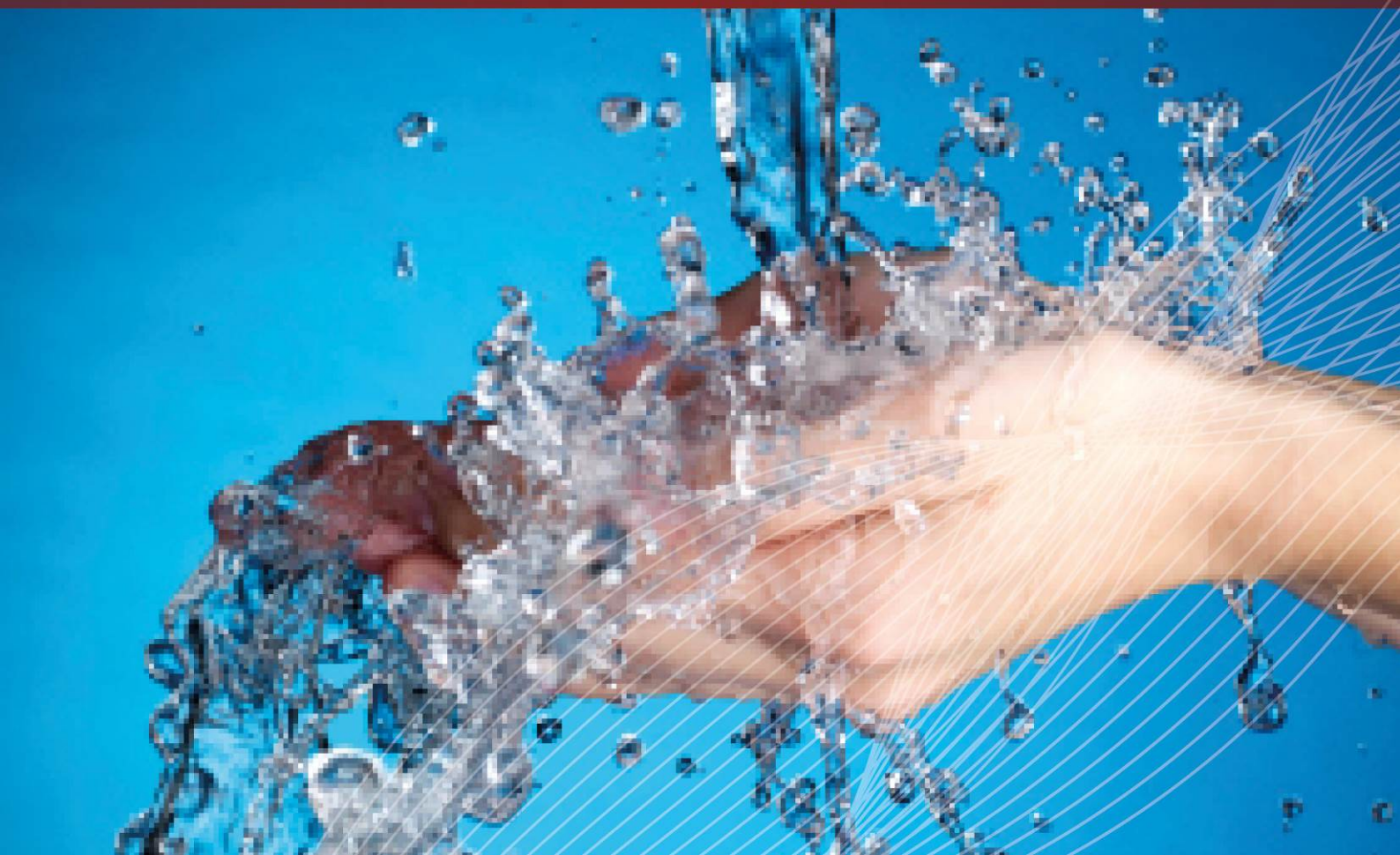
Australian Water Recycling
Centre of Excellence

