantly and the water is bacteriologically clean.

Table 2. Quality of the drinking water passed into the network from the Tallinn wastewater treatment plant in 2006-2014

Indicator	Unit	2006	2007	2008	2009	2010	2011	2012	2013	2014
Dry residue	mg/l	287	276	274	280	263	258	256	261	261
pH		7.37	7.36	7.36	7.33	7.31	7.3	7.3	7.26	7.42
Conductivity	µS/cm	443	438	441	435	373	366	366	373	381
Total hardness	mg-eq/l	4.26	4.15	4.16	4.14	3.95				
Oxidisability	mg O2/l	3.1	2.2	3.2	3.3	3	3	3.2	3.1	2.9
Dissolved oxygen	mg/l	10.7	11.3	11.1	10.8	10.7	10.2	10.8	10.1	10.8
Chlorides, Cl	mg/l	24	25	26.8	27	26	25	26	26	25
Sulphates, SO_4	mg/l	37	46	40	34	28	25	26	23	29
Calcium, Ca	mg/l	72	67	68	68	65	66	67	67	69
Magnesium, Mg	mg/l	9	8	8	8	7	7	7	7	7
Total iron	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Manganese, Mn	µg/l	5.1	3	2.47	6.67	12.5	13.2	5.2	12.2	3.1
Enterococci	CFU/100 ml	0	0	0	0	0	0	0	0	0
Coli-like bacteria	CFU/100 ml	0	0	0	0	0	0	0	0	0

Escherichia coli	CFU/100 ml	0	0	0	0	0	0	0	0	0

99.8% of the **water samples taken from consumers** in 2014 complied with quality requirements. Only six (of 2,500) samples did not comply with quality requirements, as the iron content exceeded the limit value. The water pipelines were immediately cleaned, after which the samples complied with quality requirements. 99.7% of the water samples taken from the taps of consumers in 2013 complied with legal quality requirements. These are the best results of all time.

The chemical and microbiological analyses of the drinking water obtained from **groundwater** comply 100% with the established requirements. However, the problem with some deep drill wells in Tallinn is the presence of radium of natural origin in the groundwater. In the course of a health risk assessment carried out in 2010, it was found that the radionuclide content of the water obtained from the Cambrian-Vendian aquifer has no direct impact on consumers and that the probability of health damage is low.

While the drinking water provided to consumers complies fully with the requirements of the EU Drinking Water Directive, the **water system** of the city is not yet fully compliant. The main reason for this is the incompatibility of the water quality in the pipelines of the public water supply system. The problem is the corrosion of water pipelines due to aggressive water caused by the occurrence of free CO_2, which increases the iron content of the consumed water.

The city has established the Tallinn **Stormwater Strategy** to 2030, which lays down the main development objectives of the area and contains an action plan. Tallinn stormwater system consists of 21 separate and seven combined catchment areas. The combined sewerage system runs into Tallinn wastewater treatment equipment; the separately collected stormwater runs mainly into the sea and to a lesser extent into rivers and lakes. Rainwater also immerses into the ground.

Estonia has ratified the **Floods Directive** 2007/60/EC. The assessment of risks related to flood hazards is a function of the Estonian Ministry of the Environment, which has mapped the areas that are at risk from flooding and prepared the Flood Risk Management Plans, which will be enforced by the end of 2015. Tallinn is a coastal city and has six areas at flood risk with a total area of 170.05 ha (Figure 2).

Figure 2. The risk in one of the biggest areas of flood hazard in Tallinn is mitigated by the preserved natural coastal habitats

Water reuse is practised in several companies, e.g. reuse of cooling water or reuse of water from car washes after treatment. The first two office buildings (Sõpruse pst 157 office building and Navigaator commercial

building) in which collected rainwater is used in toilets were built in 2014. There are no data about the reuse of water in households.

According to the European Union **Water Framework Directive** (2000/60/EC), Estonia has to maintain or achieve the good condition of surface water and groundwater by 2015. The catchment areas of water bodies in Tallinn are located outside the territory of the city and the city's possibilities to improve the status of these water bodies are very limited. However, Tallinn has connected the majority of private houses and other built-up properties to the sewerage network as a result of the completion of the canalisation of Tallinn, and therefore directing waste water into water bodies has stopped almost entirely. Tallinn complies with the Urban Waste Water Directive and the Sewage Sludge Directive, as over 98% of consumers have joined the sewerage system.

