Environmental Report 2016

Tallinna Vesi

CONTENTS

1. Chairman's Statement

We are the largest water utility company in Estonia and our activity has an impact on nearly one third of Estonian population. As a provider of a vital service, it is extremely important that our operation functions smoothly. In our activity, we wish to remain a good and reliable partner to our employees, customers and investors.

AS Tallinna Vesi's staff are of critical importance to the continued success of the company. As of the beginning of 2017, the company employs 312 committed people, who have helped made us so successful today and I would like to thank each and every one of them for their continued contribution. Throughout 2017, we will continue to focus on occupational safety, maintaining high levels of employee commitment and continued training and development.

As a water company, we have a direct interface with the environment throughout our activities, and we also have an effect on the quality of life, within the communities we serve. Our task is to transfer water from the catchment area to the Ülemiste Water Treatment Plant before delivering to our customers. Wastewater is then collected at our Paljassaare facility before being treated and returned back to nature, i.e. the Baltic Sea.

Production of high-quality drinking water requires continuous focus, and every step in the process need to be monitored and controlled carefully. We constantly monitor the quality of our drinking water – last year, the quality of drinking water at customer taps was 99.93% compliant with the relevant standards, which is an excellent result!

We continue to make efforts towards using water sparingly, and taking care of the natural environment that provides us with our main raw material – water. For this, we have set ourselves challenging environmental targets also for the year 2017.

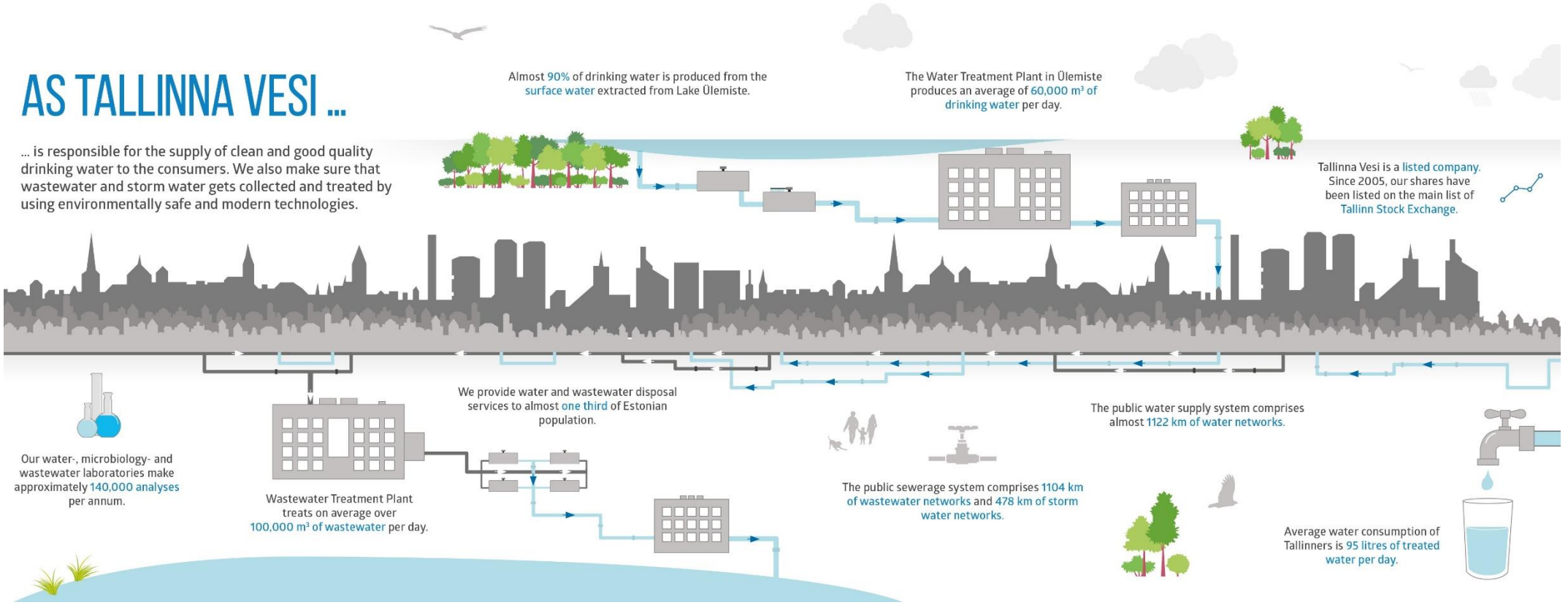
We believe that our task is to raise environmental awareness of our consumers, and also encourage them to drink tap water. For this, we carry out various campaigns and activities within the community. As a result, customers have increasingly become to trust the quality of the tap water, year-on-year. That has helped us to involve more restaurants and cafeterias in Tallinn, who offer their customers free tap water today, to think green. As a responsible company, we will continue to support and sponsor environmental education.

We will also continue to be actively involved in the community's activities. Our special attention and support goes to vulnerable areas of society. We believe that in order to have a better tomorrow we need to act responsibly today, and to get the results to our actions we need to work collectively!

Sincerely,

Karl Heino Brookes

2. AS Tallinna Vesi in brief



OPERATIONAL SITES

- Head office, customer service, support services and OÜ Watercom are located in Ädala 10, Tallinn.
- Ülemiste water treatment plant, water and microbiological laboratory are located in Järvevana road 3, Tallinn.
- Paljassaare wastewater treatment plant, composting fields and wastewater laboratory are located in Paljassaare cross 14, Tallinn.
- The catchment area of ca 1,800 square kilometres is located in Harju and Järva counties.

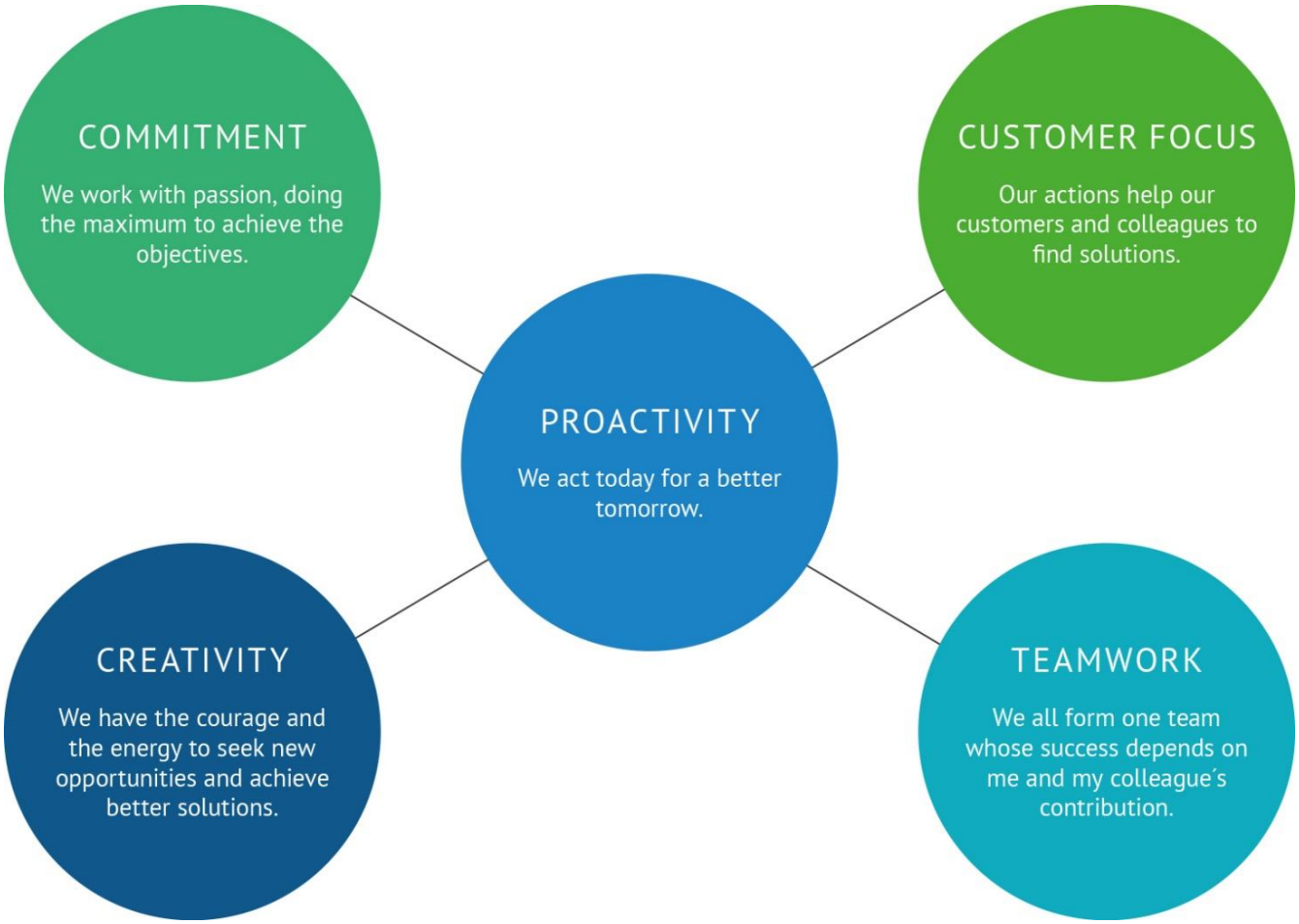
MISSION

We create a better life with pure water!

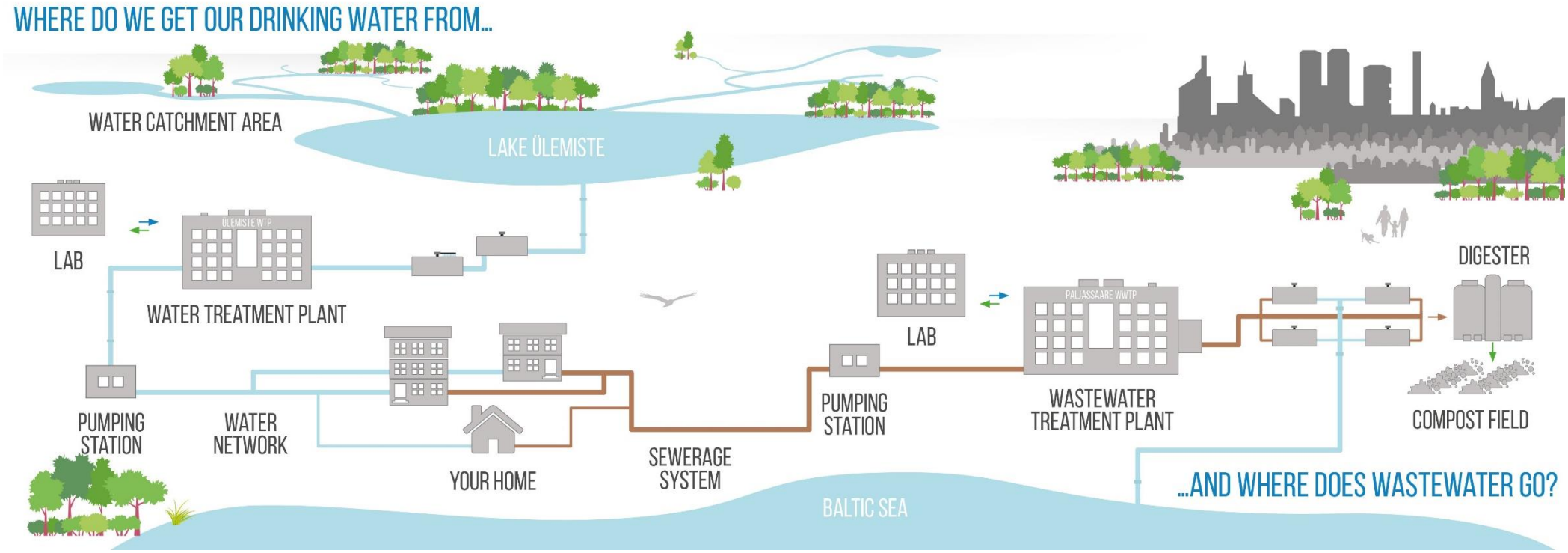
VISION

Everyone wants to be our customer, employee and partner, because we are the leading company providing water services in the Baltics.

OUR VALUES



SUMMARY OF OUR OPERATIONS



3. Environmental and Community Policy

We are the largest water company in Estonia. Our activity influences nearly one third of Estonia's population. We acknowledge that by providing service compliant with all requirements, we influence the quality of life of the citizens of Tallinn, neighbouring municipalities, as well as the Baltic Sea natural habitat and its surrounding areas. Therefore we take into account the impact we have on surrounding living environment, and association with the different stakeholder interests.

- We act responsibly – we take into consideration our impact on the natural habitat, health and quality of life of the residents as well as interests of different stakeholders.
- We fulfil all legal requirements, but we are dedicated to doing more than required.
- We value the natural environment we operate in and therefore use natural resources sparingly and continuously seek ways for a more sustainable consumption. In order to help shaping an environmentally conscious way of thinking in our community, we encourage and support others accordingly.
- We wish to give our contribution to those who need more help and attention in the community to experience the joy of success.
- We strive to be a good neighbour in the community by supporting and encouraging activities related with environmental awareness and healthy life style.

4. Environmental Management System

We have implemented an integrated management system that meets the relevant quality, environment and safety standards. Our Company`s environmental activity is in compliance with the requirements of the international environmental management standard ISO 14001 and EU Eco Management and Audit Scheme (EMAS) Regulation.

