Ruhrverband

Ruhrverband

Information department
Kronprinzenstraße 37
D - 45128 Essen
Phone 0201 / 178-0
Fax 0201 / 178-1425

Printed on
chlorine-free paper

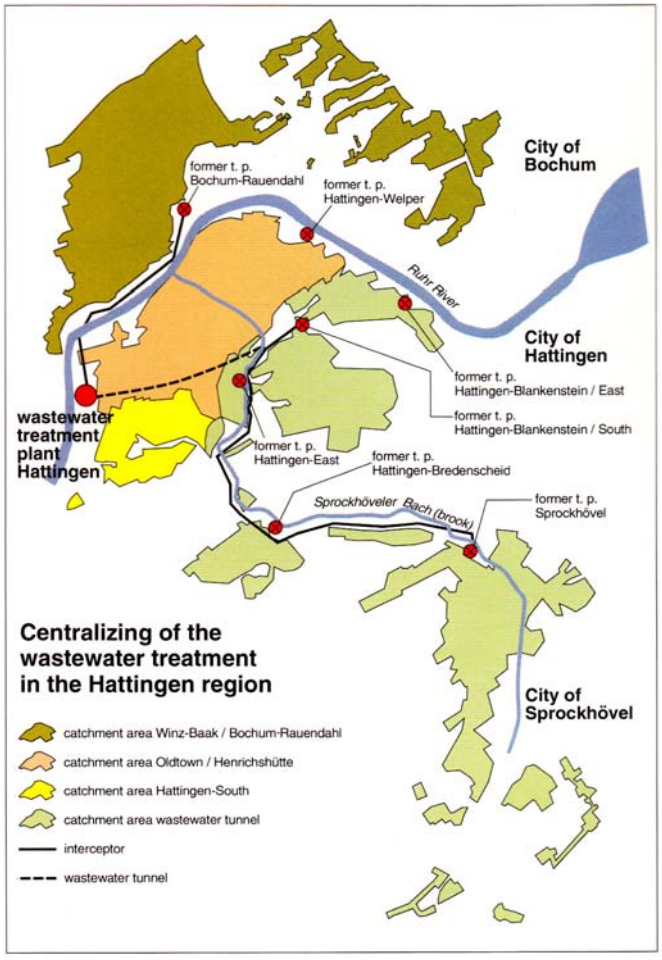
3000-1-0696

Wastewater Treatment Plant Hattingen

Wastewater Treatment Plant Hattingen

About 50 kilometres from the location where the Ruhr River flows into the Rhine River the wastewater treatment plant Hattingen is situated. It is designed to clean the wastewater of 100,000 people including population equivalents of industries and serves a catchment area of 2,200 ha. The plant represents the fourth generation of wastewater treatment plants at this particular site.

Here the wastewater which formerly was treated in the plants in Hattingen-Welper, Hattingen-Blankenstein-South and -East, Hattingen-East, Hattingen-Bredenscheid, Sprockhövel and Bochum-Rauendahl is centrally cleaned.



Wastewater tunnel Ludwigstal

Three measures enabled this concentration:

In order to connect the catchment area of the former wastewater treatment plant Bochum-Rauendahl with the plant Hattingen a 2.7 km-long interceptor with an integrated canal storage volume of 2,000 m^3 and a new double Ruhr-inverted siphon of 500 mm diameter was built. Via a 7 km collector pipe the wastewater from Sprockhövel, Hattingen-Bredenscheid and Hattingen-East is led to the wastewater tunnel Ludwigstal. The wastewater from Hattingen-Blankenstein is led to the intake structure of this wastewater tunnel as well.

Deep underneath the historical oldtown of Hattingen the wastewater runs to the wastewater treatment plant Hattingen through the wastewater tunnel Ludwigstal, which is 2,254 m long and offers a stormwater-storage volume of 7,000 m^3.

There are 12 storage canals and stormwater tanks in the catchment area of the wastewater treatment plant which offer a total storage capacity of 25,000 m^3. Three further storage canals with a total volume of 1,000 m^3 are still to be build.