Tallinn has sought to restore the attractiveness of the coastal area that was closed in Soviet times and to turn the city's wetlands into **nature education and recreation areas**. Tallinn has invested in streamlining the bird-watching towers and hiking trail network of the Paljassaare special conservation area (Natura 2000). In 2014, the city placed the 273-ha Pääsküla bog under local protection and established nature education and recreational sports tracks there (Figure 3). Tallinn has five beaches where the quality of water is good. The newest of these is Pikakari beach, which was opened in 2007 and which, together with Pirita beach, received the Blue Flag quality label in 2014 and 2015.

Figure 3. Pääsküla bog local conservation area

8B. Past Performance

Describe the measures implemented over the last five to ten years for improving water management. Comment on which measures have been most effective and what progress has been achieved.

Make reference to:

1. Technical, nature-based, economic and institutional measures adopted and their effectiveness in achieving reduction of total water consumption or improvement of water status;
2. Byelaw implementation in relation to efficiency in water usage, tariff and metering systems and water quality;
3. Awareness raising campaigns.
4. Actual and projected improvements (in %) of water status/potential compared to 2009, when the 1st river basin management plans were to be in place.

(max. 1000 words & 5 graphics, images or tables)

In the last 10 years, Tallinn has carried out a number of actions to ensure the high quality of drinking water, invested in securing the favourable status of surface and groundwater and implemented the measures set forth in the Water Management Plan of the West-Estonian Basin (2010).

The most important investment was made in the **establishment of the water pipeline** in the areas not yet covered by the public water supply system, which has cost over 55 million euros to date. The construction of water supply network in Tallinn was completed in 2010 and 99.5% of consumers are connected to the network (Table 1). In the remaining 0.5% of the territory, this is not economically practical. The total length of water pipes in Tallinn is 980 km.

Table 1. Establishment and reconstruction of pipelines from 2005-2013

	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
New water pipelines built (km)	9.9	9.08	11.46	7.21	7.85	11.3	11.9	2.5	0.08	71.28
Reconstructed water pipelines (km)	16	6.6	6.89	16.71	23.85	21.25	5.12	5.17	5.28	106.87

Old **worn-out pipelines have been replaced** with new ones at the same time (Table 1). Circular networks are established in the course of reconstruction and the number of valves is increased so as to reduce the number of interruptions to the water supply to clients. In the last 10 years, water losses in the pipelines have decreased from 21-22% to 15-17%, which means that Tallinn has achieved the goal set in the public water supply and sewerage development plan (water losses below 18%).

The renewal and expansion of the **sanitary protection zone** of Lake Ülemiste was completed in 2009. Considering the importance of the surface water intake of the lake as a source of drinking water, expanding the sanitary protection zone by more than was required under the Water Act (i.e. 90 metres) was deemed to be necessary. The sanitary protection zone covers Lake Ülemiste, its water intake facilities, its shore protection facilities and the close surroundings of the lake, which must be preserved in their natural status and where the movement of people must be restricted. The sanitary protection zone is surrounded with a fence and is not in public use.

The reconstruction and extension of the **shore protection dam of Lake Ülemiste** was completed from 2011-2012. Its goal was to increase the adjustable volume of the shallow lake, reduce the eutrophication of the water, stop the shore erosion caused by waves and guarantee a service path for the management and inspection of the lake.

A **biomanipulation** project was also carried out at Lake Ülemiste to make the food chain work in the lake and to get it under control. For this purpose, the fish population and biomass of the lake were monitored, predatory fish were introduced and non-predatory fish were caught.

Technological equipment, tanks and reservoirs at the Tallinn water treatment plant by Lake Ülemiste have been **reconstructed.** The micro-filters that are used to clean out plankton in the summer period and the ozone plant that has made the water more treatable in clarifiers and filters have been reconstructed.

In addition to surface water intake, Tallinn has also invested in **groundwater intake**, establishing water treatment equipment for many drill wells and pump rooms, especially for the removal of excess iron and manganese. Water from the Cambrian-Vendian aquifer is mostly used in the groundwater supply of Tallinn. It usually belongs in the II-III water quality class and requires treatment. The problem components are the high content of Fe^{2+}, Mn^{2+} and NH^{4+}, which is a sign of an anaerobic environment. Reverse osmosis is also used in the water treatment equipment in order to clean water of radionuclides.

Tallinn has set **restrictions and special requirements on the processing of plans and projects** for maintaining the quality of groundwater, levelling stormwater discharge, preventing floods and treating

stormwater. Groundwater has no or weak natural protection in *ca* 60% of the city's territory and it is not possible to engage in activities in these areas that may be hazardous to the environment. In other cases, collection or immersion of stormwater in the ground and minimisation of hard surfaces is required where possible.