The environmental management system covers all the activities of AS Tallinna Vesi: the extraction and treatment ground water and surface water, drinking water supply to the service areas in Tallinn and surrounding municipalities, collection and treatment of wastewater and storm water, and customer service to provide the relevant services.

The environmental management system forms a part of the Company`s management system, as we strive to make the links between the Company and the environment part of our strategy and to take them into account in our everyday operation.

The basis for the environmental management system is the identification of environmental risks, significant environmental aspects and potential environmental impacts, which form the basis for determining the Company`s environmental objectives and tasks for improving the performance. Significant environmental aspects are such activities which, directly or indirectly, influence the nature, quality of services, co-operation between stakeholders, health and quality of life of the residents, and our business performance.

Management of the environmental system has been established in accordance with the Company´s structure. The main responsibility for ensuring and improving the functioning of the environmental management system lies with the senior management and the heads of structural units. Unit managers involve their employees in setting and fulfilling environmental objectives and tasks. We measure,

monitor and assess the indicators of our environmental activities at least once a quarter, on the basis of which we annually compile an environmental report available for the public.

5. Environmental Aspects and Objectives

Table 1: SIGNIFICANT ENVIRONMENTAL ASPECTS 2016

Environmental aspect	Environmental impact from the aspect	Direction of the impact*	Further actions
Use of heat energy	Heat energy produced from biogas that emerges in the sludge digesting process reduces ecological footprint and dependence on non-renewable sources of energy	+	Maximise the use of produced biogas
Water leakages	Big leakages may cause large losses of clean water, damages on soil, waste of material and resources	-	Active monitoring of processes, reconstruction works and continue with the current actions
Emerge of construction waste	Waste that has a low potential of reuse, large quantities of waste, damages on soil etc	-	Wider use of closed methods in pipeline reconstruction
Emerge of waste (screenings) in the mechanical treatment of wastewater	Large quantities of waste, soil contamination, low potential of reuse. Screenings are wet, therefore cannot be burnt	-	Continue public/media campaigns
Emerge and handling of sludge	If the sludge is not reused, amount of waste that needs to be handled increases, and this is complicated due to its large quantities	-	Further actions waiting for the court decision
Ground water extraction	Extensive ground water extraction causes damages on ground water resources and soil. It may cause collapse funnels and reduce the usable ground water resources	-	Preferring the use of surface water, transfer to the use of surface water, if possible
Discharge of partially treated wastewater into the sea	Non-compliant treated wastewater has a negative impact on sea-life and -environment. Negative impact on fish and via that also on the food we eat	-	Reconstruction of treatment process
Use of land	Very scattered locations of activity spread over large territory is an ineffective use of space and has a negative impact on biological diversity	-	Continue optimizing the use of land
Discharge of untreated sewerage into the environment	Environment pollution, negative impact on sea-life and -environment. Impairment of living environment and smell problem	-	Reconstruction of treatment process

*Positive (+) or negative (-) environmental impact of the aspect

Table 2: ENVIRONMENTAL OBJECTIVES AND RESULTS IN 2016

Objective	Indicator	Result by the end of 2016
Compliance with all legal standards, environmental permits and requirements of the Services Agreement	0 non-compliances (except for LoS WS7)	0 non-compliances
Replacing the air cooling devices using substances that reduce the ozone layer with new, more environment-friendly devices.	Hazardous cooling devices that reduce the ozone layer have been replaced.	Hazardous cooling devices that reduce the ozone layer have been replaced.
Reduced number of clean water leakages	≤ 15.0 %	15.07%
Compliance of pollution parameters is achieved at the wastewater treatment plant outlet	0 non-compliances	0 non-compliances
Coagulant unit cost and concentration of total phosphorus (P_{Tot}) in the wastewater discharged to the outlet is reduced by the end of 2016	2016 coagulant unit cost < 2014 ($Fe_2(SO_4)_3$ kg/ influent P_{Tot} (kg). 2014 average unit cost was 9,5 kg $Fe_2(SO_4)_3$/ P_{Tot})	The average unit cost was 8.25 kg $Fe_2(SO_4)_3$/ P_{Tot}), which is less than in 2014
Minimize the evitable sudden discharge of untreated wastewater to the sea.	Amount of untreated wastewater discharged to the sea in 2018 (th m3/y) < 125 th m3/y (2010-2014 average)	Design is nearly finished, last preparations for accepting the design.
Re-organising the waste management system	Volume of mixed municipal waste in 2018 is <2015. More correct waste collecting and sorting.	Commencement of the activities is postponed
Improve the stakeholders' environmental awareness and knowledge of the Company's activity (employees, succession, consumers and community), in order to increase and maintain Company's good reputation (image).	1. ≥2 doors open days/yr 2. ≥25 guided tours/yr 3. ≥ 750 children/yr have participated in kindergarten visits 4. ≥1 water campaign	1. 1 doors open days 2. at least 138 guided tours 3. 1553 children participated in waterclasses 4. 3 water related campaigns

Table 3: ENVIRONMENTAL OBJECTIVES 2017

Objective	Indicator	Due date
Compliance with all legal standards, environmental permits and requirements of the Services Agreement	0 non-compliances	2017
Reduced number of clean water leakages	≤ 15 %	2017
Compliance of pollution parameters is achieved at the wastewater treatment plant outlet (averaged quarterly results)	0 non-compliances	2017
Reduce the risk of environmental pollution in the wastewater treatment plant	Works with the WWTP's domestic wastewater pumping station completed and equipment ready for work.	2017
By the end of 2018 the evitable sudden discharge of untreated wastewater to the sea is minimized	Amount of untreated wastewater discharged to the sea in 2018 (th m^3/yr) <125 th m^3/yr'	2018
Re-organising the waste management system	Volume of mixed municipal waste in 2018 is <2015-2016 average. More correct waste collecting and sorting	2018
Improve the stakeholders' environmental awareness and knowledge of the Company's activity (employees, succession, consumers and community), in order to increase and maintain Company's good reputation (image).	≥ 1000 children have participated in kindergarten visits ≥ 60 guided tours/yr ≥ 2 open doors day in a treatment plant ≥ 1 water- and environment related campaign or participation in an outdoor event	2017

6. Compliance of the Activities with Environmental Requirements

To a large extent the Company's environmental activities are regulated by requirements arising from the European Union (EU) as well as national legislation and the legal acts issued by local governments.

At the EU level, this means compliance with the EU Water Framework Directive (2000/60/EC). At the national level, compliance with the Water Act, Public Water Supply and Sewerage Act, Waste Act, Chemicals Act, Ambient Air Protection Act, and subordinate acts based on these acts must be ensured. At the local level, we are obliged to comply with different rules and requirements applicable in Tallinn and its surrounding municipalities.

Amendments to the requirements and legislation are being constantly monitored. In case changes are made to the legislation that concerns the Company, those are communicated to the managers and specialists responsible for the relevant matters, allowing them to assess the impact of the amendments on the Company and amend our processes accordingly if necessary.

In cooperation with the Estonian Waterworks Association we participate in the rounds of approvals of legal acts pertaining to the water sector and environmental matters by presenting our opinions and making amendment proposals to the draft legal acts under discussion. Our participation, via the Estonian Waterworks Association, in the work groups, which draft water and environmental legislation, has provided us with the opportunity to communicate our positions directly to the relevant ministries.

Our involvement in the drafting of the new Public Water Supply and Sewerage Act was of primary importance for us in 2016 and will actively continue in 2017. We also worked with the drafts of the Water Act and Waste Act and we will carry on doing so in 2017.

The key draft laws, in the development and amendment of which AS Tallinna Vesi's specialists actively participated during 2016, were the amendments to the Regulation No. 99 (*wastewater treatment requirements and maximum permitted levels of pollutants*), amendments to the Regulation No. 57 (*regulation on measuring instruments*) and the new Atmospheric Air Protection Act as well as numerous other legal acts that are important for the Company. Our participation in drafting the regulation on qualifying sludge as a product will definitely continue in 2017.

Environmental permits

We act in accordance with the terms and conditions set out in the environmental permits issued to the Company. The main licensing authority for us is the Environmental Board's department of Põhja region, who has issued the following environmental permits to us:

- 4 permits for a special use of water (details on page 16);
- 2 waste permits (details on page 35);
- 2 ambient air pollution permits (details on page 39).

Requirements of the Services Agreement

On 12 January 2001 we concluded a tripartite Services Agreement with the City of Tallinn and investors, which, among other things, obliges us to comply with 97 Levels of Service. This makes us the most regulated water undertaking in Estonia. Our activities and levels of services are assessed once a year by an impartial inspection body – Supervisory Foundation for the Water Companies in Tallinn – to

whom the Company annually, i.e. by the end of the first quarter, submits a report on compliance with the levels of service.

In 2016, we were in compliance with and in many cases outperformed all of the contractual levels of service. In 2016, the Company had only one service level failure (WS7A – interruptions to water supply must not last over 12 hours) due to time-consuming repair works on a large water main and inaccuracy of the GIS. The Company achieved the best results of all times with respect of several levels of service. For example, water quality at the customers' taps was 99.93% compliant with the standards, which is the best ever result outperforming the quality level specified in the Services Agreement by 4.93%. This has been achieved by consistent and forward-looking efforts in our daily business activities as well as timely and informed investments in our assets.

Requirements to contractual partners

As strict requirements apply to our activities, we consider it to be very important that our suppliers and contractors meet the environmental and occupational safety requirements, too. Among other things, the providers of construction works must confirm that they comply with occupational safety and environmental protection requirements at our repair and construction sites. In 2016, we organised an information day for subcontractors and cooperation partners, including a training on envronmental and occupational safety requirements. We plan to continue carrying out such events regularly also in the coming years.

We have established several criteria in our procedures which enable us to make sure that our partners meet our expectations. Our specialists monitor the activity of suppliers/contractors with regard to the safety and environment at sites on a daily basis.

Management system control and audit

In spring 2016, an external audit was carried out in the Company by an accredited certifier Det Norske Veritas in order to evaluate the compliance of the management system with the requirements of ISO 9001, ISO 14001, OHSAS 18001 standards and with the Regulation (EC) No 1221/2009 (EMAS). As a result of the external audit, DNV GL confirmed the continuous compliance of the Company's integrated management system with the aforementioned standards and EMAS regulation. The auditors also verified that the 2015 environmental report complied with the requirements of EMAS. In their report, the auditors highlighted many positive observations, which were related to the Company's contribution to the improvement of environmental awareness in society, increased customer satisfaction compared to 2014 results and outperformance of the company objectives.

Internal audits monitored the Company's compliance with environmental legislation and Services Agreement requirements, as well as with the Company's own internal requirements. As a result of internal audits carried out in 2016, our internal auditors put forward a total of 2 non-conformities and 23 improvement proposals, which provide a good input to managers for improving the management system. All the non-conformities were rectified immediately.

The compliance of the activity and management system of Company's laboratories against the requirements of ISO 17025 standard were audited by the Estonian Accreditation Centre in spring 2016. The auditor did not find any non-conformities.

7. Environmental Education and Consumer Awareness

We keep on working hard to promote the environmental thinking amongst our population. In our messages and activities we encourage them to drink tap water. With our message "Tap water IS drinking water" we draw people's attention to the very good quality of tap water. We also continued our co-operation with restaurants so that the customers would have the courage and awareness to ask for tap water when they dine out in restaurants, we organized a campaign in the old town and set up a public water tap at Tallinn Airport. While only few years ago, in 2011, 48% of people trusted to drink tap water, the number of people trusting tap water quality had grown to 80% by the end of 2016*.

Tap water campaign 2016

- We continue contributing to environmental awareness of young people who would value the nature and environment. Each year, our employees organize water lessons in kindergartens and schools discussing water circulation, how to save water and avoid blockages. 1,553 children participated in these lessons in 2016.
- Over the years, we have prepared many educational study materials related to water and environment issues for children and teachers. These include, for example, a study material series "Blue Classroom" for the teachers in nature studies supporting the national study program in water-related classes. The games and puzzle book for kindergartens and primary schools got new great sequels in the form of Tilgu's playing cards and a puzzle book „Puzzle with Tilgu".
  In September 2016 we participated in an information day organized by Ministry of the Environment to introduce our water-related study materials and programs to kindergarten and school teachers.
- Besides our main responsibilities – production of drinking water and treatment of wastewater – our treatment plants also have an important role to play in increasing the population's awareness. Each year, we introduce the plants' work to more and more people. In 2016, nearly 3,000 visitors took guided tours in the treatment plants.
- In spring 2016, we arranged an open doors day in our wastewater treatment plant, which was then visited by more then 100 people. Ülemiste water treatment plant opened its doors in August for all the sportsmen - more than 1000 people participated in the Ülemiste run.

* *Since 2016, the percentage of consumers drinking tap water reflects the responses given by the end-users' segment in the customer satisfaction survey.*

- In September, we participated in the New World Neighbourhood Festival to promote the high quality of our tap water and environmental awareness amongst the public – preferring tap water to bottled water. The visitors had the opportunity to test their knowledge on water matters and by drawing lots we gave away BPA-free reusable water bottles to the people who had passed the quiz.

New World Neighbourhood Festival 2016

8. Ecological Footprint

Ecological footprint method enables to evaluate the environmental impact of our activities in a complex manner. Ecological footprint assesses the use of space accompanying the lifecycle of a product or service and can be measured in hectares per year (hereinafter ha/y).