In the wastewater treatment plant Hattingen a daily amount of up to 110,000 m^3 (1,273 l/s) of wastewater and stormwater can be treated mechanically, biologically and chemically.

Three subsequent polishing ponds are not only very important for advanced purification; they also offer an attractive biosphere for plants and animals.

The sludge which is generated during the process of wastewater treatment is digested in two digesters before being dewatered with the help of centrifuges. After this the sludge is dried in a two streets drying plant by drying drums and is thus concentrated to 95% of solid matter. The gas which is a by-product of the digestion process is used in a package heat and power-station to aerate the activated sludge tanks via gas-combustion engines and turbine compressors and for heating the digesters and operational buildings.

The wastewater treatment plant Hattingen has been built in several successive steps the last of which was completed in 1993. Since 1995 the sludge drying plant is in operation.

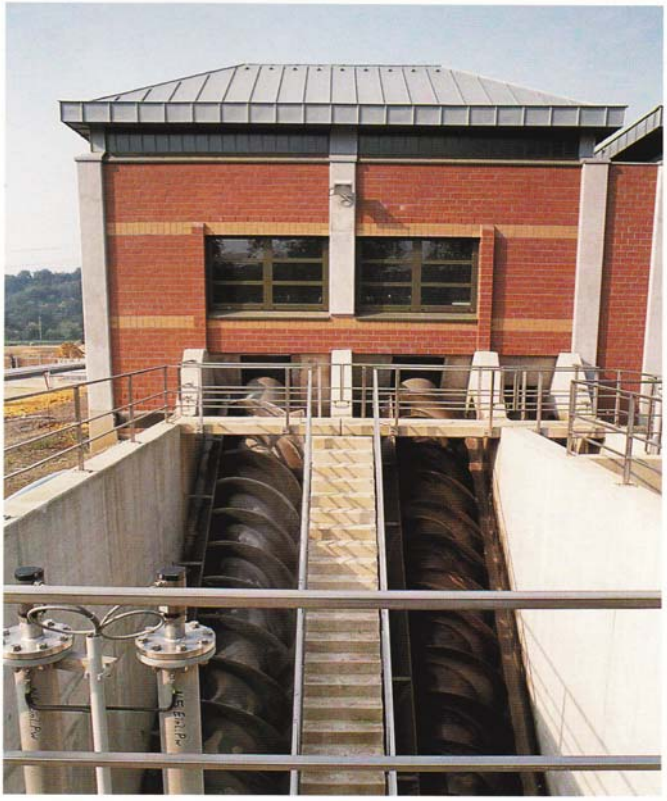
Buildings and Facilities

Intake Pumping Station

Before arriving at the screening plant the wastewater is lifted in a srew pumping station by 2,70 m or 7,20 m respectively, and flows then through the wastewater treatment plant by gravity. There are three screw pumps with capacities of 1 x 147 l/s and 2 x 606 l/s. One pump of 606 l/s serves as reserve. It is not necessary to pump the inflow from the wastewater tunnel Ludwigstal.

Screening Plant

As a first step of processing, the wastewater runs through two double screens. Here, solid materials are removed. The screenings are dewatered and collected in containers before being stored on a controlled deposit. The screens are located in a building in order to avoid emissions and to guarantee an undisturbed process even during winter.



Grit Chamber

The aerated grit chamber consists of two parallel channels where sand and inorganic materials are removed. Together with wastewater the settled sand is abstracted by submersible pumps which are attached to a scraper. Sand and wastewater are separated with the help of a classifier. The dewatered sand is then collected in a container before being stored on a controlled deposit.

Preliminary Clarification

The preliminary clarification consists of two parallel longitudinal tanks (volume = 2 x 990 m^3) with an automatic shield scraper. The settleable solids slowly sink on to the bottom and are transported by scrapers into hoppers at the head of the tanks. Depending on its density the raw sludge is directly pumped to the digesters.

