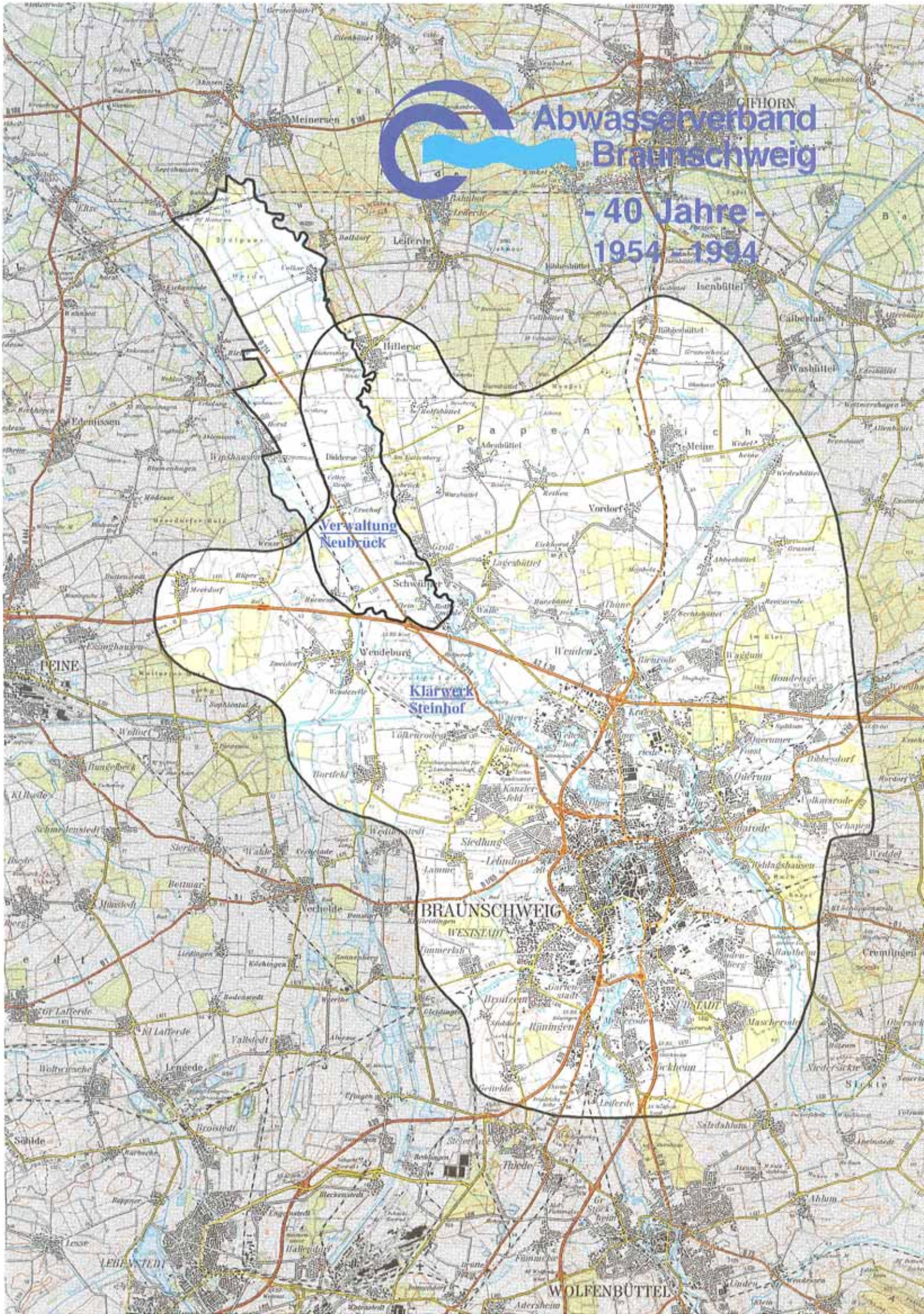

Abwasserverband
Braunschweig
- 40 Jahre -
1954 - 1994
Verwaltung
Neubrück
Klärwerk
Steinhof
BRAUNSCHWEIG
PEINE
WOLFENBÜTTEL
Meinersen
Leiferde
Hillerse
Edemissen
Wipshausen
Isenbüttel
Calberlah
Washüttel
Meine
Vordorf
Schwülper
Wendeburg
Wenden
Bienrode
Waggum
Querum
Cremlingen
Lengede
Broistedt
Söhlde
Lesse
Ahlum
Adersheim