Our ecological footprint is calculated based on the methodology developed by the Estonian Fund for Nature. The calculation takes into consideration 11 different components and corresponding factors[1]. The components have been divided into five fields (water, waste, electricity, heating, transport). In order to get a better comparison, the ecological footprint per one employee has been pointed out separately.

Table 4: GROUP'S ECOLOGICAL FOOTPRINT IN 2015-2016

Aspects that serve as the basis for calculating the ecological footprint	Year	Consumption/ production	Ecological footprint per employee, ha/y per employee	Ecological footprint, ha/y	Direction of change
WATER					
1. Water consumed, m^3	2016	1 878 410	0,5	150,3	↑
	2015	1 259 936	0,3	100,8	
WASTE					
2. Recycled paper, t	2016	5	0,0	12,2	↓
	2015	5	0,0	13,5	
3. Recycled metal, t	2016	34	0,1	37,5	↓
	2015	68	0,2	74,4	
4. Concrete (to a landfill), t	2016	77	0,0	7,7	↓
	2015	274	0,1	27,4	
5. Mixed municipal waste (to a landfill), t	2016	90	1,2	362,3	↑
	2015	67	0,9	269,0	
ELECTRICITY					
6. Electricity, MWh	2015	40 787	21,3	6 566,7	↑
	2015	38 465	20,1	6 192,9	
HEAT ENERGY					
7. heat energy produced from natural gas*, MWh	2016	4 150	1,3	390,1	↑
	2015	3 623	1,1	340,5	
TRANSPORT FOR PEOPLE					
8. By car, km	2016	5 670 165	1,1	340,2	↑
	2015	5 558 977	1,1	333,5	
9.By plane, km	2016	67 061,0	0,02	6,0	↓
	2015	153 346	0,04	13,8	
10. By bus, km	2016	32 472	0,0032	1,0	↑
	2015	1 948	0,0002	0,1	
11. By ship, km	2016	2 068	0,0001	0,0	↓
	2015	5 576	0,0002	0,1	
TOTAL:	**2016**		**25,6**	**7 874**	↑
	2015		**23,9**	**7 366**	

*In addition to the heat energy produced from natural gas we use the biogas, which is a by-product of the sludge treatment process, to produce the heat energy.

[1] Ecological footprint factor is a conversion unit which helps to equalize the measured source data so that the result would be easily understandable and comparable.

In relation to the many challenges we faced last year, our ecological footprint has slightly increased. The highest impact on the environment comes from the use of electricity, followed by the use of heat energy, mixed municipal waste and motor transport. The use of electricity and heat energy and motor transport are in a close and inevitable connection with our core activity and the factors that impact this. The reduction of mixed waste has been set as one of the Company's environmental objectives.

Significantly higher quantities of process water were used in 2016 due to the lower quality of raw water in Lake Ülemiste, which required more frequent backwashing of water filters. If the average monthly use of process water at Ülemiste Water Treatment Plant in 2015 was 64,000 m^3, then in the second half of 2016 the respective figure amounted to even over 200,000 m^3 a month, taking the annual average to 118,000 m^3.

The consumption of all the resources is analysed in the next chapters of this report.

Tap water campaign 2016

9. Quality and Use of Water Resources

Permits for special use of water

Our activities in using water resources are regulated by the Water Act and its implementing provisions. As a water company we must hold a valid permit for a special use of water and pay a fee for the water resource we have used. The permit for a special use of water sets us certain obligations and restrictions. For instance, the permit determines the allowed water extraction volume (m^3), obligation for keeping account over the used water quantities, requirements for sampling, monitoring and analyse standards, as well as the allowed limit values for pollutants in effluent, requirements for monitoring the pollutants and the measures to reduce the impacts deriving from the use of water.

All requirements established in the permits for a special use of water were met in 2016. Fee for a special use of water is paid for the amount of water taken from Ülemiste lake into the water treatment plant and for the ground water pumped from the aquifers. In 2016, the fee for a special use of water amounted to 4.5% of the costs of the sold products/services (2015: 4,6%).

Table 5: VALID PERMITS FOR SPECIAL USE OF WATER OF AS TALLINNA VESI

Permit for special use of water no.	Valid until	Description of special use of water
L.VV/323855	31.10.2018	**Saue City public water and sewerage service area.** Extraction of ground water from boreholes, over 5 m^3/day. Collection of wastewater and directing wastewater to Paljassaare Wastewater Treatment Plant owned by AS Tallinna Vesi.
L.VV/322982	31.03.2018	**Tallinn public water suply and sewerage system main operating area, Tallinn surface water catchment system facilities area in Harju and Järva Counties.** Regulating surface water resources in water bodies of Ülemiste-Pirita-Jägala surface water system, water extraction from Lake Ülemiste, extracting ground water from Ordivician-Cambrian and Cambrian-Vendi aquifers through Tallinn public water supply and sewerage system boreholes, for discharging biologically treated effluent through a deep-sea outlet pipe into Tallinn Bay and for discharging mechanically treated storm water into the sea, Mustjõe Stream and Pääsküla Wetland.
L.VV/320972 L.VV/328381	6.11.2016 31.12.2042	**Harku Municipality.** Extraction of ground water from boreholes, over 5 m^3/day.
L.VV/320980 L.VV/328349	30.11.2016 01.07.2039	**Maardu City public water supply and sewerage system operating area.** Extracion of industrial and drinking water from Cambrian-Vendi aquifers in order to supply water to Maardu City, Kallasvere and Muuga area. From november 2012 all Kallasvere and Maardu public sewerage system is discharged to Tallinna public sewerage system.

Water catchment

Nearly 90% of our consumers in Tallinn and Maardu get their drinking water from the surface water resources. Even though Lake Ülemiste is the main drinking water source for the people of Tallinn, the natural catchment of the lake itself is small. To increase the water volume and ensure that the needs of the City of Tallinn are met, we have established a water catchment system, which consists of hydropoints constructed on rivers, as well as water reservoirs and channels connecting those. Our

water catchment system mainly comprises Harju sub-basin and the river basins of Soodla, Jägala and Pirita rivers with the total area of ca 1,800 km^2. The most important water reservoir is Lake Ülemiste with a net volume of 15.8 million m^3. Additional water reserves for dry periods have been accumulated to Paunküla water reservoir on the headwaters of the Pirita River (9.9 million m^3) and to Soodla water reservoir on the Soodla River (7.4 million m^3).

The volume of water resources in Tallinn surface water catchment system primarily depends on the annual amount of precipitation. Constant information on the flows enables us to use the water resource in the most efficient manner. To regulate the water resources in an optimum and accurate manner we have established water metering points at all hydropoints, which enable us to meter the flows conducted to the channels and the sanitary flows in the rivers. We perform metering regularly, as per the requirements of the permit for a special use of water.

The year 2016 was on average slightly warmer, more rainy and sunny than usual, which contributed to good conditions for the growth of flora in water bodies. Especially warm and wet December 2015 was followed by a slightly colder January, whereas, February showed again some warmer and rainier weather than usual. Heavy rainfall events occurring quite frequently throughout the summer flushed high quantites of pollutants and nutrients from soil to water bodies, causing the water quality to decline in the entire catchment area, which provides water to Tallinn, and making the water treatment plant's work more difficult. The challenge in 2016 was to find ways to supply raw water of sufficiently good quality to Lake Ülemiste. For that purpose we used water stock from Paunküla reservoir in which the water quality remained at its best throughout the year.

In order to protect the water resources and the water body used for the drinking water extraction, a sanitary protection zone around Lake Ülemiste has been formed. The sanitary protection zone, which comprises Lake Ülemiste, water catchment facilities, bank reinforcements and the land in the immediate vicinity of the lake, needs to be kept in its natural condition. In addition, sanitary protection zones have been formed in the catchment area to protect the facilities of Soodla, Kaunissaare, Paunküla and Aavoja water reservoirs.

Use and quality of surface water

According to the permit for a special use of water no L.VV/322982, the Company is allowed to extract 47.60 million m^3 of surface water per year from Lake Ülemiste. The actual surface water extraction in 2016 was 23.73 million m^3.

Table 6: USE OF SURFACE WATER FROM LAKE ÜLEMISTE AND COMPLIANCE WITH THE PERMIT FOR A SPECIAL USE OF WATER No. L.VV/322982, million m^3

	2012	2013	2014	2015	2016
Use of surface water from lake Ülemiste	21,75	22,2	22,61	22,76	23,73

The water quality in surface water sources is monitored in line with the program determined by the permit for a special use of water. In 2016, the quality of raw water extracted from the water catchment system was compliant with the Decree No 1 (*Quality and control requirements for the surface and ground water used or intended to be used for the production of drinking water*) issued by the Minister of Social Affairs. We have been taking raw water samples from the intake of our water treatment plant on a daily basis to ensure the compliance. Nitrogen and phosphorus compounds and total organic carbon are determined in raw water once a week. Furthermore, an in-depth analysis of raw water is carried out once a month in line with the quality monitoring programme established for a drinking

water source. We study the results of the analyses to understand the changes and processes in the catchment area and decide upon the necessity to replenish the water stock in the lake.

Table 7: PERMANGANATE OXYGEN DEMAND IN RAW WATER IN 2012-2016 O_2, mg/l

	2011	2012	2013	2014	2015	2016
COD_{MN}	9,4	10,1	10,1	8,9	9,6	10,0

Table 8: RAW WATER COLOUR IN 2012-2016, Pt mg/l

	2012	2013	2014	2015	2016
Colour	46	43	33	35	34

In 2016, the water quality in Lake Ülemiste was slightly lower than in 2015. The permanganate oxygen demand was above the average and plankton remained high for a longer period of time compared to the previous years.

Use and quality of ground water

Approximately 10% of consumers in Tallinn are supplied with water extracted from the Cambrian-Vendian and Cambrian-Ordovician aquifers. Ground water is supplied in the districts of Nõmme, Laagri, Merivälja, Pirita and Tiskre in Tallinn, Tiskre village in Harku Rural Municipality and City of Saue. Total of 2,762,852 m^3 of ground water was extracted in 2016.

Table 9: USE OF GROUND WATER AND COMPARISON WITH THE MAXIMUM VOLUMES SET BY PERMITS FOR A SPECIAL USE OF WATER, th m^3

Parameter	Maximum volume permitted	Average results				
		2012	2013	2014	2015	2016
Tallinn (Permit no. L.VV/322982)	7150,7	2161,8	2152	2076,3	2 146,1	2437,4
Saue (Permit no. L.VV/323855)	511	210,7	205,2	230,7	265,5	278,7
Harku (Permit no. L.VV/320972) / (Permit no. L.VV/328381*)	138,12 / 110	57,2	58,3	57,9	58,6	46,7
Maardu City (Permit no. L.VV/320980) / (Permit no. L.VV/328349**)	1382,4 / 720	36	1,5	0	0,1	0,3

* valid from 02.11.2016

** valid from 01.12.2016

According to the EU Water Framework Directive (2000/60/EC), the qualitative or chemical condition of ground water is regarded to be good if the concentration of pollutants does not indicate an inflow of salty water or other water, nor does it exceed the respective quality standards. In 2016, the quality of drinking water at the borehole pumping stations complied with the requirements of the Regulation No 82, issued by the Minister of Social Affairs. There were no ground water pollution incidents or potential pollution incidents demanding the notification of the City of Tallinn and the Health Board.

We monitor the ground water quality parameters in accordance with the permits for a special use of water and the drinking water source quality monitoring programme, and if necessary, the ground water will undergo a treatment process. On a monthly basis we monitor the treated ground water quality (content of iron, manganese, and ammonia) in 20 ground water pumping stations, which

constantly provide water to the public network. All the bore-wells that are currently in use are equipped with automatic hydrostatic pressure sensors, which enable to measure the static and dynamic level of ground water. The results of this measuring enables us to assess the recovery of ground water resources.

Ground water in Northern Estonia (Cambrian-Vendian aquifer) contains natural radionuclides. The natural radioactivity of Estonian ground water has been thoroughly studied by the Geological Survey of Estonia, as well as the Estonian Radiation Centre. To assess the health impacts of radioactivity, the Radiation Centre together with the Health Board carried out a health risk assessment in Tallinn ground water areas in 2010. Based on the results of this risk assessment, any random health damage resulting from the content of radionuclides in the water of Cambrian-Vendian bore-wells is unlikely. Repeated radiological analyses in all the bore-wells are carried out in every ten years, in accordance with the requirements.

10. Drinking Water Production and Quality

Last year we supplied 25 million m^3 of pure drinking water to our consumers. Drinking water quality is required to comply with the Regulation No 82 "Quality and Control Requirements and Analysis Methods for Drinking Water", issued by the Minister of Social Affairs on 31 July 2001 (hereinafter referred to as the Regulation No 82), originating from the Estonian Water Act and the European Union Drinking Water Directive 98/83/EC.

The water quality is monitored following the monitoring programmes approved by the Health Board. Samples are taken from the raw water (Lake Ülemiste, its catchment area, and ground water), treatment process, water tanks at the groundwater pumping stations, as well as the customer taps. Water analyses are carried out by the Company's water and microbiology laboratory, which is one of the largest water laboratories in Estonia. The quality of the analyses is guaranteed by the certified samplers and laboratories accredited by the quality management system (EVS-EN ISO/EC 17025 standard), using modern equipment and professional staff. In 2016, our water and microbiology laboratory performed a total of 99,000 analyses.

Thanks to the high quality of water and improved awarenesss of consumers, the number of people drinking tap water in our service area has shown a steady increasing trend over the last years.