Tallinn Environment Department has been **monitoring** stormwater outlets for over 15 years in order to observe their impact on the receiving bodies of water (Table 2). The results of monitoring clearly show the impact of the construction of sewerage networks in the city, as the direction of pollutants into stormwater systems has decreased and the quality of stormwater has improved considerably. The limit concentration of oil products and heavy metals has not been exceeded in the last 10 years.

Table 2. Pollution loads of the two largest rainwater outlets in Tallinn (Lauluväljak and Rocca al Mare) from 2004-2014

Indicator	Lauluväljak					Rocca al Mare				
	2004-2009	**2011**	**2012**	**2013**	**2014**	**2004-2009**	**2011**	**2012**	**2013**	**2014**
Suspended solids t/y	24	17.1	19.8	48.5	19.8	126	236	38.8	82.0	37.2
BHT_7 t/a	10.3	10.5	11.6	8.5	5.1	33.7	40.0	12.1	11.1	17.9
N_{tot} tN/y	13.6	21.4	20.8	8.2	6.9	11.1	13.4	9.8	6.2	5.2
P_{tot} tP/y	0.403	2.03	1.07	0.57	0.38	2.19	2.26	0.96	0.76	0.61

Construction of the **stormwater drainage system** of Ülemiste junction, which is designed to reduce the rainwater impact load of the new junction on the sewerage pipelines, was completed in 2012. In the course of construction, water was directed to the historical Kadriorg Park, where it feeds the park's canals (Figure 1).

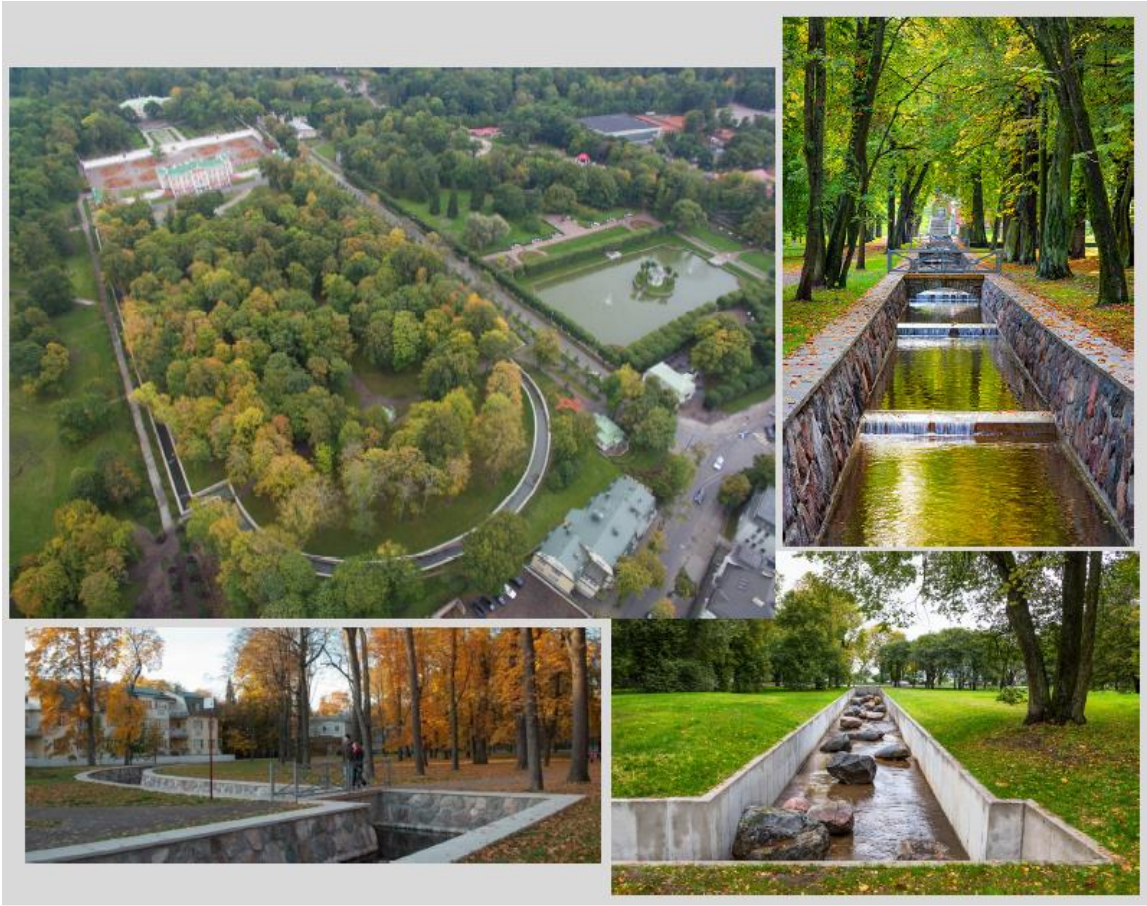

Figure 1. Stormwater at Ülemiste junction is directed to Kadriorg Park. The historical circular canal in front of Kadriorg Palace was reconstructed and stormwater facilities, a cascade with five levels, a pond and stormwater outlet into the sea were built in the course of the reconstruction work