The Sewage Utilization Association of Braunschweig

Purification and agricultural utilization of communal wastewater

Contents

Introduction

In the brochure for the 20th anniversary of the Sewage Utilization Association of Braunschweig, I quored an inscription from a Lower-Saxony farm:

"A wise man has to reflect on the past
has to do what has to be done at present
and has to think about the future"

Following the wisdom of this saying the Sewage Utilization Association has done its work in the past decades. Their own experiences and those of others were used to improve the accomplishments, and to satisfy the steadily increasing demands.

The simple cost-effective system of wastewater sprinkler irrigation which was only purified mechanically, had to be replaced by an improved system. The inadequacies, above all the unpleasant odours during certain weather conditions, could not be tolerated by the people within or near the area of the Association. The problem was solved by the building of a pre-treatment plant which was the first building stage of the present purifying plant.

The other problems could be solved too. I would only like to mention the harmful contents, which were reduced to a degree which is far below the permissable standards which were once again reduced in 1992.

The completion of the sewage Treatment Plant of two further building sections has created besides sludge removal for agricultural use outside the Association, the possibility for the elimination of nitrate and phosphate. By that the Association is capable to adapt in exact time the contents of the wastewater to the needs of the plants.

For the realization of the many tasks high investments were necessary. The increase of the budget plans from a few hundred thousands to many million Mark today is evident. The increased payments, which have to be paid by the members, are still lower than those of comparable cities.

For the support given to us so that we could achieve the present status, I would like to express my thanks in the name of the Association.

In this context I would like to mention the name of Mr. Schärff- manager of works, who died last year. After the war he has recaptured the idea of utilization of the wastewater of the city of Braunschweig in agriculture. And he has represented this idea as the responsible civil servant for the Water Management with the then administrative president in Braunschweig. I remember with pleasure the time during which I was the representative of the local farmers and I had many discussions with him in the preliminary stage of the foundation of the Association as well as in the following years of the Association development, during which he was a representative of the Board of Control.

My thanks to those who helped to adapt the agricultural wastewater utilization to the demands and develop them further. To all associations, authorities and departments, to the Universities, Research Institutes, Engineering offices, the press, which informed the public about our work.

My personal thanks to all Association members and their representatives, committee members, members of the Association and the Sewage Treatment Plants.

Only through the good co-operation of all the above mentioned, could we have achieved what was achieved in the last 40 years.

Neubrück, June 1995

Theodor Eggers

Prof. Theodor Eggers

Chairman
of the Sewage Association Braunschweig

1. Development of the Association

1.1 Previous history

The idea for the agricultural utilization of the wastewater of the City of Braunschweig started in 1936, when experts of the Water Development Department and Agriculture from Braunschweig and its vicinity, visited plants for the utilization in agriculture of municipal wastewater in Central Germany. The purpose of the visit was to inspect the sprinkler irrigation of the wastewater of Leipzig , Delitzsch as well as Erfurt and Nordhausen.

During this time the need for the City of Braunschweig arose, to look for new solutions for the purification of the municipal wastewater arose. The surface flooding area from the year 1895, which was constructed (set up) in Steinhof north of Braunschweig for 1000 000 inhabitants according to the pattern of the Berlin surface flooding area, were no longer sufficient for the increased population of 250 000. The surface flooding area was overburdened and vast amounts of wastewater flowed from the rainfall spilways of the municipal canalization directly into the Oker. Therefore the construction of a mechanical-biological sewage treatment plant as an addition to the surface flooding was taken into consideration.

In cooperation with the public Water Development Department, the decision was taken to sprinkle some of the surplus wastewater on to the areas north of the surface flooding area Steinhof, which were used for agricultural purpose. The good results with the purification of wastewater through soil treatment by means of sprinkler irrigation in Central Germany, and since 1938 also in Wolfsburg, and the good experiences with the spray irrigation on the surface flooding building were decisive for the aspired solution. Regarding the costs, the city opted for agricultural utilization because it was assumed that the contribution of the town to the costs would not exceed these of a sewage treatment plant.