Surface water treatment process

Ülemiste water treatment plant treats water extracted from the lake applying a treatment scheme which is used world-wide. Due to the quality of surface water in Lake Ülemiste, the law stipulates that in order to ensure the drinking water quality, the surface water must undergo mechanical and chemical treatment – preliminary ozonation, coagulation, clarification, filtration, and disinfection.

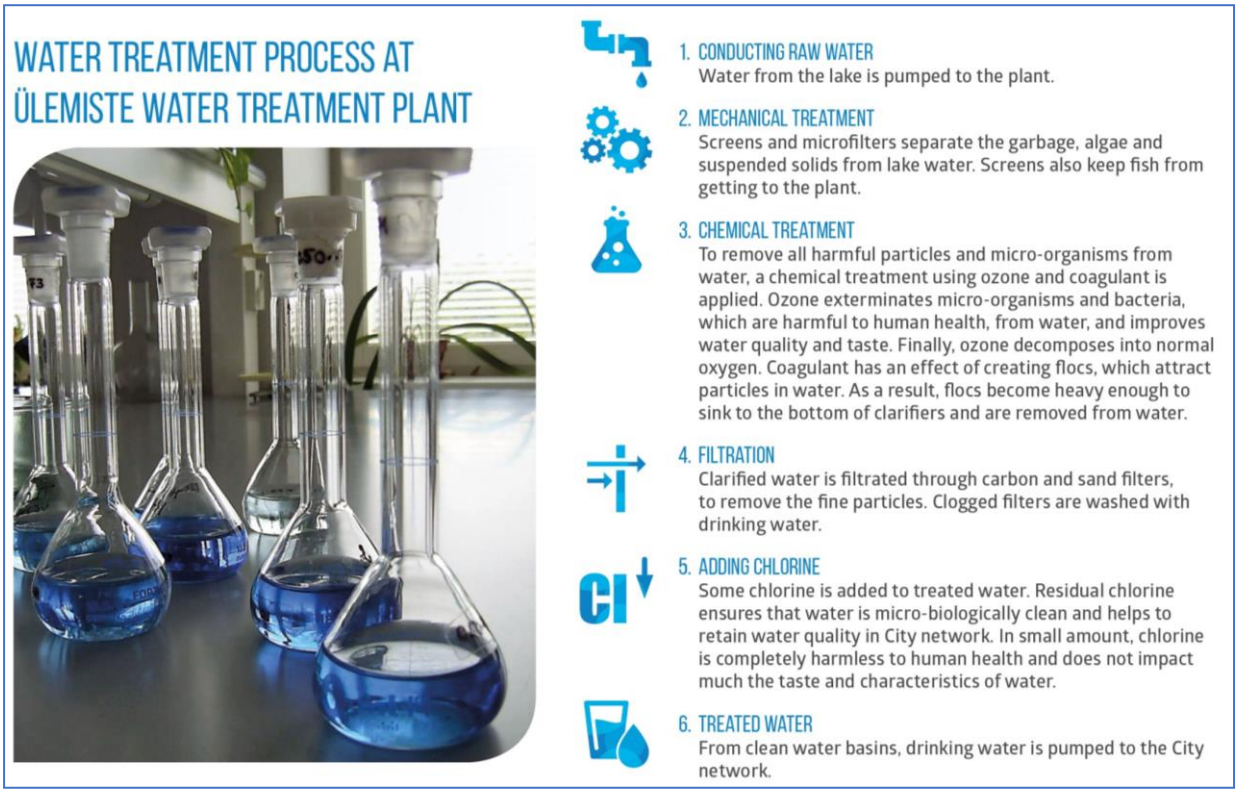


Figure 1: WATER TREATMENT PROCESS AT ÜLEMISTE WATER TREATMENT PLANT

Last year four filters were regenerated to improve the efficiency of the water treatment process. Furthermore, 2016 saw the start of reconstruction of one clarifier, which allows spreading the load out more evenly in case the raw water quality deteriorates and extend water retention time in the clarifier.

In 2016, the ozone plant also went through several renewals. The ozone pipes (1,160 pcs) made of dielectric material were replaced in one of the ozonators in the ozone plant in spring and the drying systems used in ozone production were replaced by the more environmentally friendly ones in autumn. The old (replaced) equipment used fluorinated greenhouse gases to cool the air.

Table 10: DRINKING WATER QUALITY IN ÜLEMISTE WATER TREATMENT PLANT IN 2012-2016

Parameter	Unit	Average results					EU directive 98/83/EC, act nr 82
		2012	2013	2014	2015	2016	
Odour	points	1	1	1	1	1	Acceptable to consumer
Taste	points	1	1	1	1	1	Acceptable to consumer
Turbidity	NTU	0,12	0,11	0,07	0,09	0,1	1,0
Colour	Pt mg/l	<3	<3	<3	<3	<3	Acceptable to consumer
pH		7,3	7,26	7,42	7,37	7,33	6,5 – 9,5
Conductivity	µS/cm	366	373	381	385	368	2500
Alkalinity	mg-ekv/l	2,79	2,93	2,93	2,94	2,71	
Total hardness	mg-ekv/l	3,86	3,96	4,04	4,07	3,79	
Permanganate index (COD_{Mn})	O_2 mg/l	3,2	3,1	2,9	3,07	3,17	5,0
Total organic carbon (TOC)	mg/l	6,2	5,8	5,7	5,73	5,7	Without unusual changes
Chlorides Cl^-	mg/l	26	26	25	26	27	250
Sulphates SO_4^{2-}	mg/l	26	23	29	28	26	250
Orthophosphates PO_4^{3-}	mg/l	<0,02	<0,02	<0,02	<0,02	<0,02	
Fluoride F^-	mg/l	0,1	0,09	0,11	0,1	0,1	1,5
Nitrates NO_3^-	mg/l	3,1	2,6	2,6	3,2	3,3	50
Ammonium NH_4^+	mg/l	<0,006	<0,006	<0,006	<0,006	<0,006	0,5
Caltcium Ca	mg/l	67	66,4	67,4	65,5	61,5	
Magnesium Mg	mg/l	6,6	6,9	7,5	7,8	8,05	
Total iron Fe	µg/l	<10	<10	<10	<10	<20	200
Manganese Mn	µg/l	5,3	12,2	3,1	4,3	2,7	50
Aluminium Al	µg/l	110	79	73	94	104	200
Sodium Na	mg/l	6,3	6,1	5,9	6,2	6,27	200
Potassium K	mg/l	2,7	2,6	2,5	2,4	2,69	
Chromium Cr	µg/l	0,59	0,67	0,69	0,61	0,51	50
Copper Cu	µg/l	0,52	0,58	0,57	0,42	0,45	2000
Mercury Hg	µg/l	<0,1	<0,1	<0,1	<0,1	<0,1	1
Lead Pb	µg/l	<0,02	0,02	0,02	<0,02	<0,02	10
Selenium Se	µg/l	<0,7	<0,7	<0,7	<0,7	<0,7	10
Zinc Zn	µg/l	0,43	0,55	0,47	0,42	0,45	
Enterococci	CFU/100ml	0	0	0	0	0	0
No of colony forming units at 22^{0}C	CFU/ml	0	0	0,5	0	0	Without unusual changes
Coliform bacteria	CFU/100ml	0	0	0	0	0	0
Escherichia coli	CFU/100ml	0	0	0	0	0	0
Clostridium perfringens	CFU/100ml	0	0	0	0	0	0

Ground water treatment

Ground water used for producing drinking water usually falls under the quality class I-III. Ground water from Ordovician-Cambrian aquifer usually falls under the quality class I and does not need any treatment. However, ground water from Cambrian-Vendian aquifer, which is the main drinking water source, qualifies as class II or III and requires treatment. The main reason is mostly a natural excess content of iron, manganese, or ammonium, resulting in higher turbidity of water than usual.

Table 11: GROUND WATER QUALITY IN PUMPING STATIONS IN 2012-2016

Parameter	Unit	Average results					Decree no 82, EU directive 98/83/EC
		2012	2013	2014	2015	2016	
Odour	points	1	1	1	1	1	Acceptable to consumer
Taste	points	1	1	1	1	1	Acceptable to consumer
Colour	mg Pt/l	<4	<3	<3	<3	<3	Acceptable to consumer
Turbidity	NTU	0,38	0,39	0,37	0,3	0,27	Acceptable to consumer
pH		7,95	7,97	7,93	7,96	7,93	6,5 – 9,5
Conductivity	µS/cm	493	489	482	494	492	2500
Permanganate index (COD_{Mn})*	O_2mg/l	0,69	0,73	0,61	0,77	0,55	5
Total organic carbon (TOC)	mg/l	0,73	0,76	0,71	0,75	0,75	Without unusual changes
Total hardness	mg-ekv/l	3,29	3,23	3,21	3,27	3,33	
Total iron Fe	µg/l	50	44	21,5	30	31,8	200
Fluoride F^-	mg/l	0,59	0,59	0,54	0,58	0,61	1,5
Manganese Mn	µg/l	12	14	8,15	10,4	9,9	50
Ammonium NH_4^+	mg/l	0,125	0,126	0,107	0,125	0,108	0,5
Nitrites NO_2^-	mg/l	0,010	0,014	0,012	0,01	0,011	0,5
Nitrates NO_3^-	mg/l	<1	<1	<1	<1	<1	50
Stability index		0,1	0,11	0,08	0,093	0,06	
Calcium Ca	mg/l	46	45	45	46	45	
Sodium Na	mg/l	43	44	42	48	42,7	200
Potassium K	mg/l	6,8	6,76	6,79	6,95	7,05	
Sulphates SO_4^{2-}	mg/l	19	20	20	15,92	20,9	250
Bicarbonates HCO_3^-	mg/l	158	152	155	154	155,4	250
Chlorides Cl^-	mg/l	83	85	83	86	84	250
Boron B	mg/l	0,16	0,156	0,166	0,166	0,162	1
Aluminium Al	µg/l	1,4	1,52	2,57	3,0	5,5	200
Chromium Cr	µg/l	0,52	0,48	0,5	0,47	0,45	50
Copper Cu	mg/l	0,0036	0,005	0,0022	0,001	0,001	2
Mercury Hg	µg/l	<0,1	<0,1	<0,1	<0,1	<0,1	1
Nickel Ni	µg/l	1,5	3,24	1,29	0,35	0,48	20
Lead Pb	µg/l	0,20	0,3	0,13	0,078	0,055	10
Enterococh	CFU/100ml	0	0	0	0	0	0
No of colony forming units at 22^0C	CFU/ml	3	4	3	2	3	Without unusual changes
Coliform bacteria	CFU/100ml	0	0	0	0	0	0
Escherichia coli	CFU/100ml	0	0	0	0	0	0

* Minister of Social Affairs decree No 82 does not establish a requirement to determine COD in drinking water, provided that total organic carbon has been determined. The listed indicator has been determined in the drinking water sources and the content of that does not change after going through filters.

In order to supply compliant drinking water, we treat ground water by using filtration and aeration to remove excess iron, manganese and ammonium from the water. The Water Act implies the preservation of ground water as similar to its natural conditions as possible, therefore, no chemicals are used. The samples taken after the ground water treatment process indicate a significant decrease in turbidity as well as in the content of iron, manganese and ammonium, an improvement of colour and stability index and an increase in oxygen content.

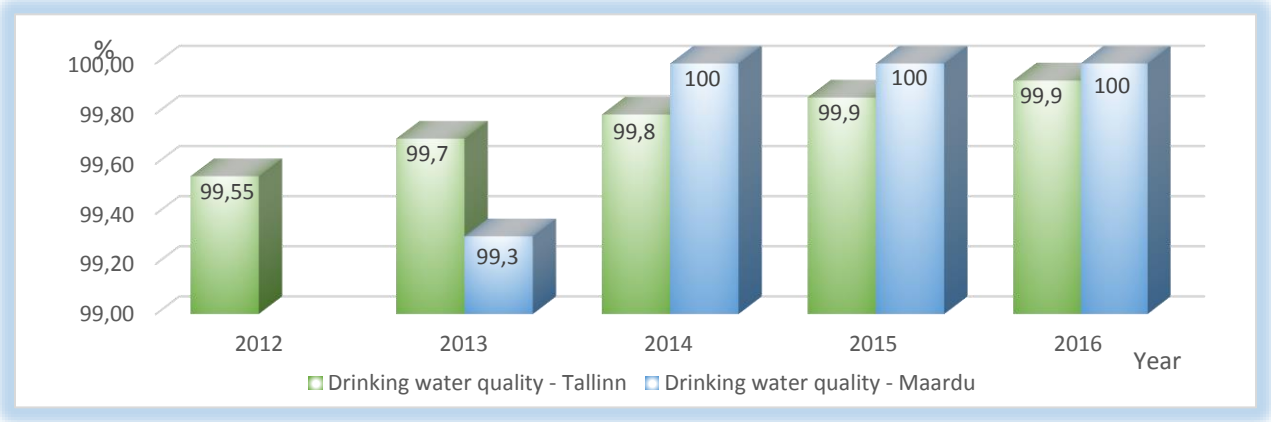
Drinking water quality in the network and at customer premises

Tap water in Tallinn and Maardu is of a very good quality and safe to drink. In terms of quality, the year 2016 did not differ from the previous periods. During the year, we took samples twice a month at the sampling points (at customer premises) agreed with the Health Board.

The best ever result - 99.93% of all water samples complied with the standards - means that in 2016 we detected non-compliances only in 2 samples of the total of 2,948 samples taken from the customer taps. Non-compliances are mainly related to higher iron and turbidity parameters caused by the conditions of the water network. We always react immediately to a non-compliance.