Buffer Storage Tanks

Peak flows of wastewater can be storaged in two buffer storage tanks which are identical to the preliminary clarification tanks. They have a total storage volume of 1,980 m^3.

Activated Sludge Tanks

In the activated sludge tanks soluble wastewater compounds are biologically degraded. The water runs through four Carrousel tanks (each with a volume of 5,125 m^3). The microorganisms are supplied with oxygen by fine-bubble compressed air injected by diffusers on the bottom of the tanks. The activated sludge tanks can be operated in different ways for nitrification and denitrification.

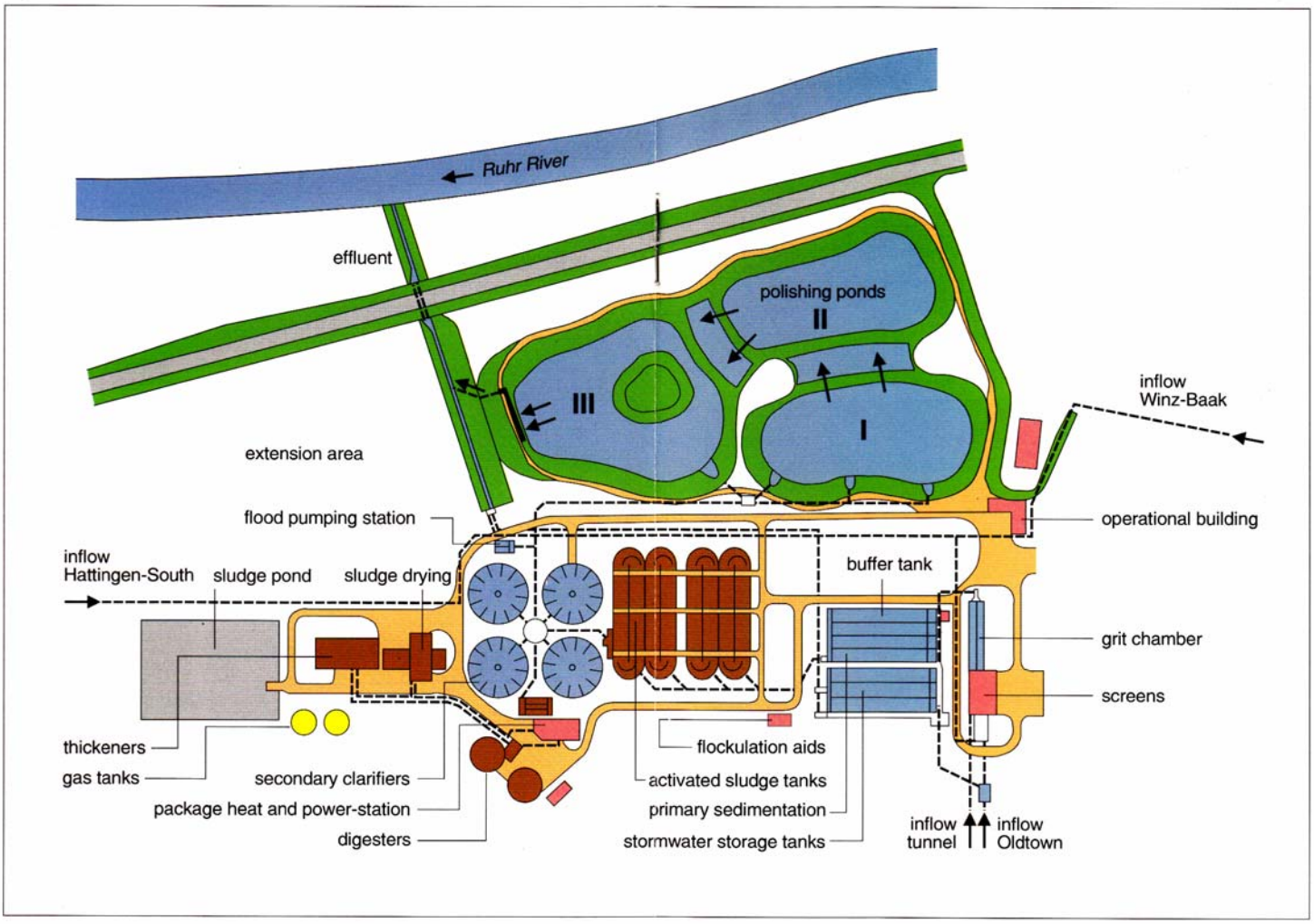
Phosphate Elimination

In the activated sludge tanks phosphorous is simultaneously transformed into settleable flocks by flocculation aids and eliminated from the system together with the surplus sludge.

Secondary Clarification and Return-Sludge Pumping Station

The separation of the activated sludge from the treated wastewater takes place in the final clarification stage, consisting of four circular tanks (volume = 4 x 2,720 m^3). The treated wastewater is discharged through perforated pipes. The settled sludge is transported to the hoppers in the central structure by sludge scrapers. Via inverted siphon pipes the sludge is further transported to the return-sludge pumping station which then return it to the activated sludge tanks.

The excess sludge can be pumped either directly to the digesters or to the thickeners or to the primary clarification. A mechanical thickening is possible as well.



Polishing Ponds

In order to further remove suspended solids and to serve as a buffer in case of peak loading the treated wastewater flows through three polishing ponds with a total volume of 40,000 m^3. These ponds are thus serving as a step of advanced treatment.

Flood Pumping Station

In times when the flow of the Ruhr exceeds 220 m^3/s, which means a water level in the river of 64.20 m above sea-level and beyond, the treated wastewater cannot flow into the Ruhr River by gravity. Therefore the treated wastewater then must be pumped into the river.

Digesters