For the sprinkler irrigation of wastewater onto agricultural soil besides the excellent purification of wastewater there was another positive effect: that is the utilization of the water with its nutrients for the production of crops.

In this case, areas were taken into consideration which were situated north of the motorway-Hannover Berlin, and which were bordered by the Oker in the east, and the Aue-Erse in the West. Soil with soil index from 20-35 and with a commonly low ground water level offered favorable conditions in this area for the sprinkler irrigation.

Finally the water resources were supported by the wastewater irrigation, and the extraction of ground water which otherwise would have been necessary for the irrigation of the fields, was not required.

Thus the advantage was threefold.

1.2 Legal basics

A suitable organization type was the corporate body of public law, i.e. a Water and Soil Association abiding by the Water Association regulations of 1937. Other examples, particularly that of Wolfsburg had shown that the joining of owners of agricultural land, which was situated in the area of the Association, as wastewater consumers, was the suitable type of organization.
In Wolfsburg, the membership of the city as wastewater supplier was an advantage for both the city and the country. It was concluded that problems could be best solved jointly. Therefore the decision was made in Braunschweig, to incorporate the city as a member into the Association .

1.3.Foundation of the Association

The Association was founded on 30th November 1954. The city of Braunschweig and the land owners of the irrigation districts I and II became members of the Association. In March 1955 the land owners of the irrigation districts III and IV became members too. In all, 550 land owners as agricultural members stated their willingness to act jointly with only a few adverse votes. The number of agricultural members has decreased in the meantime to 434. This has not however diminished the dimensions of the Association territory.
The Association territory spread across the areas of the former .communities of Kl. Schwülper, Gr. Schwülper, Didderse, Hillerse, Volkse, Seershausen, Ohof (district Gifhorn), of the communities Harvesse, Neubrück (district Braunschweig), Wipshausen, Rietze(district Peine). The Association territory was not changed in subsequent years . In the course of the district reforms, the communities of Harvesse and Neubrück were confederated into the district of Peine. The entire Association territory consists of 4300 ha, of which the sprinkler irrigated areas comprise of ca. 3000 ha. The remaining areas are taken in by localities, roads, paths, forests, hedges etc.

1.4 Building planning and constructio

The technical pre-planning as well as the estimate of the building and maintenance costs,
which preceded the foundation of the Association, were an important basis for the consent of the members to the foundation, and the responsibility of the Water Development Dep. of Braunschweig. The Agricultural District Office in Braunschweig of the Ministry of Agricultural Chamber in Hannover was the main contributor in the planning and determined the pollution limit for the agriculture. On the basis of this expertise the payments were fixed at 120 DM/ha. The Braunschweig Department for Cultivation of Lower Saxony did the land consolidation in two proceedings (methods).

The implementation was in the hands of the Water Development Department of Braunschweig which set up a construction department in Neubrück. The operational technical installations: main pipe, pumping stations with alternate areas , pressure pipelines, wind breaks, were constructed in the years 1955-1966. The sprinkler irrigated districts were set into operation one after the other, I 1957, II 1960, III 1963 and IV 1966.

2. Technology

2.1 Sprinkler irrigation

2.1.1 The Association areas

The mainly light soils of the Association territory complied with the most important criteria for a wastewater irrigation: that is the water absorption over the entire year.
Further criteria, a climatic water balance which requires on the annual average, an additional sprinkler irrigation, resulted from 80 years of data of the meteorological station Braunschweig-Völkenrode: Although the climatic water balance annually shows an increase of 50 mm, the vegetation period April-September showed a decrease of 122 mm.
The water demand for agricultural purpose was calculated according to these facts and estimated with 300 mm additional sprinkler irrigation amounts annually, of which 150 mm were calculated in the vegetation- period. Experience has shown in the following decades that the additional water quantity could be increased to 500 mm.
In dry years, however, the wastewater was not sufficient. The climatic water balance showed for example 1959-241 mm, 1964 -241 mm, 1973 -293 mm, 1983 -228 mm, 1992 -330 mm.