100% of the 144 water samples taken in Maardu in 2016 complied with the requirements. Before connecting with Tallinn water network, the quality compliance of drinking water in Maardu was only 33%.

Chart 1: COMPLIANCE OF THE QUALITY OF DRINKING WATER WITH THE REQUIREMENTS SET OUT BY THE MINISTER OF SOCIAL AFFAIRS DECREE NO 82 IN 2012-2016, %



Water network maintenance and related investments

We are constantly performing maintenance and rehabilitation works on the network to retain and improve the drinking water quality. To guarantee high drinking water quality for our consumers we regularly clean and flush the water network. During the cleaning process the sediment build-up is removed from the network, serving as one of the important methods for improving water quality in distribution networks. In 2016, air-scouring pipe cleaning method was carried out on 136 km of water network.

Table 12: CLEANED WATER NETWORK 2012-2016, km

	2012	2013	2014	2015	2016
Cleaned water network	143	140	145	140	136

Investments in replacing old water pipes have facilitated an improvement in water quality at customer premises and a more efficient use of water resources. Each year, we renovate at least 5 km of sewerage network and 5 km of water network, pursuant to the Services Agreement signed with the City of Tallinn.

Leakages and interruptions to water supply

One of our key objectives is to keep the losses of water in the water network at a minimum level. The Services Agreement covering the service area in Tallinn sets the obligation to the Company to reduce the level of leakages to 26%. We have managed to keep the leakage at a considerably lower level than that for several consequtive years already, achieving 15.07% in 2016. About ten years ago the level of leakages exceeded 32%, which means that we are currently saving over 14,000 m^3 of treated water a day compared to ten years ago. The reduction in the level of leakages has been facilitated by our consistent efforts to use the water resurce sustainably and with lower losses.

Table 13: LEAKAGE LEVEL IN 2012-2016, %

	2012	2013	2014	2015	2016
Leakage level	15,86	16,98	16,14	14,68	15,07

Detecting and eliminating the leakages as fast as possible contributes to the reduction in the level of leakages. Our specialists have special equipment for finding leakages and, along with zoning the network and remote reading devices, it allows us to detect the leakages faster.

In order to mitigate the inconveniences resulting from an interruption to the service, we notified the customers in advance of unplanned interruptions nearly 99% of the events. In case of interruptions to water supply we provide customers with a temporary water supply with the water tanks.

Water metering

The water meters we use are of high quality. All new water meters comply with the currently applicable European standards and European Measuring Instruments Directive along with the relevant accuracy requirements established therein. The expert studies and calibration of water meters is performed by the national Central Office of Metrology, AS Metrosert.

23,715 water meters in total have been installed to customers' connection points. Water meters enable a more accurate accounting for the usage of water resources.

Pursuant to the Metrology Act, we have had an obligation to verify and replace the water meters every two years. However, in the third quarter of 2016, the Metrology Act was amended to stipulate that the verification of water meters shall now be performed every five years.

In 2016, we replaced the total of 11,712 water meters based on a programme developed for that purpose. In 2017, we shall continue our work to make sure that all our customers have duly verified water meters.

11. Wastewater Collection

Wastewater network and collection of wastewater

Wastewater is directed to the wastewater treatment plant by using the combined sewer system, which collects both sewerage and storm water. Some parts of our service area are also covered with a separate storm water system with storm water outlets. However, most of the storm water is collected with a combined sewer system and ends up at the wastewater treatment plant in Paljassaare.

The number of blockages is a good indicator for reflecting the condition of the wastewater network. Blockages are mainly caused by the sediments build-up in the wastewater network or the misuse of the wastewater network by consumers. Initially, the pipelines were dimensioned for larger flow volumes, so today's smaller water consumption results in the reduction of flow volumes and flow speeds, which in turn increases the risk of blockages. Additionally, continuous extension of sewerage network is affecting the total number of blockages.

Table 14: NUMBER OF BLOCKAGES IN 2012-2016, pcs

	2012	2013	2014	2015	2016
Number of blockages	749	789	771	759	706

We have been able to achieve steadily good level of blockages in the recent years due to many preventive actions, such as arranging preventive flushing on the pipelines. For flushing a pipe, first, a flow speed is generated with high pressure carrying sediment into the nearest cesspool. Sediment is then collected with pressure washing trucks and transported to Paljassaare Wastewater Treatment Plant.

In addition, each year the Company rehabilitates at least 5 km of problematic wastewater pipelines, which also contributes to the effective wastewater collection.

Discharging

To serve the inhabitants whose properties have not been connected to the sewerage system, the Company has provided two dicharge places in Tallinn, where sewage suction trucks bring sewage from septic tanks. The availability of discharge places contributes to ensuring that the sewage from septic tanks finally ends up in the wastewater treatment plant and gets treated to a required degree. Consequently, it diminishes the risk of environmental pollution caused by discharging sewage in a manner and place not intended for the specific purpose.

The discharge services that help to make sure that sewage from septic tanks is delivered to Paljassaare Wastewater Treatment Plant through the discharge places are provided by our partners in Tallinn. Although the number of inhabitants, who are not connected to the sewerage system, is below 1%, the volume of sewage transported from the septic tanks in Tallinn and neighbouring municipalities to our discharge places last year amounted to approximately 105,000 m^3. Therefore, we continue to cooperate with various local governments in Harju County to find the best solutions for discharge services outside Tallinn as well.

Pollution load in wastewater and storm water

In order to ensure acceptable pollution load in wastewater reaching the Paljassaare wastewater treatment plant we regularly monitor the wastewater discharged in Tallinn and Maardu and in the surrounding areas and check the compliance of pollution parameters with legal requirements.

Information on the average pollution indicators of major industries is also regularly submitted to the Environmental Board.

In 2016, our Wastewater Inspectorate performed 672 inspections to identify inspection wells, to check local treatment facilities and boundary drawings. 1,416 wastewater samples, incl. 464 monitoring samples were taken for determining the wastewater pollution load at sites. Over-pollution instances were identified and over-pollution fees were applied on 432 occasions.

The average level of precipitation in Tallinn was 774 mm per area unit in 2016, which is about 30% more than in 2015 when this figure was 590 mm. Consequently, the amount of storm water discharged to the environment through storm water outlets also increased in 2016.

Table 15: STORM WATER VOLUME 2012-2016, million m^3

	2012	2013	2014	2015	2016
Storm water volume	7,40	4,17	4,08	4,2	5,8

According to the requirements set by the permits for a special use of water we monitor 24 storm water outlets, the largest among them being the Lasnamäe, Harku and Mustoja outlets. In orde to prevent any potential pollution, some of our storm water outlets (in Olevi, Kaare, Raba and Vabaduse Streets) have been equipped with sand and oil traps, which are regularly maintained.

Table 16: POLLUTANTS FROM THE MAIN OUTLETS IN 2012-2016, t

	2012	2013	2014	2015	2016
Suspended solids	143,4	69,8	109,4	84	87
Oil products	0,5	0,5	0,8	0,2	0,4

12. Wastewater Treatment

We treat the wastewater collected in Tallinn and nearest surrounding areas, using environment-friendly and modern technologies at Paljassaare Wastewater Treatment Plant. We are committed to maintaining the high standards and achieving the results that would outperform the standards that have been set for the treated effluent discharged into the Baltic Sea.

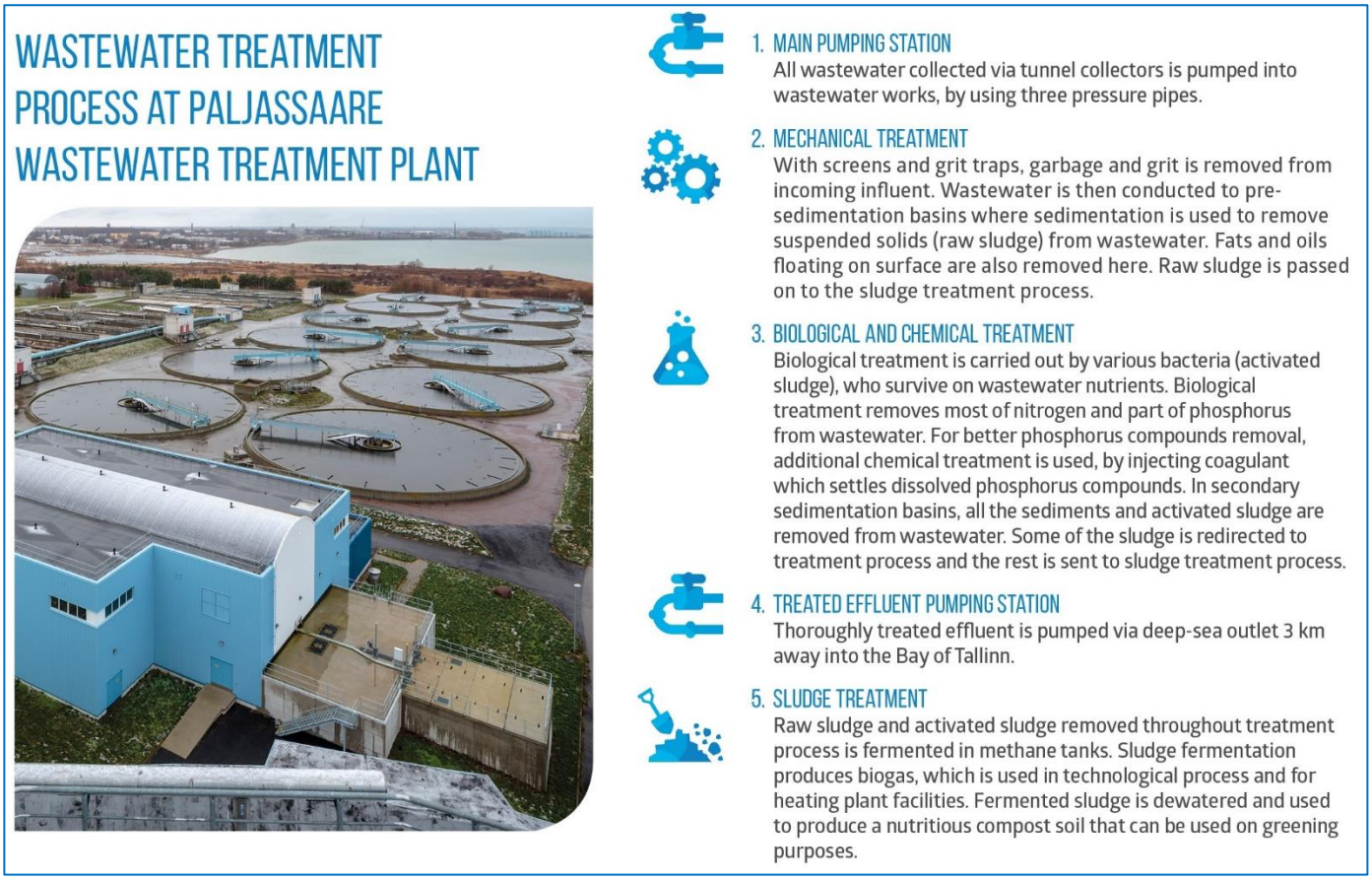


Figure 2: DESCRIPTION OF THE WASTEWATER TREATMENT PROCESS AT PALJASSAARE TREATMENT PLANT

Slightly over 50 million m^3 of wastewater was treated at Paljassaare wastewater treatment plant in 2016.

Table 17: TREATED WASTEWATER VOLUME IN 2012-2016, million m^3

	2012	2013	2014	2015	2016
Treated wastewater volume	56,98	45,02	42,99	45,07	50,22

The reuirements for the quality of effluent discharged into the sea are determined by the legal acts and the water extraction permit no L.VV/322982. The concentration of pollutants in inlet and in the outlet are monitored in order to assess the efficiency of the treatment process and the quality of effluent. In 2016, the wastewater laboratory carried out about 50,000 analyses at different wastewater treatment stages. The results of the analyses provide us with an important input for effective management of the treatment processes. The important pollution parameters for us are the following:

- **BOD_7 -** biological oxygen demand shows the amount of oxygen, it takes to decompose the organic matter in the course of 7 days;

- **COD_{Cr}** - chemical oxygen demand is an indicator for the decomposition of organic matter, measured as the consumption of oxygen in chemical oxidation of the organic matter in water;
- **SS -** suspended solids shows the volume of solid matter in water which is caught in a filter with a defined mesh size;
- **N_{total}** and **P_{total}** - total phosphorus and total nitrogen are nutrient salts, which foster the growth of plankton in water. Nitrogen- and phosphorus compounds serve as nutrients, which in high quantities lead to the eutrophication of water bodies.
- **Oil products** - shows the amount of non-volatile oil products in water.