Project Report

Global Potable Reuse Case Study 5: Torreele/St. Andre, Koksijde Belgium

A report of a study funded by the
Australian Water Recycling Centre of Excellence

University of New South Wales, November, 2014



Global Potable Reuse Case Study 5: Torreele/St. Andre, Koksijde Belgium

This report has been prepared as part of the National Demonstration Education and Engagement Program (NDEEP). This Program has developed a suite of high quality, evidence-based information, tools and engagement strategies that can be used by the water industry when considering water recycling for drinking purposes. The products are fully integrated and can be used at different phases of project development commencing at "just thinking about water recycling for drinking water purposes as an option" to "nearly implemented". The information contained in this Case Study was first published on the Public Health pages of a University of New South Wales Wiki website in 2012.

Stream 1.1 Leader

Dr James Wood
School of Public Health & Community Medicine
Faculty of Medicine
University of New South Wales
Sydney, NSW, 2052, AUSTRALIA

Telephone: +61 403704794
Contact: Dr James Wood james.wood@unsw.edu.au

Partners

Public Utilities Board, Singapore
Seqwater
OCWD
Water Corporation P/L

About the Australian Water Recycling Centre of Excellence

The mission of the Australian Water Recycling Centre of Excellence is to enhance management and use of water recycling through industry partnerships, build capacity and capability within the recycled water industry, and promote water recycling as a socially, environmentally and economically sustainable option for future water security.

The Australian Government has provided $20 million to the Centre through its National Urban Water and Desalination Plan to support applied research and development projects which meet water recycling challenges for Australia's irrigation, urban development, food processing, heavy industry and water utility sectors. This funding has levered an additional $40 million investment from more than 80 private and public organisations, in Australia and overseas.

ISBN: 978-1-922202-41-3

Citation:

Onyango, L., Leslie, G. and Wood, J.G. (2014). *Global Potable Reuse Case Study 5: Torreele/St. Andre, Koksijde Belgium*, Australian Water Recycling Centre of Excellence, Brisbane, Australia.

Date of publication: November, 2014

Publisher:
Australian Water Recycling Centre of Excellence
Level 5, 200 Creek St, Brisbane, Queensland 4000

www.australianwaterrecycling.com.au

This report was funded by the Australian Water Recycling Centre of Excellence through the Australian Government's National Urban Water and Desalination Plan.

TABLE OF CONTENTS

1. Scheme Overview

Background

The **Torreele/St-André water reclamation plant** (TSAWRP) is an example of indirect potable reuse (IPR) via aquifer (dune) recharge. The scheme has been in operation since **2002**. Located in the touristic coastal region of Veurne, it was built to:

- Prevent **saline intrusion** into the coastal aquifer
- Meet **increased demand** during peak tourist season
- Compensate for **lack of suitable alternatives.** [1]

Following 10 years of research into wastewater reuse, construction of a reuse plant began in 2001. The project cost the **Intermunicipal Water Company of the Veurne Region** (IWVA) **€6 million** to build and produces **1.32 mgd** of purified water that is used to recharge the aquifer in dune water catchments (**up to 70%**). The water resides in this environmental reservoir for **~35-55 days** before it is extracted, retreated, and distributed to a population of **60,000 - 200,000 residents** (depending on seasonal demand). The plant is currently undergoing expansion to handle changes in effluent quality due to stormwater capture. The plant has been awarded 1 regional award.

Pilot testing

- 1996: first tests using different MF/UF membranes treating drainage water from polder area
- 1997-1999: pilot tests using UF and RO treating wastewater effluent from the Wulpen wastewater treatment plant (WWTP) [2]

Figure 1: Location of Torreele/St-André water reclamation plant, Veurne, Belgium.

Further information on the Torreele/St-André water reclamation plant can be found on the Global Connections Map on the *Water360* website.

2. Scheme Infrastructure

Operational Monitoring

Prior to the commissioning of the scheme, an environmental permit was issued for the **reuse plant (Torreele)** and the **infiltration scheme (St-André)** which stipulated specific control of parameters and their assessment frequency. **Four critical control points (CCPs)** are identified within the water system: **MF, RO, UV** and the **distribution system**.