Tallinn has invested considerably in the maintenance of its five **beaches**, which attract around twenty thousand people a day when the weather is good. The international quality eco-label the Blue Flag has been awarded to two beaches – Pikakari and Pirita – in 2014 and 2015. In order to receive the Blue Flag, more than 30 environmental criteria must be complied with, good water quality and security must be guaranteed and events aimed at raising environmental awareness must be organised at the beaches.

There are six **flood hazard areas** in the coastal area of Tallinn: Kakumäe, Pelgulinn, Paljassaare, Kopli, City Centre and Pirita. Tallinn considers the risk of flooding when processing plans and projects and makes sure that risk reduction and mitigating measures are taken in these areas, such as the establishment of stormwater systems for new developments, preference of water-permeable surfaces to hard surfaces, establishment of buffer areas and green networks and maintenance of river beds.

Tallinn and the water undertakings of the city have been working for decades to **raise the water-related environmental awareness** of visitors and residents of Tallinn. The main emphasis 10 years ago was on the water saving, but today, with this objective having been achieved, the emphasis is on **promoting the drinking of tap water**. This is a result of the poorer quality of tap water in the 1990s and the increasing popularity of bottled water, even though the quality of tap water in Tallinn has been very high for years. The website www.jookraanivett.eu was created to promote the drinking of tap water, which provides information about the benefits of drinking tap water, saving tap water and campaigns that will be organised. Many restaurants in Tallinn have joined the initiative 'Tap Water Is Drinking Water!' and are happy to offer free tap water to customers (Figure 2). Events and advertising campaigns have also been organised where Estonian celebrities make tap-water cocktails. Another campaign 'Don't Cause a Blockage!' was organised to advise people what

not to throw into the sewerage system in order to avoid blockages.

Figure 2. Many restaurants in Tallinn have joined the initiative 'Tap Water Is Drinking Water!'

AS Tallinna Vesi cooperates with and gives information to different age groups, incl. children. Regular **open-house days and tours** have been organised at the Ülemiste water treatment plant and Paljassaare wastewater treatment plant for many years to showcase the production of drinking water and the wastewater treatment process. Several environmental awareness events take place at Blue Flag beaches in summer.

Tallinn participates in several **international water projects**. The experience and know-how of each partner country in the area of stormwater are exchanged within the scope of the project 'Baltic Flows – Rainwater monitoring and management in Baltic Sea catchment areas' in order to implement them in other participating countries where possible.

Tallinn participates in the Life+ project CITYWATER (*Benchmarking water protection in cities*), whose goal is to specify the principles of water protection, raise awareness of water protection among local authorities in the Baltic Sea region, exchange experience in the area of rainwater treatment and promotion of cooperation between cities. The Lepiku ditch that runs from a nearby residential area to Tallinn Botanical Gardens was reconstructed and streamlined as part of the project in 2015. New habitats for water and shore plants, including endangered and protected plants, were created in the course of the works and the area was landscaped (Figure 3).

Figure 3. Reconstructed Lepiku ditch

8C. Future Plans

Describe the short and long term objectives for water management and the proposed approach for their achievement, including how they are influenced by the expected impacts from climate change and other long-term trends. Emphasise to what extent plans are supported by commitments, budget allocations, and monitoring and performance evaluation schemes.

Place particular emphases on water quality goals and on key water saving and reuse targets for the future and the proposed approach to achieve these**,** including technical and nature-based measures incorporating water infrastructure to deal with future impacts of climate change.

(max. 800 words & 5 graphics, images or tables)

The main goal set by the city in the Tallinn Environmental Strategy to 2030 is to achieve the good status of the city's water environment and sustainable use of water resources and to guarantee a healthy living environment for people.

In terms of **surface water** protection, the main goal set in the strategy is the improvement of the ecological and physical-chemical status of the city's larger bodies of water, i.e. guaranteeing a good ecological status, by 2021. Another goal is the preservation and improvement of the natural diversity of surface-water bodies. Organisation of efficient protection against pollution for the catchment area of Lake Ülemiste and the surface water intake system of Tallinn is important (Figure 1).