Chart 2: AMOUNT OF POLLUTANTS COMING TO THE WASTEWATER TREATMENT PLANT AND DISCHARGED INTO THE SEA IN 2012-2016, t/y

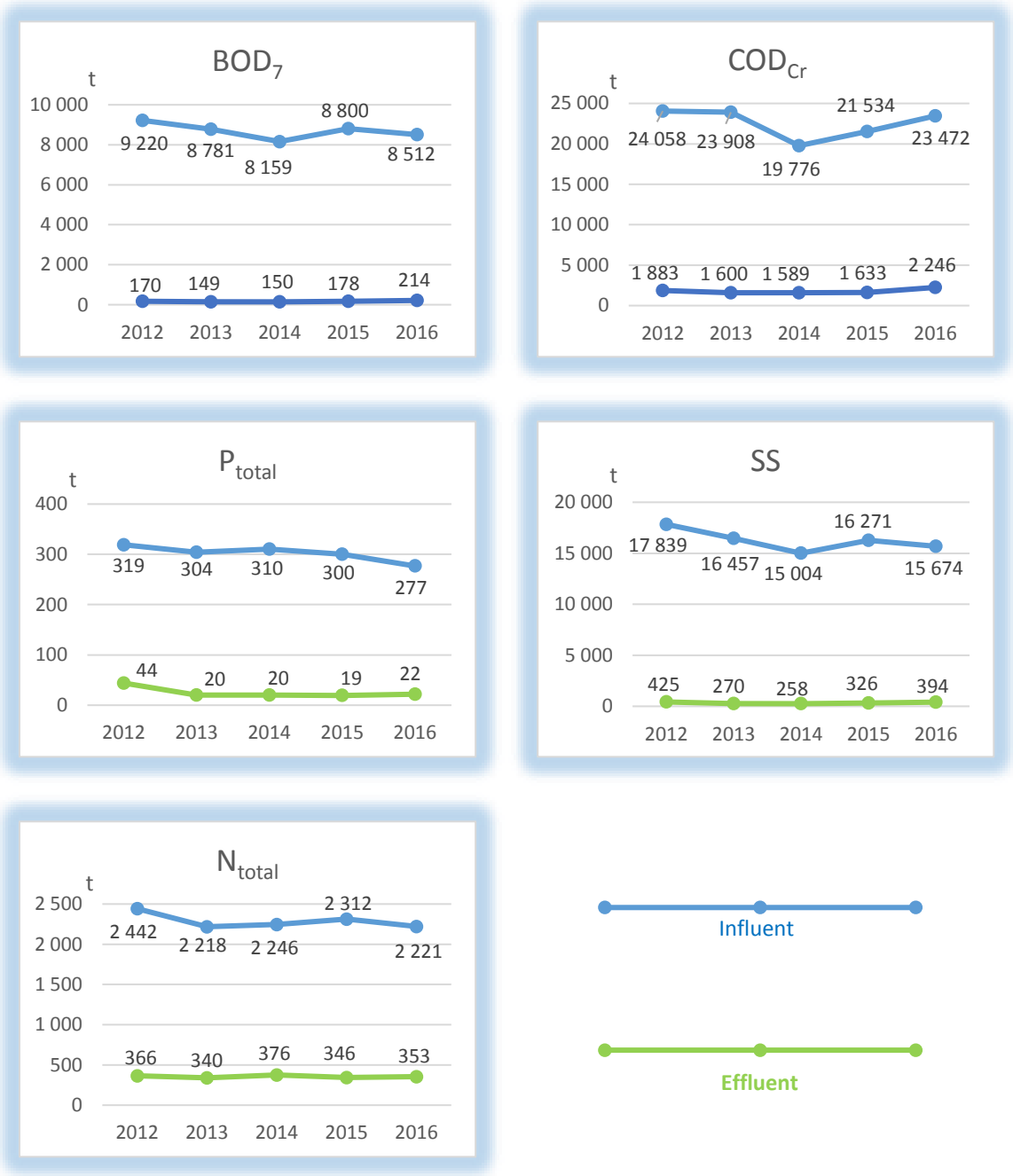
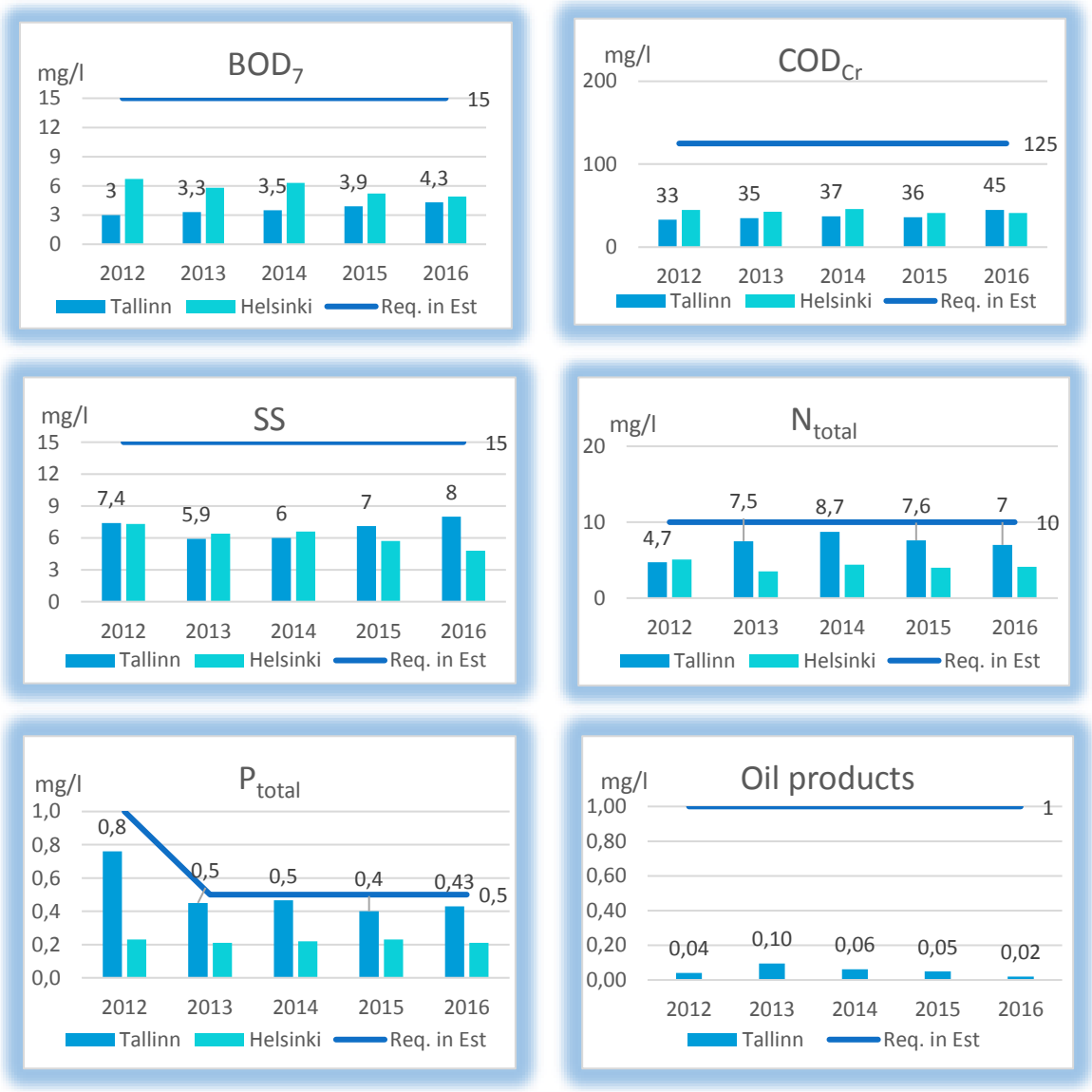
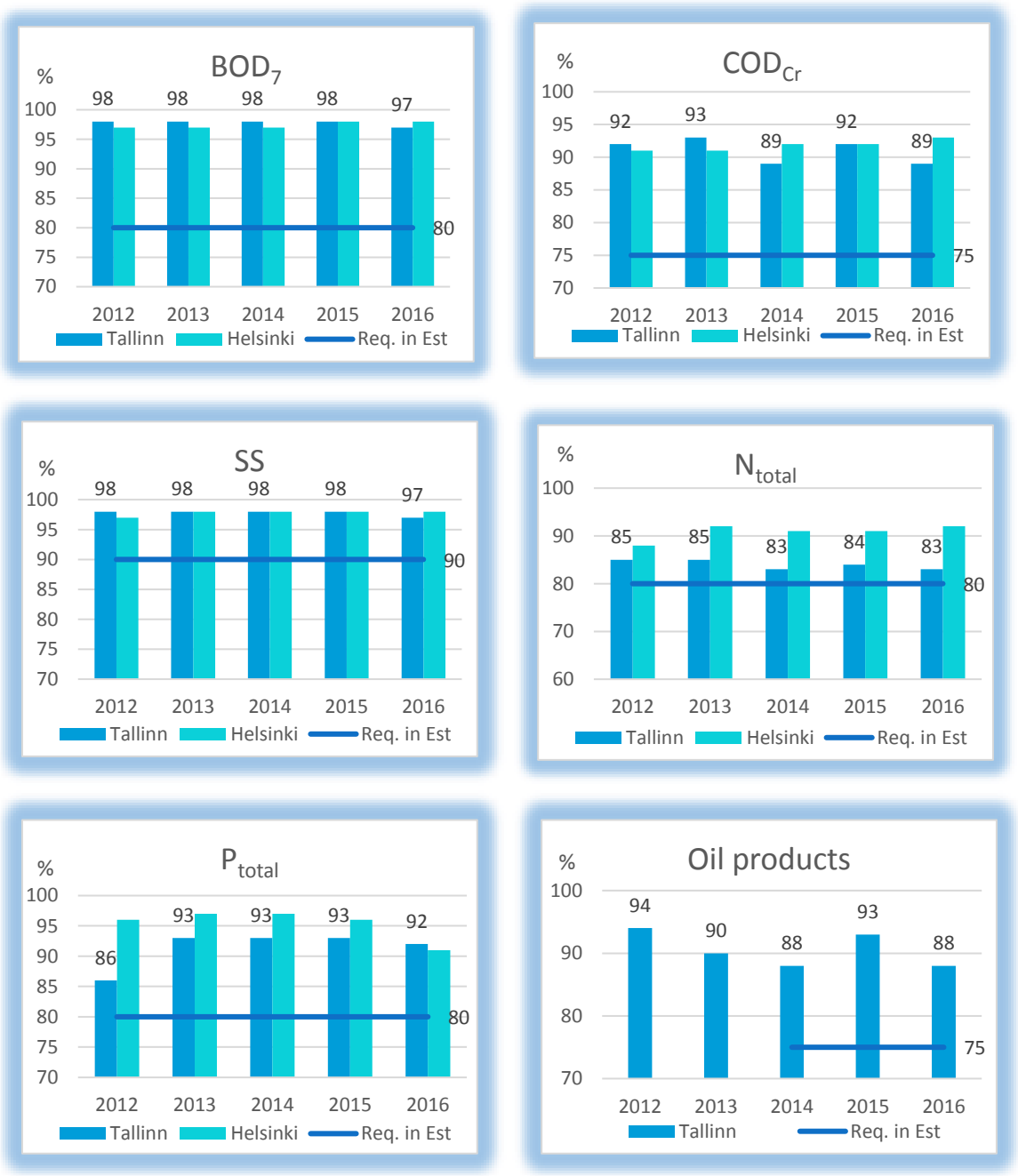


Chart 3: AVERAGE POLLUTION CONCENTRATION IN TREATED EFFLUENT IN 2012-2016, COMPARED TO REGULATORY MAXIMUM ALLOWABLE LIMIT AND RESULTS OF HELSINKI HSY, mg/l



In 2016, all parameters of the effluent discharged from the wastewater treatment plant were fully compliant with the requirements, however, the cumulative average treatment performance was lower than in 2015. The main reasons for this were intense snow-melting and high quantities of precipitation during the period of almost 3 days. The daily volumes of treated effluent were 2-3.5 times higher than in the previous period, also the temperature of incoming wastewater decreased by ca 2°C per day. A fast drop in temperature considereably disrupted the activated sludge process and wastewater treatment performance, thus adversely affecting the annual average results.

Chart 4: WASTEWATER TREATMENT PLANT'S TREATMENT EFFICIENCY IN 2012-2016, COMPARED TO REGULATORY MINIMUM REQUIREMENTS AND RESULTS OF HELSINKI HSY, %



Wastewater outlets to the sea

During 2016, we were bound to open the emergency outlets in the wastewater treatment plant eight times for a short period of time during heavy showers, in order to avoid any major damages. Total of 122,687 m^3 of wastewater diluted by storm water (dilution ¼) was conducted to the sea.

Table 18: WASTEWATER TREATMENT PLANT OVERFLOWS IN 2012-2016, th. m^3/year

	2012	2013	2014	2015	2016
Untreated wastewater discharged to the sea	137	380	1,3	45,0	122,7
Partly treated wastewater discharged to the sea	186	200	225	317	584

Due to the shock loads which exceeded the biological treatment capacity, 584,074 m^3 of highly diluted wastewater that had undergone mechanical treatment was discharged into the sea through the deep-sea outlet in 2016.