The TSAWRP uses an online Supervisory Control and Data Acquisition (SCADA) system that provides real time data about the operational processes of the plant. The plant employs one full-time operator who manages the daily aspects of the plant (temporary replacement available in case of emergencies). External maintenance staff are contracted when needed.

The maintenance schedule includes monthly maintenance cleaning of all UF trains; twice a year a **'disinfection' cleaning** is performed and twice a year citric acid is used to remove metals (iron) and hardness from the membranes. For the RO, clean-in-place measures are performed according to loss of normalized pressure or salt removal - on average between 4 to 6 times a year.

Treatment & Multiple Barriers

The scheme utilises treated domestic wastewater from the Wulpen wastewater treatment plant as its source water. All wastewater effluent has to meet the regional standards and there is minimal industrial trade waste in the region to affect their source water. A combination of barriers is utilised along the water system (Figure 2).

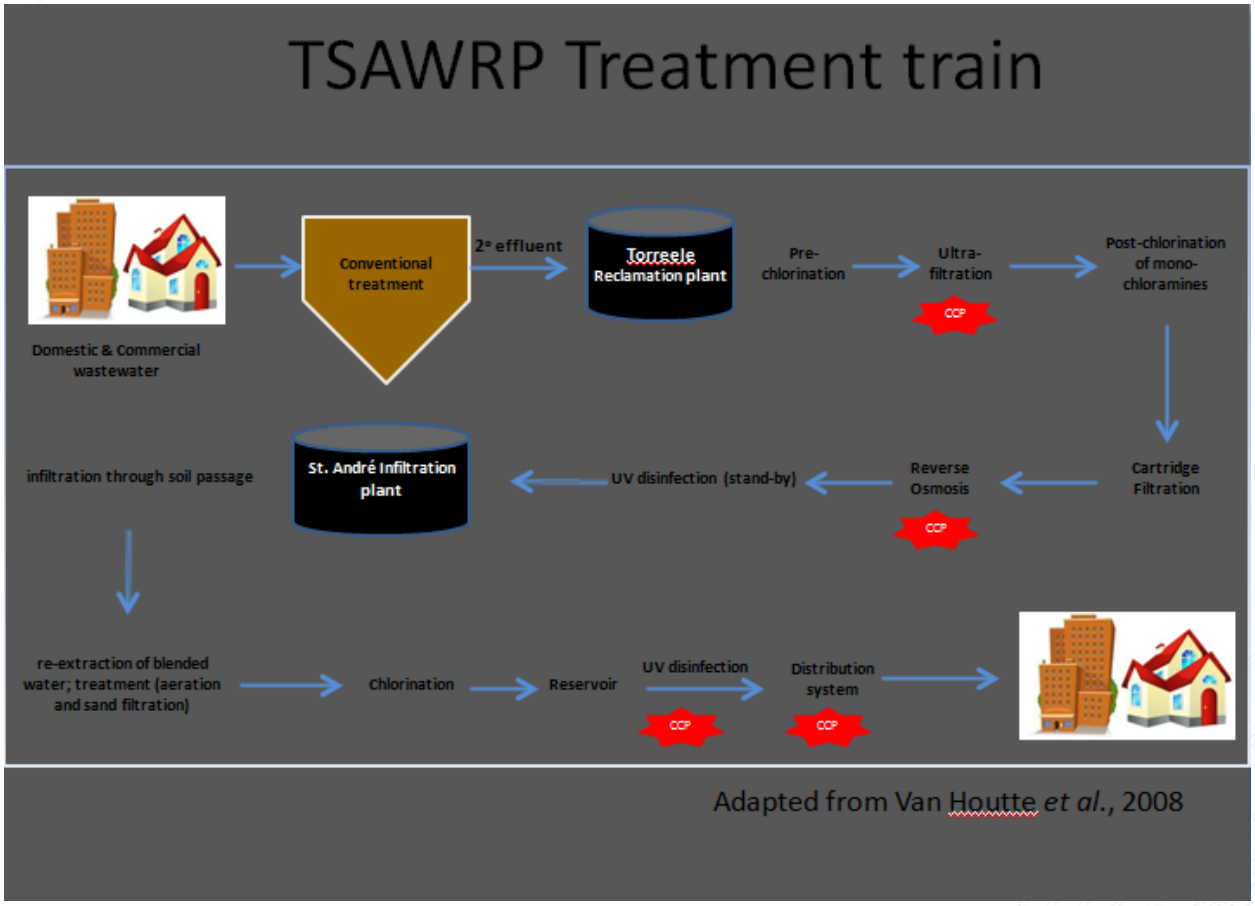


Figure 2: Torreele/St-André water reclamation plant treatment train.

At **Torreele** reuse plant, prechlorination, UF, post-chlorination of monochloramines, RO and UV (stand-by) form the barrier system. At the **St-André** infiltration scheme site, infiltration through soil passage, sand filtration, and UV/chlorination prior to distribution are the barriers in place. At St-André, the sand filtration is independent from infiltration. Infiltration and soil passage occurs first and after re-extraction of the blended water from the groundwater extraction wells, it is treated using aeration, sand filtration, and chlorination prior to reservoir storage. UV treatment is applied before distribution [2].