In the digesters (2 x 2,500 m^3) the organic substances of the different sludges are decomposed anaerobically to such an extent that the sludge is stabilized and thus rendered odourless. The methane gas which is thus produced, is used to run the gas engines which, with help of a turbine blower, press compressed air into the activated sludge tanks. The gas can be intermediately stored in gas tanks.

Operational Building

In the operational building are the staff rooms, the workshop and the laboratory as well as an instruction room and the control centre.

Engine and Power House with Package Heat and Power-Station

In this building four gas engines/air compressors supply the activated sludge tanks. The air is either distracted from the wastewater tunnel Ludwigstal or absorbed by an air shaft. Close by is the electrical main- and secondary distribution.

The package heat and power-station uses the waste heat from the gas engines for heating of the digesters as well as the operational building and the screening plant.

Sludge Thickener

Sludge thickeners with a volume between 250 m^3 and 390 m^3 each serve for provisional storage, thickening and homogenization of the sludge.

Sludge Drying Plant

The sludge which is generated by wastewater treatment is dewatered by centrifuges before it is dried in a parallel drying plant with the help of drying drums. With their water content of only 5% the granules produced during this process can be used as a fertilizer in agriculture or as fuel in power stations or in sludge incineration plants. They can also be stored on controlled deposits.

Technical Data

Basic Design Data

Inhabitants of the catchment area and population equivalents	100,000 p. e.
Maximal inflow with discharge to stormwater tank	10,817 l/s
Dryweather inflow	550 l/s
Maximal stormwater inflow	1,273 l/s

Stormwater Storage

3 tanks	each L/W/H = 60/7/2.4 m
Total volume	3,000 m³

Inflow Canals

Inflow canal 1 (Oldtown)	diameter 2,400 mm
Inflow canal 2 (collector Henrichshütte / Winz-Baak / Rauendahl)	diameter 1,400 mm
Inflow canal 3 (Hattingen-South)	diameter 500 mm
Inflow canal 4 (sewer tunnel Ludwigstal)	diameter 900 mm

Intake Pumping Station

1 screw pump, diameter 1,000 mm for inflow canal 1 with 147 l/s capacity
1 screw pump, diameter 1,800 mm for inflow canals 2 and 3 with 606 l/s capacity
1 screw pump, diameter 1,800 mm as reserve with 606 l/s capacity