This was the reason why at the sites of all 4 pumping works, wells were drilled to equalize the deficit in ground water.
The daily effluent of wastewater in Braunschweig was estimated to 45 000 m^3, from which 30 000 m3 should be sprinkler irrigated and 15 000 m^3 should be sprayed to the surface flooding areas.

	ha	km
Total area	4.300	
Sprinkler irrigated area	3.000	
Spraying protected hedges	50	60
Wind break hedges	20	40
Outlet channels		43
Drainage	411	

2.1.2 Pumping stations and sprinkler irrigation plants

The conveyance of the treated i.e. wastewater is done by the gravity pipes from the Sewage Treatment Plant into the sprinkler irrigation area towards the 4 main pumping stations. Each pumping station is coordinated with a sprinkler irrigation area. Through the underground pressure pipe network the water is pumped as far as the hydrants in the fields. Here sprinkler machines are installed and are connected to the hydrants. The sprinkler machines have PE pipes, on average 400 m long, which are slowly unrolled during the sprinkling procedure. For each sprinkler irrigation phase an area of circa 1,5 ha is irrigated.

	km	numbers
Flow by gravity pipe from sewage treatment plant. DN 1000 - 800 mm	12	
Main pumping station		4
Pressure pipes	117	
Sprinkler irrigation machines		158

The pumping stations are equipped with rotary controlled pumps, so the operational pressure can be kept constant, independent from the amounts taken out. In all 16 pumps with a capacity of 150-500m^3/h each, at 6,5 bar are installed.

2.1.3 Vehicle stock

The Association has to maintain according to its tasks a corresponding vehicle stock. Besides the direct tasks which result from the sprinkler irrigation, the hedges have to be cared for, the drainage has to be kept in good order, as well as the ditches, paths have to be mended and agricultural work have to be done on its own areas.

Main pumping station IV

Sprinkler irrigation machine

Type of vehicle	Number
Trac - tractors	19
Tractors	2
Unimog	2
Digger	2
Wheel-loader	2
Forklift	1
Cars	14
Transport vehicle	6

2.1.4 Maintenance of vehicles, machines and appliances

The maintance and repair of vehicles is done by our own workshop, which is managed as a central - workshop with training facility. Because of the specialized qualifications of the mechanics, the vehicles and machines are kept working condition longer than is normal.

Sprinkler irrig. machines	Number
Perrot	112
Hüding	36
Deierling	3
Nerthus	2
Other	5
Total	158

The change from the pipe method with strong sprinklers to sprinkler machines took place in the years 1973 - 1977.
A large number of the machines acquired in the beginning, were overhauled in our own workshop, so that they continue to be fully operational. Thus the replacement was restricted to a few machines annually.

2.2 Agriculture

2.2.1 Farms and their dimensions

The structural change in agriculture is also evident in the Association territory. The following table illustrates this by the number of farms and the changes in size of the cultivated areas.

Number of farms and their cultivated areas in the Association territory

Year	Total	up to 5 ha	5-20 ha	20-50 ha	above 50 ha
1968	555	404	118	28	5
1974	473	338	101	29	8
1984	423	301	82	31	9
1994	302	206	50	36	10

The cultivated areas are only partial areas shown above for the main income farms, as there are other cultivated areas outside the Association territory The reason for the high number of farms below 5 ha is the cultivation of asparagus, which is produced by many small producers as a sideline and has a long tradition.

2.2.2 Cultivation

40 years of wastewater sprinkler irrigation has made it possible for the farms to adapt their cultivation, which otherwise would not have been conceivable. "On the long term the production moves to the most suitable location". This economic fundamental principle is clearly applied in the wastewater catchment area. Light sandy soils have become economically atractive locations because the wastewater provides organic substances, nutrients and above all, water. The sugar beets are an example. The farms could continuously deliver sugar beets to the factories, also in dry periods, and because of the delivery at the right time gave extended quota to the farms. The share of the turnip cultivation on 26% of the cultivated areas confirms this statement.

The cereal cultivation totals 53%. The share of wheat is quite high and is atypical for light soils. But as the water supply is guaranteed, wheat as a demanding cereal can be grown.

The asparagus cultivation is decreasing locally. The particular reason are the market conditions and it is only attractive for small producers, when a high share can be marketed directly. Otherwise the high expenditure is not paid off. The corresponding area is now 5,3%.