3. Water Quality & Public Health

Water quality produced at the plant is approved by the **Flemish Environmental Agency** [1]. Although the scheme is not required to report operational breaches, analytical analyses that do not comply are reported to the FEM and the Flemish Health Authorities. In the event critical parameters exceed threshold values, alarms are generated. Two processes are programmed to halt if there are any exceeded values:

- High turbidity stops the UF train automatically
- High conductivity stops the RO skid immediately.

Assessments of Water Quality

A number of water quality parameters are assessed at both the Torreele site (59 - infiltration water parameters + pesticides) and the St-André site (83 - drinking water parameters + pesticides). A summary of key parameters, pre- and post-treatment values and permit values are provided in Table 1.

Table 1: Summary of key parameters assessed at both the Torreele and the St-André sites.

Water Quality Category	Parameter
Physical & Organoleptic constituents	Biological Oxygen Demand
	Colour
	Chemical Oxygen Demand
	Alkalinity
	Turbidity
Chemical components	Chloride
	Nitrate and Nitrite
	Sulphate
	Total trihalomethanes
Metals	Aluminium
	Iron
	Manganese
	Zinc
Microbiological indicators	Total coliforms
	Enterococci
	Heterotrophic plate counts
	Escherichia coli
	Clostridium viable spores
	Clostridium perfringens
Biological indicators	Chlorophyll a
	Giardia *spp*
	Cryptosporidium *spp*

TSAWRP water quality data

A summary of average effluent, UV filtrate and Infiltration water quality values for the period 2009-2013 for the Torreele/St-André water reclamation plants is presented in Table 2.

Table 2: Water quality target values for key microbial indicators for the TSAWRP.