Figure 1. Pine forest in the sanitary protection zone surrounding Lake Ülemiste offers several ecosystem services that help to improve the quality of the city's drinking water (the buildings of the water treatment plant can be seen in the background)

The goals of **groundwater protection** are the preservation of groundwater resources and guaranteeing their protection and quality, and preferring the use of groundwater in areas that already rely on groundwater supply. Another goal is to increase the share of the better-quality groundwater layer in supplying drinking water to

residents and the creation of a groundwater-based water supply system that covers the entire city in the event of a crisis.

The goals in terms of the **coastal waters** of Tallinn are to achieve a good ecological status to reduce the pollution directed from land into the sea and opening up urban space to the sea.

The separate goal in terms of **stormwater** is the development of a stormwater policy. Stormwater must be regarded as a natural resource that is accumulated and used in a sensible manner. Tallinn aims to achieve the good ecological status of the waterbodies, to where the stormwater is directed, by 2021.

In order to achieve these goals, Tallinn will implement the following measures in the next five years:

1. Replacement of all water pipelines older than 60 years, total length 235 km. The plan is to invest over 10 million euros in the reconstruction of water supply networks from 2015-2020 and over 5 million euros in the construction of new water supply networks.
2. Preparation of an action plan for maintaining and improving the status of Tallinn's small bodies of water and marshes and for the restoration of water beds will also be prepared.
3. Preparation of an action plan for improvement of the status of Lake Harku and implementation of the plan in cooperation with Harku Municipality. Lake Harku has become eutrophic and its status is bad; the goal is to achieve a good ecological status by 2021.

Figure 2. Lake Harku on the western border of Tallinn is surrounded by new residential areas

4. Reconstruction of drill wells that have not yet been reconstructed, construction of new drill wells that get water from the Ordovician-Cambrian aquifer and organisation of the elimination of the residual pollution sites that still exist.
5. Identification of the factors that deteriorate water quality in beach areas. The status of the five beaches in Tallinn is generally very good, but the quality of water at two beaches has fluctuated and the reasons for this must be determined.
6. Reduction of the pollution load generated by stormwater directed into the sea and continuing the regular monitoring of water quality in stormwater outlets, coastal waters and inland bodies of water. There are plans to restrict the content of oil and oil products in stormwater even further and to install oil filters in

the rainwater drainage systems of main roads and car parks.

7. Continuation and improvement of international cooperation among Baltic Sea countries and national cooperation for the improvement of the environmental status of marine waters.
8. Mapping catchment area-based stormwater regions, creation of a GIS database and preparation of catchment area-based stormwater models.

8D. 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)

Annual Reports of Water Use of the Environment Agency – http://www.keskkonnaagentuur.ee/et/veekasutuseaastaaruanded

Development Plan of Public Water Supply and Sewerage in Tallinn 2010-2021 – https://oigusaktid.tallinn.ee/?id=3001&aktid=118953&fd=1&leht=1&q_sort=elex_akt.akt_vkp

Flood areas in Estonia – www.envir.ee/et/uleujutused

Regulation No 82 of the Minister of Social Affairs 'Requirements of Quality and Inspection of Drinking Water and Methods of Analysis' of 31 July 2001 – https://www.riigiteataja.ee/akt/27212?leiaKehtiv

Tallinn Environmental Protection Action Plan 2013-2018 – https://oigusaktid.tallinn.ee/?id=3001&aktid=125983&fd=1&leht=1&q_sort=elex_akt.akt_vkp

Tallinn Environmental Strategy to 2030 – https://oigusaktid.tallinn.ee/?id=3001&aktid=120867&fd=1&leht=1&q_sort=elex_akt.akt_vkp

Tallinn Stormwater Strategy to 2030 – https://oigusaktid.tallinn.ee/?id=3001&aktid=123505&fd=1&leht=1&q_sort=elex_akt.akt_vkp

Water Act – https://www.riigiteataja.ee/akt/104032015011?leiaKehtiv

Water Management Plan of the West-Estonian Basin. Ministry of the Environment, 2010 – http://www.envir.ee/sites/default/files/elfinder/article_files/2010.04.07kinnitatudlaane-eestivesikonnaveemajanduskava.pdf

Yearbooks of AS Tallinna Vesi – http://www.tallinnavesi.ee/et/Ettevote/Aruanded_ette/Keskkonnaaruanded