Pollution charges

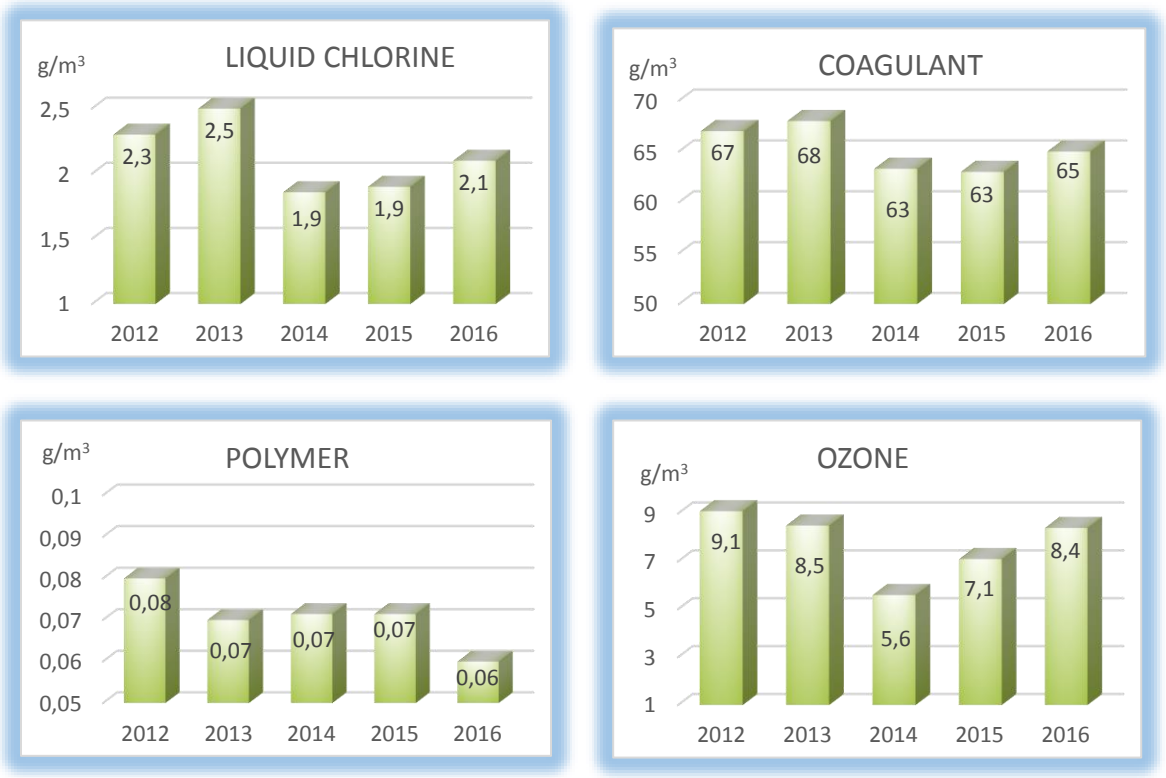
As a water company we are required to act in line with the environmental permits and pay pollution charge with the aim to prevent and reduce the potential damage caused by pollutants or waste discharged to the environment.

The calculation of pollution charge is established in the permit for a special use of water and the Environmental Charges Act, and is applied to the pollutants contained in the effluent and storm water at the particular outlets. Both the receiving water coefficient of the specific outlet, as well as compliance with the pollutant limit value in effluent are taken into account in pollution charge calculations. In 2016, the pollution charge paid for discharging pollutants into receiving waters formed 4.2% of the cost of services sold (2015: 4.2%).

13. Use of Chemicals

We use approximately 380 hazardous and less hazardous chemicals in our operating activities. With regard to the health and wellbeing of our employees we deem a safe handling of chemicals at the work site extremely important. For this purpose, we have created necessary conditions for a safe storage and use of all chemicals. At the end of 2016, we carried out a chemical safety audit, which covered the entire company and addressed the compliance with safety requirements. In 2016, we used about 5,540 tons of vairous chemicals, but no reported accidents with chemicals occurred, which could have caused damage to people or the environment.

Chart 5: AVERAGE USE OF WATER TREATMENT CHEMICALS PER UNIT OF PRODUCTION IN 2012-2016, g/m^3



Use of water treatment chemicals

- **Chlorine** is an effective disinfecting chemical with a long-term aftereffect. The Regulation No 82 issued by the Minister of Social Affairs “Drinking Water Quality and Testing Requirements, and Analysis Methods" (dated 31.07.2001) specifies the content of chlorine added to the drinking water produced out of surface water to be in the range 0.2 – 0.5 mg/l. We add chlorine in the final stage of the water treatment process to ensure the microbiological purity of water and to help to maintain the water quality in the city’s water distribution network. Chlorine has a strong oxidising effect and is extremely poisonous for aquatic microorganisms. In Estonia, we have been classified as a category B company with risk of a major accident due to the chlorine stored at the plant and used in the water treatment process. By applying the necessary safety measures we have minimized the likelihood of chlorine accidents.
- **Ozone** is a good and quick oxidiser, which effectively breaks down organic matter and microorganisms in raw water and improves the coulour of the water. Ozone is produced locally in the plants from the ambient air and only in necessary quanities. Thanks to the closed process and the absence of stock reserve the environmental risk is taken to minimum.

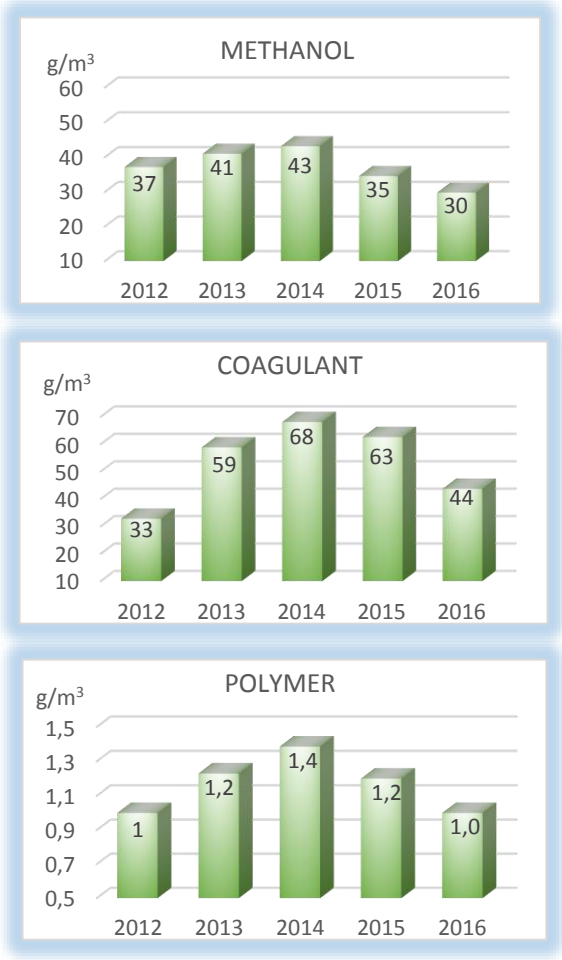
- **Coagulants and polymers** are chemicals that are used in significant amounts in liquid form. These chemicals are added in the treatment to remove the particular matter (e.g. suspended solids and organic substance) from water.

Water quality in Lake Ülemiste is strongly dependent on the weather. However, long-term observation patterns show periodic changes of water quality also over the years. In 2016 the raw water parameters were poorer compared to 2015, which also affected and increased the consumption of chemicals in the water treatment plant.

Use of wastewater treatment chemicals

- **Methanol** – We use methanol at the wastewater treatment plant to increase the nitrogen removal efficiency of the bacteria participating in the biological treatment process. Due to the extremely explosive methanol used in the wastewater treatment, we have been classified as one of the most hazardous companies in Estonia.
- **Coagulants and polymers** are used in large amounts in the wastewater treatment process. Coagulants are used for the chemical processing of wastewater to remove phosphorus. Polymers are used to change the qualities of sludge by accelerating the dewatering process.

Chart 6: AVERAGE USE OF WASTEWATER TREATMENT CHEMICALS PER UNIT OF PRODUCTION IN 2015-2016, g/m³



The amount of chemicals used in the wastewater treatment process is dependent on the pollution levels of incoming wastewater, which in turn is affected by the weather. The higher the concentration of pollutants in incoming wastewater and the lower the regulatory limits for pollutants in the treated effluent, the higher is the volume of chemicals used in the wastewater treatment process.

The use of chemicals in 2016 was slightly smaller than in 2015. The reconstruction of the coagulant dosing plant contributed to the savings made on both coagulant and methanol. Moving the coagulant dosing point to the end of the biological treatment stage provided better conditions for the activated sludge process i.e. biological removal of nutrients, and the required effluent quality can be achieved with lower doses of chemicals.

The use of polymer depends on the quantities of dry solids and sludge to be treated. The amount of sludge conducted to dewatering was slightly lower in 2016 than in 2015, but its content of dry matter was lower and less polymer was used.

14. Waste Management

Waste generation

A total of 45,401 tons of waste was generated in the Company in 2016. The majority of waste is made up by the sludge, which is a by-product of the wastewater treatment process. Quite a substantial part of waste is also generated as a result of the construction and excavation works.

Table 19: TYPES AND AMOUNTS OF MAIN WASTE IN 2012-2016, t

Type of waste	2012	2013	2014	2015	2016
Mixed municipal waste	96	97	93	67	90
Paper and cardboard *	4	4	5	5	5
PackagesPaper and cardboard *	0,7	0,7	0,5	0,6	1
Biodegradable waste*	4,4	5,0	7,2	7	7
Waste from screens	920	984	1085	615	651
Wastewater sludge*	20 437	27 220	32 109	31 974	31741
Sandtraps grid	141	422	142	0	161
Excavated stones and soil*	39 183	13 341	10 882	11 235	11354
Asphalt waste	2 305	869	1 190	1 548	1181
Mixed building waste	103	47	84	40	81
Concrete and bricks	243	53	72	274	77
Metal scrap*	47,0	14,0	44,8	68	34
Hazardous waste	3,0	0,0	3	2,4	4
Other waste	32	79	2	9	15
TOTAL	***63 518***	***43 135***	***45 711***	***45 844***	***45 401***

* - possible to reuse

Although the sludge generated in the wastewater treatment process forms large part of our waste, we recycle all the sludge through our sludge treatment process. Sludge treatment process includes producing of planting soil from raw sludge and biogas from raw sludge fermentation, which then is used in the technological process and to heat the buildings. We analyse the planting soil four times a year according to the requirements set in the Decree No 78, issued by the Minister of Environment on 30.12.2002. All the results of the sludge analyses are public and the last results are also available on the Company's webpage.

In addition to sludge, the wastewater treatment process produces significant amount of other types of waste, such as waste from screens, which is disposed to our waste handling partner. The volume of waste generated within the wastewater treatment process is directly affected by the volume of incoming wastewater, the weather and the efficiency of the City cleaning services. However, people also have an important role to play here as they can avoid throwing waste and hazardous substances into the wastewater system.

Excavated soil, stones and asphalt waste account for the majority of waste resulting from the networks maintenance and repair works. The volume of waste from construction and excavation works is again dependent on the volume of works. However, since 2013, we have been performing most of the network reconstruction works using the so-called no-dig closed method, which allows carrying the works out faster and reduces the inconveniences caused by traffic jams during the road works.

We collect and sort the other types of waste, which have a smaller share in the total waste volume, and hand them over to the waste handling company. We separate paper and cardboard, biodegradable waste, hazardous waste, metal and mixed municipal waste.

Waste permits and sludge

The Company has two waste permits, issued to allow recycling the sludge produced in the wastewater treatment process. The permits establish technical and environmental requirements for the waste handling process.

Table 20: VALID WASTE PERMITS ISSUED TO AS TALLINNA VESI

Permits	Valid until	Description of waste permit
Waste permit No. L.JÄ/325362	*	Issued for recycling waste at Paljassaare, procedure code R3o - recycling
Waste permit No. L.JÄ/325737	18.06.2020	Issued for recycling waste in Liikva, procedure code R12o – biological treatment preceding the recycling of waste

* Valid until a court decision to be made in the administrative case no 3-14-52374 takes effect or the currently applied interim injunction is amended or terminated.

In 2016, a total of 31,741 tons of mixed sludge was produced within the wastewater treatment process and by the end of the year, the estimated volume of mixed sludge in stock on the composting fields was 32,074 tons of mixed sludge. In 2016, 39,073 tons of soil for greenery was given to people for free. Although a waste permit was issued also for Liikva composting field, since 2014, no sludge has been recycled in Liikva because the new permit does not allow recycling.

Table 21: VOLUME OF PRODUCED SLUDGE AND STABILISED SLUDGE AND COMPLIANCE THEREOF WITH THE WASTE PERMITS IN 2012-2016, t/y

Type of waste	Permitted	Actual				
		2012	2013	2014*	2015	2016
Waste permit L.JÄ/325362 (Paljassaare)						
Domestic wastewater treatment sludge	32000*	26 928	29 856	32 109	31 974	31 741
Stabilised waste		24 764	24 548	25 744	31 904	32 561
Waste permit L.JÄ/325737 (Liikva)**						
Domestic wastewater treatment sludge	7000	4 210	5 524	0	0	0

* According to the waste permit, effective until the middle of 2014, the limit set to the volume of produced sludge was 45,000 t/y. Since October 2014, the allowed volume is 32,000 t/y.

** Liikva composting field is out of use since 2014.

15. Energy Consumption

Electricity consumption

The majority of electricity is used to run the Company's core processes – to operate the water treatment plant, wastewater treatment plant and pumping stations on the network.

Although we have been making significant investments aimed at decreasing electricity consumption, the energy consumption is still inevitably and closely connected to the operation of our core processes. Those are in turn affected by changes in consumption and in service areas, also by the weather conditions.

Table 22: ELECTRICITY CONSUMPTION IN 2012-2016, MWh

Unit	2012	2013	2014	2015	2016
Water Treatment	10 325	9 705	8 709	9 746	10 721
Wastewater Treatment	25 195	22 336	21 295	21 617	22 516
Networks pumping stations, incl. Maardu	7 662	6 838	6 409	6 346	6 841
Other	993	830	776	757	710
TOTAL	***44 175***	***39 709***	***37 188***	***38 465***	***40 787***

Although the total consumption of electricity in 2016 was slightly higher than in 2015, it has been quite stable over the few last years. Increase in the use of electricity last year was mainly induced by higher wastewater volumes and lower raw water quality in Lake Ülemiste.