The wastewater Association especially promotes the cultivation of intermediate crops, for instance grass, because it absorbs the highest amount of nitrates, which it transforms into organic substance. This substance is again mineralized in the following year and thus is available to the next crop.

2.2.3 Sprinkler irrigation plan

The sprinkler irrigation plan is drawn up by the sprinkler irrigation master in co-operation with the farmers, on the base of cultivation plans of the respective farms. It is aimed at providing the various plants at the right time with sufficient water.

The sprinkler irrigation plan is the basis for the safeguarding of sufficient sprinkling in the individual phases of the vegetation.
The limiting factors:
performing abilities of pumps and sprinkler machines,
availability of the needed water,
availability of the needed workforce,
have been vastly eliminated in the course of years. Limiting, however, is the pipe system, because the optional pressure for the sprinkler machines cannot be achieved. The pipe system has been laid out for irrigation which requires less pressure.
The performance of the 4 pumping stations with 66 000 m3 and the according performance of the 158 sprinkler machines is sufficient.
The water supply in high peak times is secured with 54.000 m^3/d by the purifying plant and 12.000m^3/d of ground water.

2.2.4 Farming

In 1985 the Association rented the state owned farm Wipshausen which was bought by the city of Braunschweig. Herewith the Association cultivates about 140 ha agricultural land. Grown are 25% sweet turnips, 30% winter barley and 45% summer wheat. Their own cultivation of the land makes a flexible intake of wastewater possible.

The planning of the crop rotation, with its high share of summer wheat permits an extensive cultivation of grass as intermediate crop. Thus in times of high precipitation a greater amount of wastewater can be sprinkled onto these areas.

The areas of the exdomaine are used by the Association partially for practical tests - cereal - type tests and N - min tests are done on differently sprinkled areas e.c.t.

2.3 Steinhof

2.3.1 Sewage treatment plant

The development from the pre-treatment plant to a modern large sewage treatment plant with dual stream operation.

In order to maintain the agricultural wastewater irrigation, a wastewater pre-treatment plant was started in 1979. This plant had to pre-treat the hence untreated sprinkler irrigated raw wastewater and to prevent the unpleasant smells, which called into question the agricultural sprinkler irrigation. The plant performed a partial biological cleaning and the excess sludge was again added to the sprinkler irrigation water. The plant mainly consisted of an active sludge double basin and two post treatment basins.

To ensure that harmful heavy metal concentrations did not reach agricultural areas, at the end of 1986 a pre-purification unit with the corresponding sludge storing and dewatering was started. Also the biological excess sludge is only added to the irrigation water during the vegetation period in order to avoid an excess fertilization of soils and a percolation of nutrients into the groundwater during winter months.

The excess sludge is thickened through flotation and is then dewatered together with the pre- purified sludge in a chamber filter press.

In order to reduce the toxic elements concentration in the sprinkler irrigation water, the indirect discharge supervision and consultation of the effluent industrial enterprises, besides the sludge treatment, was introduced in Braunschweig. The results of this supervision and consultation were extremely positive. Considerable improvements have been achieved in the first years, which are still increasing. For example the cadmium load of 573 Kg in 1980 has been reduced to 16 Kg in 1994. Similar reductions in other heavy metals have been achieved.

In September 1991 the extended stage for the nutrient elimination and the further purification started operating. The pre-treatment plant was extended into a modern major purifying plant. The extension was necessary because of several reasons. The wastewater amounts, which had to be purified, had greatly increased because on one hand from the sanitation of the mixed water channel system in the city center of Braunschweig and on the other hand from the increase in level of the mixed water overflow barriers. The main pumping station of Ölper was extended in order to transport the water to the treatment plant, and a new transport pipe DN 1500 from Ölper to the treatment plant Steinhof was installed.

Administration and operation buildings Neubrück

Sewage Treatment Plant Steinhof

On the other hand the treatment plant for the protection of the Oker with its low water flow had to be equipped with a complete nitrogen elimination, so that the nutrients could not get into the Oker. Mainly two active double basins and two post treatment basins were installed for this procedures. The phosphate elimination is performed in a biological manner without chemical flocculation substance.