Parameters	Units	Effluent average					UF Filtrate average					Infiltration water average					Permit limits for infiltration
Microbiological Indicators		**2009**	**2010**	**2011**	**2012**	**2013**	**2009**	**2010**	**2011**	**2012**	**2013**	**2009**	**2010**	**2011**	**2012**	**2013**	
Escherichia coli	counts/100 ml	NA	NA	NA	NA	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	None
Enterococci	counts/100 ml	NA	NA	NA	NA	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	None
Clostridium perfringens	counts/100 ml	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	NA	None
HPC 22°C	counts/100 ml	NA	NA	NA	NA	NA	24.55	14.17	22.42	3.71	1076.57	0.61	0.33	0.33	1.94	0.67	None
Total colibacteria	counts/100 ml	NA	NA	NA	NA	NA	1.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	None
Metals																	
Aluminium	µg/l	83.58	53.17	37.92	NA	NA	64.52	44.67	34.92	NA	NA	11.31	2.58	2.58	0.00	0.00	200.00
Antimony	µg/l	0.48	0.50	0.43	NA	NA	NA	NA	NA	NA	NA	0.00	0.00	0.00	0.00	0.00	10.00
Arsenic	µg/l	2.23	3.08	3.08	4.31	3.95	NA	NA	NA	NA	3.70	0.00	0.01	0.01	0.00	0.00	-
Boron	µg/l	NA	NA	NA	NA	NA	272.73	242.39	229.13	NA	NA	175.80	136.50	136.50	91.75	105.00	-
Barium	µg/l	5.75	7.00	4.58	NA	NA	3.68	4.36	3.59	NA	NA	NA	NA	NA	NA	NA	-
Cadmium	µg/l	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	0.00	0.00	0.00	0.00	0.00	0.00	-
Calcium	mg/l	NA	NA	NA	NA	NA	91.55	95.89	91.85	135.33	97.27	1.04	0.25	0.25	0.69	0.07	-
Chromium	µg/l	0.08	0.08	0.17	2.13	0.00	0.16	0.02	0.05	NA	0.00	0.00	0.00	0.00	0.30	0.00	50.00
Copper	µg/l	0.92	1.33	1.75	0.00	0.26	1.38	1.55	1.06	NA	0.00	0.08	0.00	0.00	0.00	0.00	100.00

Iron	µg/l	43.58	61.92	56.08	NA	NA	31.93	37.58	34.35	NA	NA	0.00	1.08	1.08	0.00	6.67	200.00
Lead	µg/l	0.17	0.33	0.17	0.02	0.00	0.00	0.00	0.32	NA	0.00	0.00	0.00	0.00	0.00	0.00	-
Manganese	µg/l	46.17	52.92	43.50	NA	NA	43.92	49.92	44.84	NA	NA	0.00	0.00	0.00	0.00	0.00	50.00
Magnesium	mg/l	NA	NA	NA	NA	NA	11.82	10.98	10.68	13.07	12.97	0.11	0.01	0.01	0.02	0.01	50.00
Mercury	µg/l	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	NA	0.00	0.00	0.00	0.00	0.00	1.00
Nickel	µg/l	4.00	3.67	1.58	1.66	0.00	1.57	1.28	1.04	NA	0.00	0.08	0.00	0.00	0.20	0.00	50.00
Total phosphorus	mg/l	NA	NA	NA	0.82	1.26	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00	0.40
Phosphate	mg/l	2.07	2.88	4.48	NA	NA	1.90	31.88	4.14	NA	NA	0.00	0.00	0.00	NA	NA	-
Potassium	mg/l	NA	NA	NA	NA	NA	25.99	24.56	27.62	NA	NA	0.55	0.58	0.58	0.41	0.55	-
Selenium	µg/l	0.20	0.34	0.17	NA	NA	NA	NA	NA	NA	NA	0.01	0.00	0.00	0.00	0.00	10.00
Silicon	µg/l	NA	NA	NA	NA	NA	NA	NA	NA	8012.00	NA	NA	NA	NA	NA	NA	-
Strontium	µg/l	398.67	441.67	398.83	NA	NA	404.61	430.16	397.48	NA	NA	1.00	0.67	0.67	NA	NA	-
Zinc	µg/l	21.67	19.42	18.67	19.29	22.91	15.90	16.80	14.20	NA	14.00	0.08	0.92	0.92	6.00	0.00	200.00
Nutrients																	
Ammonia	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	0.44	1.12	0.13	0.18	0.18	0.08	0.17	1.50
Nitrogen as NO3	mg/l	NA	NA	NA	NA	4.18	18.80	20.52	18.40	23.77	15.44	1.75	1.09	1.09	1.81	1.71	15.00
Nitrogen as NO2	mg/l	NA	NA	NA	NA	0.21	NA	NA	NA	0.50	0.19	0.02	0.00	0.00	0.02	0.00	0.10
Total nitrogen	mg/l	5.41	6.13	4.76	6.40	7.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
Inorganic constituents																	
Biological oxygen demand	mgO2/l	2.26	2.49	2.68	1.40	1.96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
Chemical oxygen demand	mgO2/l	31.80	29.08	32.17	27.92	30.27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
Disinfection by products																	
THMs	µg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.82	2.83	2.83	NA	NA	200.00

