WATER CATCHMENT

The pump station
14 high-capacity rotatory pumps—the amount of water pumped can be regulated—feed the drinking water from the reservoirs into the drinking mains of the towns of Mülheim, Oberhausen and Bottrop. Because the towns are at different heights it is necessary to have three different pressure zones. Pumps with water-cooled electrical gears and protective caps ensure a maximum level of noise insulation in the pump house. Noise levels can be reduced from an original amount of 86 dBA to 72 dBA.

The water tower
The Bedingrade water tower in Essen-Frintrop is filled by the pumps of the waterworks Styrum/East and Styrum/West. The water tower can also be filled by the booster station “Aktienstraße” at the border between Mülheim and Essen. The tower has a capacity of about 1,000,000 liters and supplies the south of Bottrop with drinking water.

The central control room
All RWW waterworks, the Kahlenberg power station in central Mülheim and the main RWW supply network are supervised and controlled from the computer-aided control room of the Styrum/East waterworks. Here RWW staff work around the clock in shifts to ensure that people can have continuous supplies of the most important nutritional element known to man directly from the pipeline.

The slow sand filtration and recovery of water
- Filter area: 50,000 m²
- Filter speed: 1 – 3 m/d
- Soil passage: 50 – 150 m
- Water collection: 190 vertical wells (depth: 3 m) and 460 m of horizontal collecting galleries
- Siphon system using vacuum pumps
- 4 collecting wells (depth: 1.0 – 1.2 m)
- 5 pumps
  - Amount of water raised: 6,500 m³/h
  - Pressure head: 16 m
- The pumps raise the water directly into the ozonation plant.

The ozonation plant
- 3 ozone generators (capacity per generator: 21.0 kg/h = 6.3 kg O₃/h)
- Rated voltage: 6 – 9 KV controllable
- Frequency: 7 – 12 kHz, controllable
- Air preparation: Blower, refrigerating machine, air drier
- Ozone gassing: in 2 gassing routes (2 gassing chambers and 1 reaction chamber per route)
- Feed system: 28 gassing plates per gassing chamber
- Water throughput: max. 6,000 m³/h
- Ozone feed: 1 – 3 g O₃/m³
- Ozone remains are removed by catalytic converters

The filter plant
- 12 twin-chamber filters
- Diameter: 6.3 m
- Height: 13.5 m
- Weight: gross 350 t / net 80 t
- Filter construction top
  - 1.20 m VA coke
  - 0.80 m filtersand
  - 0.45 m gravel and support layers
- Filter construction bottom
  - 4 m activated carbon
  - Water throughput: max. 500 m³/h each one
- Filter speed: max. 14.5 m/h
- Filter backwashing: automatic with water 24.5 m/h and air 55 m/h

Facts and figures

THE UV plant
- 4 reactors
- Water throughput: max. 2,000 m³/h each one
- Power requirement: 6 – 17 MW each one
- Reactor length: 3,000 mm incl. inflow and outflow segments
- 1 row of irradiation, each one with 9 low pressure gas discharge lamps, dimmable

The drinking water reservoir
- 3 circular containers
- Diameter: 28 m
- Capacity net: 3,500 m³

The pumping
- 14 horizontal rotatory pumps, one of each zone
- Speed regulated
- 3 pressure zones
- Mülheim zone
  - max. 6,750 m³/h
  - max. 102 m = 10.2 bar
- Oberhausen zone
  - max. 5,250 m³/h
  - max. 84 m = 8.4 bar
- Bottrop zone
  - max. 6,750 m³/h
  - max. 126 m = 12.0 bar
- Speed regulation

THE RWW WATERWORKS IN MUELHEIM STYRUM/EAST

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THE RW W WAT ERW ORKS IN M UELHEIM STY RUM/ EAS T

1406x50 to 1499x69
1406x273 to 1659x536
583x-0 to 782x222
28x565
1123x151
1123x141
1123x121
1123x91
1123x81
1123x71
1123x61
1123x1
1123x11
1123x10
1123x8
**HISTORY**

As early as 1871 the “AEG Hüttenwerke Oberhausen” built up factories beside the River Ruhr in order to supply drinking water to the industrial works and railways that belonged to the company’s owners. Only 8 years later, in 1879, the company began to provide drinking water to parts of the Oberhausen population. In the years prior to 1903 the water supply main was extended to include Mülheim, Dortmund, Stadtkern and Holten. In 1893 the industrialist August Thyssen set up his ironworks in Mülheim and his collieries in Gladbeck. Later Thyssen & Co also took over responsibility for the local authority waterworks of the town of Mülheim. In 1902 the Ruhrwaterwerke Styrum/East was extended with the addition of a multifunctional congress centre, the Aquatorium. The waterworks now provides drinking water to more than 350,000 people in Mülheim, Oberhausen and Bottrop. In order to ensure enough water in 1904 the RWW constructed a new waterworks just a kilometre away, called Styrum/West.