Chart 7: ELECTRICITY CONSUMPTION PER UNIT PRODUCTED AT THE WATER TREATMENT PLANT IN 2012-2016, kWh/m^3

Electricity consumption in the water treatment plant has been increasing year-on-year along with the growing use of surface water. A significant proportion of the electricity consumption in the water treatment plant is used to produce ozone. Both the higher doses of ozone and increased electricity consumption in the second half of 2016 were brought along by lower quality of raw water in Lake Ülemiste.

Chart 8: ELECTRICITY CONSUMPTION PER UNIT PRODUCTED AT THE WASTEWATER TREATMENT PLANT IN 2012-2016, kWh/m^3

Consumption of electricity in the wastewater treatment process depends largely on the weather, as it is mainly used to pump wastewater and to produce air i.e. to aerate the activated sludge in the biological treatment stage. During the years 2012-2015 the aeration tanks were reconstructed in stages, which resulted in the replacement of the membranes of aerators in all aeration tanks and installation of new dissolved oxygen sensors in the aeration tanks. This allows saving electricity in producing the air.

Consumption of heat energy

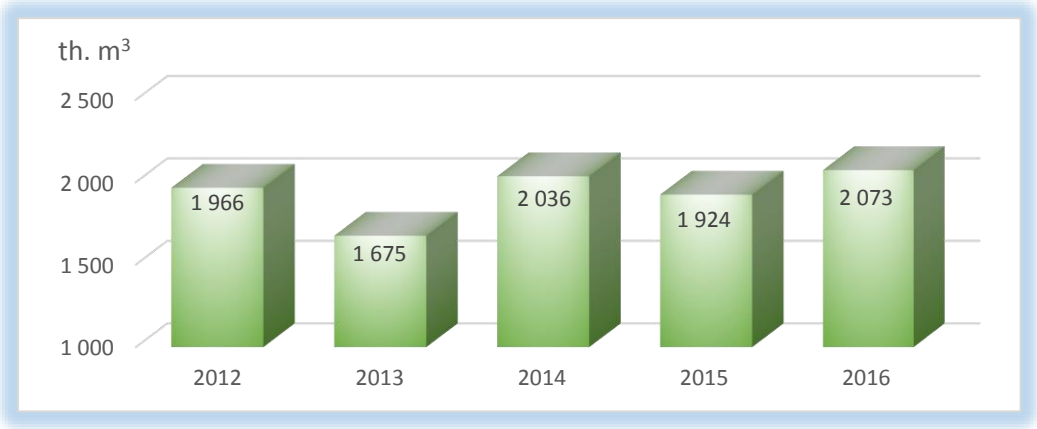
In addition to heating the premises we need heat energy to run the core processes. The water treatment plant produces heat out of outsourced natural gas in its boiler house. Ädala site uses central heating also produced out of natural gas in our area. The majority of the wastewater treatment plant's needs for heat energy is covered by biogas.

Table 23: CONSUMPTION OF HEAT ENERGY IN 2012-2016, MWh

Unit	2011	2012	2013	2014	2015	2016
Water Treatment	4 358	4 800	4 111	3 978	3 540	3 224
Wastewater Treatment	6 634	10 467	7 310	8 989	9 446	9 281
incl. heat energy from biogas	5 134	10 467	7 310	8 977	9 446	9 272
Ädala office	1 176	1 213	1 049	1 164	920	1 100
TOTAL	***12 168***	***16 480***	***12 470***	***14 131***	***13 906***	***13 605***

We produce biogas at the wastewater treatment plant within the process of digesting sludge in the digesters. Biogas is used to produce heat energy on site, which is then used for heating the premises at the wastewater treatment plant and for operating the core processes. Due to the nature of biogas production from time to time we are bound to burn some of the biogas and to use some natural gas as well. In 2016, we used 71% of the total volume of biogas to produce heat energy (78% in 2015) and it accounts for 68% of the total heat energy consumed in 2016 (2015: 68%).

Chart 9: BIOGAS PRODUCTION IN 2012-2016, th m^3



Transportation and fuel consumption

Road transport accounts for the biggest part of our need for transportation. The Company has 95 vehicles for carrying out different operating tasks and for driving between the company locations and numerous service sites. The biggest group of vehicles is cars and operating vehicles, including minivans and team vans. We have a total of 84 cars and operating vehicles and a total of 11 special purpose vehicles (such as tractors, loaders, excavators, jet washing trucks etc.).

Table 24: NUMBER OF VEHICLES AND FUEL CONSUMPTION IN 2012-2016

	2012	2013	2014	2015	2016
Total number of vehicles, pcs.	95	95	93	94	95
Petrol, l	71 939	71 095	70 075	65 962	63 289
Diesel, l	132 284	135 738	122 456	115 485	113 622
Total fuel, l	**204 223**	**206 833**	**192 531**	**181 447**	**176 911**

In 2016, the total consumption of fuel has again slightly reduced in comparison with the previous year. We continuously try to keep the fuel consumption under control through the fuel limits set on the car users and through GPS-tracking devices. Some of the cars are being shared between employees, which means that all authorised employees are able to use the cars to deliver their work duties. This enables the Company to cut down the costs and save natural resources.

The number of business trips made by our staff in and outside Estonia is relatively low. In planning the travel routes we follow the principle of always choosing the most advantageous option. The most frequent destinations of business trips outside Estonia are the United Kingdom and Finland, to where our staff usually travels by plane and by boat respectively. Other means of transport (e.g. bus and train) are used very little.

16. Air Emission

AS Tallinna Vesi has been issued two ambient air pollution permist. In order to reduce any potential air pollution, the Company focuses on limiting the amount of pollutants emitted from Ülemiste and Paljassaare boiler houses, particularly the pollutants of primary importance, such as nitrogen dioxide, carbon monoxide and volatile organic compounds, as well as CO_2 greenhouse gas emissions. Also the emissions of ozone produced for drinking water treatment are regulated. The Company pays a pollution charge for pollutants emitted into ambient air.

Table 25: VALID AIR POLLUTION PERMITS OF AS TALLINNA VESI

Permit	Valid until	Description of ambient air pollution permit
Pollution permit No. L.ÕV.HA 48701	termless	Valid for Paljassaare wastewater treatment plant pollution sources - the chimney of the boiler house, exhaust pipes, the chimney of the combined heat plant. Establishes the list of pollutants emitted into ambient air and the annual permitted emission amounts thereof.
Pollution permit No. L.ÕV/319438	termless	Valid for Ülemiste water treatment plant pollution sources - the chimney of the boiler house, ozonisation, diesel generator. Establishes the list of pollutants emitted into ambient air and the annual permitted emission amounts therof.

Emissions from both Ülemiste water treatment plant and Paljassaare wastewater treatment plant have been relatively low and remained stable throughout the years. Also in 2016, there were no significant changes in this regard.

Table 26: AMBIENT AIR POLLUTION FROM WATER TREATMENT PLANT SOURCES IN 2012-2016, t

Pollutant	Limit	2012	2013	2014	2015	2016
Nitrogen dioxide	1,954	1,24	1,11	1,1	1,01	0,829
Carbon monoxide	1,846	1,13	0,98	0,97	0,88	0,761
Volatile organic compounds	0,125	0,08	0,07	0,07	0,06	0,052
Carbon dioxide	1688	1021	880	868	787	692
Sulphur dioxide	0	0,001*	0,001*	0,001*	0,001*	0,001*
Total solid particles	0,004	0,004	0,004	0,004	0,004	0,003

* Sulphur dioxide pollution below the limit

Table 27: AMBIENT AIR POLLUTION FROM WASTEWATER TREATMENT PLANT SOURCES IN 2012-2016, t

Pollutant	Limit	2012	2013	2014	2015	2016
Nitrogen dioxide	29,8	2,9	2,3	2,7	2,6	2,8
Carbon monoxide	210	2,6	2,3	2,7	2,6	2,8
Volatile organic compounds	14	0,2	0,2	0,2	0,2	0,2
Carbon dioxide	4440	2392	2039	2477	2341	2523
Sulphur dioxide	17,8	17,8	17	16,8	17,2	17,5

17. Environmental Performance

In addition to the data on ecological footprint and as set out by the requirements of EMAS, we outline below our main indicators of the environmental performance regarding energy efficiency, material efficiency, water, waste, biological diversity and emissions. Three elements have been presented for each main indicator:

- Figure A, which stands for the total annual input/impact in the respective area.
- Figure B, which stands for the total gross sale revenue of the organization in millions of euros.
- Figure R, which stands for the ratio A/B.

Table 28: ENVIRONMENTAL PERFORMANCE IN 2015-2016

Main indicators of environmental performance	Year	Consumption (rounded) i.e. annual input (figure A)	Annual output of the Company (figure B)	Ratio R (A/B)
Electrycity				
Electric power produced from oil shale, MWh	2016	40 787	59,0	692
	2015	38 465	55,9	688
Heat				
Heat produced from natural gas, MWh	2016	4 150	59,0	70
	2015	3 623	55,9	65
Thermal energy produced from biogas, MWh	2016	9 281	59,0	157
	2015	9 446	55,9	169
Handling of chemicals				
Liquid chlorine, t	2016	51	59,0	0,9
	2015	43	55,9	0,8
Coagulant, t	2016	3 738	59,0	63,4
	2015	4 266	55,9	76
Polymer, t	2016	53	59,0	0,9
	2015	55	55,9	1,0
Ozone, t	2016	200	59,0	3,4
	2015	161	55,9	2,9
Methanol, t	2016	1 497	59,0	25
	2015	1 557	55,9	28
Water				
Water for own consumption, th. m^3	2016	1 878 410	59,0	31847
	2015	1 259 936	55,9	22528
Surface water, th. m^3	2016	23 734	59,0	402
	2015	22 756	55,9	407
Ground water, th. m^3	2016	2 763	59,0	47
	2015	2 470	55,9	44
Effluent, th. m^3	2016	50 216	59,0	851
	2015	45 075	55,9	806
Waste				
Mixed municipal waste, t	2016	90	59,0	1,5
	2 015	67	55,9	1,2
Recycled paper and cardboard, t	2016	5	59,0	0,1
	2 015	5	55,9	0,1
Recycled packages, t	2016	0,7	59,0	0,01
	2 015	0,6	55,9	0,01

Recycled biodegradable waste, t	2016	7	59,0	0,1
	2 015	7	55,9	0,1
Waste from screens, t	2016	651	59,0	11
	2 015	615	55,9	11
Recycled sludge, t	2016	31 741	59,0	538
	2 015	31 974	55,9	572
Sandtraps grid, t	2016	161	59,0	2,7
	2 015	0	55,9	0,0
Recycled excavated stones and soil, t	2016	11 354	59,0	192
	2 015	11 235	55,9	201
Asphalt waste, t	2016	1 181	59,0	20
	2 015	1 548	55,9	28
Mixed building waste, t	2016	81	59,0	1,4
	2 015	40	55,9	0,7
Concrete and bricks, t	2016	77	59,0	1,3
	2 015	274	55,9	4,9
Recycled metal, t	2016	34	59,0	0,6
	2 015	68	55,9	1,2
Hazardous waste, t	2016	4	59,0	0,1
	2 015	2	55,9	0,0
Other, t	2016	15	59,0	0,3
	2 015	9	55,9	0,2
Biological diversity				
Land use, land carryng buildings*, m^2	2016	678 135	59,0	11497
	2 015	462 000	55,9	8261
Emissions				
Nitrogen dioxide, t	2016	3,6	59,0	0,1
	2 015	3,6	55,9	0,1
Carbon monoxide, t	2016	3,6	59,0	0,1
	2 015	3,5	55,9	0,1
Volatile organic compounds, t	2016	0,3	59,0	0,005
	2 015	0,3	55,9	0,005
Carbon dioxide, t	2016	3 215	59,0	55
	2 015	3 128	55,9	56
Sulphur dioxide, t	2016	0,001	59,0	0,00002
	2 015	0,001	55,9	0,00002
Total solid particles, t	2016	0,003	59,0	0,0001
	2 015	0,004	55,9	0,0001
Hydrogen sulphide, t	2016	18	59,0	0,3
	2 015	17	55,9	0,3

*From 2016 land use is described as the total area under the buildings on Company's properties (Estonian Land Board data)

18. Important changes in the Environmental Report

This chapter outlines the major substantive changes made to the 2016 Environmental Report in comparison with the 2015 Environmental Report.

- The 2016 Environmental Report excludes the chapter about our employees, customers and community, because the EMAS regulation does not require the submission of the said information and a comprehensive overview on those topics can be found in the Company's integrated social responsibility and financial report 2016.

19. EMAS Verification

Having examined the environmental management system and the information provided in the 2016 environmental report of AS Tallinna Vesi, AS Metrosert as an accredited verifier EE-V-0001 certified that the information and data presented in the organisation's environmental report was reliable and adequate and complied with the requirements of the Regulation No 1221/2009 (on the voluntary participation of organisations in a Community eco-management and audit scheme (EMAS)) of the European Parliament and of the Council dated 25th November 2009.

The environmental report was verified on 29th May 2017.

Andres Martma
EMAS verifier
Metrosert AS
www.metrosert.ee

EMAS
Verified environmental management
REG.NO. EE-000001
REG.NO. EE-000001