Volatile aromatic & halogenated solvents																	
Poly aromatic hydrocarbon	µg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00	0.00	0.00	0.41	0.02
Aesthetic																	
Conductivity	µS/cm	1136.92	1147.00	1091.25	984.83	1527.27	1203.51	1094.76	1125.27	1081.44	1378.20	44.00	24.25	24.25	20.97	26.33	1000.00
pH	pH unit	7.60	7.61	7.60	6.86	7.65	7.98	7.97	8.02	7.86	7.95	6.28	5.94	5.94	5.89	5.99	6.5 - 9.2
Total dissolved solids	mg/L	NA	NA	NA	NA	NA	800.41	740.65	744.52	744.29	846.15	NA	NA	NA	NA	NA	-
Total hardness	°F	NA	NA	NA	NA	NA	NA	NA	27.38	29.21	28.04	0.13	0.00	0.00	0.00	0.00	-
Total organic carbon	mgC/l	NA	NA	NA	NA	NA	10.38	9.28	9.21	8.17	9.02	NA	NA	NA	NA	NA	-
Total alkalinity	°F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.63	0.26	0.00	0.00	0.00	-
Total bicarbonate	°F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.87	0.1	0.72	0.72	1.62	-
Temperature	°C	15.33	14.38	15.86	16.53	11.00	15.24	14.66	15.35	15.70	11.57	15.45	15.49	15.49	15.59	14.5	25.00
Suspended solids	mg/l	2.18	3.98	2.67	2.88	0.28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
Inorganics																	
Fluoride	mg/l	NA	NA	NA	NA	NA	0.17	0.09	0.06	NA	NA	0.02	0.00	0.00	0.00	0.07	1.50
Chloride	mg/l	NA	NA	NA	NA	NA	219.80	194.08	213.22	189.50	252.73	4.72	2.41	2.41	0.00	0.00	250.00
Sulphate	mg/l	NA	NA	NA	NA	NA	75.05	70.80	64.38	69.75	73.92	1.11	0.14	0.14	0.00	0.83	250.00
Sodium	mg/l	NA	NA	NA	NA	NA	157.10	130.81	140.84	164.42	154.85	10.09	4.79	4.79	3.91	4.61	150.00
Silicon dioxide	mg/l	NA	NA	NA	NA	NA	19.37	18.74	18.51	NA	16.61	0.48	0.13	0.13	NA	NA	-
Bromate	µg/l	NA	NA	NA	NA	NA	0.22	2.20	1.64	NA	NA	NA	NA	NA	NA	NA	-

Notes: N/A – not analysed
Zero value – not detected

4. Public Education and Engagement

- IWVA presented its plans and pilot testing results to the public via the visitor's centre
- Ten years of ecological and hydro-geological research prior to implementation
- Publicly accepted since it solved drinking water quality and water shortage issues and environmental issues
- Public frequently rate the water quality and provide feedback
- Public informed about the water quality using the 'annual report', the website and the visitor's centre
- Results of the plant presented to public and information renewed yearly
- Guided tours of the plant organised
- Media reported about the plant before it became operational and continues to do so from time to time.

5. References

1. Van Houtte, E. and J. Verbauwhede (2008). **Operational experience with indirect potable reuse at the Flemish Coast**. Desalination 218(1–3): 198-207.
2. ↑ 2.0 2.1 Van Houtte, E. and J. Verbauwhede (2012). **Sustainable groundwater management using reclaimed water: the Torreele/St-Andre case in Flanders, Belgium**. Journal of Water Supply: Research and Technology - AQUA 61: 473-483.