Today’s RWW waterworks Styrum/East in the Mülheim district of Styrum is the outcome of uniting the activities of the Oberhausen and the Thyssen waterworks.

**WATER TREATMENT**

The slow sand filtration

This waterworks, as with all the RWW waterworks belonging to the Ruhrwasserwerke, operates since the so-called Mülheim process, but in a somewhat altered form. Instead of the first stage of flocculation and sedimentation, large slow sand filter basins are used to effect an artificial groundwater enrichment. Thereafter water from the Ruhr River is led downwards in a natural course in 1.5 metre thick pipes to basins filled with sand in a somewhat deeper level. Sliding valves regulate the amount of incoming water. The slow sand filter basins with an active adsorption area of around 5,000 square metres make up a natural barrier for any particles that have not been dissolved, like single articles of worth. Editions of microorganisms living in the River Ruhr and lakes particles, thereby considerably reducing a huge amount of unwanted materials in the later drinking water.

The water recovery

After a subaqueous passage of two to four days the raw water is recovered by 190 vertical suction wells and 460 metres of collecting galleries which are situated in parallel lines between the filter basins. If it then passes into four collecting walls. Although the water is now optically clear it has not yet reached the quality necessary for drinking water.

The ozonation

After the water has undergone the first stage of mechanical and biological cleaning, it still contains a number of different harmful liquid materials like garden pesticides and other substances. In addition clogging and sedimentation products that could be dangerous to people’s health in addition the water contains too much dissolved iron and manganese that are naturally present in ground and water. Thus, they are not harmful to people. Indeed, in certain amounts, they are vital to us all. In large amounts, however, they are not particularly good for the health, and in the long term they can also clog supply pipelines. Aggressive ozone, produced out of natural oxygen by high tension electricity, is now added to the water via two gas routes. This has three effects which arise within a very short period of time.

1. Germs and bacteria are removed by disinfection.
2. Iron and manganese oxide are removed and transformed into filterable granules.
3. The chemical structure of organic substances is decomposed and transformed into smaller organic matter. In this way they are prepared for being biologically drawn off in the following stages of filtration.

The half finished product is now led into clear water chambers, before continuing its passage through the filter house.

**The activated carbon filtration**

Subsequently the water runs into 12 twin-storey filter towers. Here weakly activated carbon is used to eliminate any remaining organic matter in order to allow a natural methodology to develop in the layers of sand and gravel below. It particularly eliminates unwanted aromas (stabilisation) and filters off iron oxide and manganese oxide.

The activated carbon can be found in the bottom half of the filter tower. It is able to bind any organic substance whose structure has been changed by the ozone (pesticides, and where necessary also paint, varnishes, solvents, oil, petrol or the many more variants in water). Special microorganisms that flourish and reproduce in this atmosphere ensure that the great majority of harmful products from deterioration are removed.

The UV disinfection

The waterworks Styrum/East is the first of its kind in the Ruhr area to use a secure disinfection process in a U/V plant to guarantee the elimination of all pathogenic germs. Here water is treated with ultraviolet light (240 to 270 nanometers). This changes the DNA in the cell nucleus to such an extent that the bacteria lose their ability to divide, cannot multiply any more and die off. In this way it is possible to avoid any unpleasant tastes or smells caused by disinfection methods with chlorine, not to speak of the creation of harmful byproducts from chlorination.

The Drinking water reservoirs

Both round water containers on the site have a diameter of 20 metres and a capacity of around 165,000 cubic metres (7,000,000 litres). They are used to ensure supplies during peak periods and to regulate the pressure on the mains.

**The Rhine waterworks in Bottrop-Styrum/East**

**Drinking water recovery**

**Ultraviolet disinfection**

**Activated carbon filtration**

**Wastewater treatment**

**Drinking water containers**

**UV disinfection**

**Wastewater treatment**

Today’s RWW waterworks Styrum/East in the Mülheim district of Styrum is the outcome of uniting the activities of the Oberhausen and the Thyssen waterworks.

**The RWW waterworks Styrum/East**

The waterworks now provides drinking water to more than 350,000 people in Mülheim, Oberhausen and Bottrop. In order to ensure enough water in 1904 the RWW constructed a new waterworks just a kilometre away, called Styrum/West.

**The water production site stretches over 160 ha on both sides of the Ruhr River from the boundaries of Düsseldorf all the way to the inner city of Mülheim.**

In 2002 Styrum/East waterworks was extended with the addition of a multifunctional congress centre, the Aquatorium.