Screening Plant

2 double screens with 50/20 mm clearance
Screenings press, conveyor belt and 2 containers (with a volume of 10 m³ each), transfer-station for faeces and sand classifier with grit container

Grit Chamber

Aerated grit tank, 2 chambers with grit scraper	each L/W/H = 34/2.4/3 m
Total volume in case of stormwater flow	384 m³
Total surface	162.2 m²
Detention time at dryweather flow	10.9 min
Detention time at stormwater flow	5 min
Surface feed at dryweather flow	12 m/h
Surface feed at stormwater flow	28 m/h

Primary Clarification Tanks

2 tanks with double sludge scrapers	each L/W/H = 60/7/2.4 m
Volume	1,980 m³
Surface	840 m²
Detention time at dryweather flow	1 h
Detention time of stormwater flow	0.43 h
Surface feed at dryweather flow	2.4 m/h
Surface feed at stormwater flow	5.5 m/h

Buffer Tanks

2 tanks with double sludge scrapers	
volume	1,980 m³

Activated Sludge Tanks

Horizontal circulation flow caused by propelling, oxygen supply by fine bubble diffused air aeration

4 activated sludge tanks with optional denitrification- and nitrification zones, each L/W/H = 71/17/4.6 m

Total volume	20,500 m³
Detention time at dryweather flow	10.35 h
Detention time at stormwater flow	4.47 h
BOD_5 space loading	0.21 kg / (m³ · d)
BOD_5 sludge loading	0.09 kg / (kg d.s. · d)

Secondary Clarification

4 circular tanks	diameter 30.60 m maximal depth 4.30 m minimal depth 3.41 m
Volume	10,880 m³
Surface	2,913 m²
Detention time at dryweather flow	5.50 h
Detention time at stormwater flow	2.37 h
Surface feed at dryweather flow	0.68 m/h
Surface feed at stormwater flow	1.57 m/h

Return Sludge- and Excess Sludge Pumping Station

3 screw pumps; (return sludge) diameter 1,400 mm with a maximal capacity	of 330 l/s each
2 submersible pumps (excess sludge) with a maximal capacity	of 8,3 l/s each

Polishing Ponds

3 ponds with a total volume of	40,000 m³
Surface	20,000 m²
Detention time at dryweather flow	64 h
Detention time at stormwater flow	32 h

Engine- and Power Station

4 turbine air compressors maximal capacity	6,000 m³/h each
Package heat and power-station	0.9 MW

Flood Pumping Station

3 submersible propelling pumps	275, 550 und 723 l/s

Digesters
put into operation for the first time in 1958; rebuilding in 1996

2 tanks, volume	each 2,500 m³
Diameter	16.0 m
Height	19.7 m
Amount of raw sludge	265 m³/d
Dry solid concentration of raw sludge	5 %

Gas Tanks

2 tanks with a total volume of	1,000 m³

Sludge Thickener

Excess sludge thickener	2 x 273 m³ = 546 m³
Centrate storage	2 x 342 m³ = 684 m³
Secondary thickener for digested sludge	3 x 250 m³ = 750 m³
Intermediate storage tanks for digested sludge	2 x 390 m³ = 780 m³

Sludge Dewatering Building

1 excess sludge centrifuge	capacity from 6 to 31 m³/h thickening from 0,5-2,5 to 6-8 % dry solids
2 digested sludge centrifuges	capacity from 7 to 18 m³/h dewatering from 3-6 auf 27-35 % dry solids

Sludge Drying

2 drying drums, capacity	700 kg/h dry solids each
Water evaporation capacity	1,808 kg/h
Grading of dry solids	1 to 8 mm
Dry solid concentration after drying	about 95 %
Annual capacity	about 10,000 t of dry solids

Sludge Deposit

2 tanks with a total volume of	11,000 m³

Scheme of the sewage sludge drying process