The plant has not only the task of cleaning wastewater, but it has to provide also sprinkler waste for farming. As the agricultural wastewater utilization can only be handled in a useful way if the nutrients contained in the water can be utilized, the wastewater for irrigation purpose still undergoes a partial biological treatment. The treatment plant is divided in 2 ways. The first way (a double active basin and a post-treatment basin) produces in the summer under bypass of phosphate elimination, nutritional sprinkler irrigation water. In the second way (two active basins and three post treatment basins) phosphate elimination as well as nitrogen elimination through nitrification and denitrification is carried out. From this way, the completely biologically cleaned wastewater is either being led into the overland flow system of Braunschweig or in the case of strong rain into the Aue - Oker channel

Description of the single components of the Sewage Plant

Lifting equipment:	6 screw pumps ∅ 1.800 mm (3 for raw wastewater, 3 for return sludge). Capacity each 3600 m^3/h. Lift ca. 250
Bar interceptor:	4 bar interceptor each 2 m width, space 20 mm (1 behind each screw pump and 1 behind the pressure pipe line), 1 bar interceptor for excess sludge, 85 cm width, space 10 mm
Grit collector:	2 aeration grit collectors, volume each 425 m^3, length 40 m, width 5 m, with suction chamber and grit classifier
Pre- treatment basins:	2 basins, volume total 2.900 m^3, each length 60 m, width 8m, depth 3m
Mixing basins:	2 basins, volume total 2.900 m^3, dimensions like pre-treatment basins, as mixing basins with each 4 pieces rotors, each 2 kW
Activated sludge basins:	6 activated sludge basins, volume total 51.000 m^3, length 205 m, width 6 x 17 m, depth 2,50 m, aeration: 7 double-mammuth rotors each basin, power each 75 kW
Post-treatment:	4 post-treatment basins ∅ 45 m, surface total 3.100 m^2, volume total 20.800 m^3, mean depth 3,30 m
Spray-pumping station:	max. 2.500 m^3/h

Mean daily totals Sewage Treatment Plant Steinhof

Sewage water inflow in dry weather:	65.000 m^3
in rainy weather:	77.000 m^3
Floating debris caught by rack(bar interceptor):	4 m^3
Grit:	2 m^3

Sludge

Pre-treatment sludge:	330 m^3, 3,5 %DS, 11,5 t DS
Excess sludge (sprinkler irrigation):	3.400 m^3, 3,2 g/L, 11 t DS
Dewatered sludge:	55 m^3, 30 % DR 20 t DR
Lime demand(CaO):	4,5 t
Ferrochloride demand:	3,8 t
Number of charges:	3

Inflow and outflow concentrations

Parameter	Dim.	Inflow	Outflow
pH		7,5	7,7
BSB_5	mg/l	288	12
CSB	mg/l	571	72
NH_4	mg/l	35	4,7
NO_3	mg/l	n.d.	6,9
NO_2	mg/l	n.d.	0,07
org. tot. N	mg/l	19,1	5,7
TKN	mg/l	53,9	10,3
P_{tot}	mg/l	7,0	1,1
Cd	mg/l	<0,001	0,0007
Cr	mg/l	0,014	0,007
Cu	mg/l	0,043	0,005
Hg	mg/l	0,0014	0,0007
Ni	mg/l	0,026	0,006
Pb	mg/l	0,067	0,003
Zn	mg/l	0,156	0,09
AOX	mg/l	0,13	0,081
CKW	mg/l	0,01	0,01

Inflow means pre-treated effluent

2.3.2 Sludge treatment

The accumulated sludge of the Steinhof Sewage Treatment Plant is used in agriculturally its entirety. There are two kinds of sludge.

1. Pre-treatment sludge

The pre- treatment sludge is accumulated the year round, is separated during the pre-treatment stage and is transported into the sludge reservoir by sludge pumps. The sludge is conditioned with slake quicklime and Ferrochloride, and is dewatered up to about 30% solids in the chamber filter press.The dewatered sludge is transported by lorries to the sludge storage reservoir and is stored for agricultural use.

2. Biological excess sludge

The biological excess sludge is utilized in two ways. During the vegetation period the sludge is mixed with the sprinkler irrigation water and thus utilized in the irrigation area of the Association. In the winter the excess sludge is thickened through a flotation from 0.3% to about 3 % solid contents and is transported through the storage tanks and the conditioning into the sludge dewatering.

For the future, considerations are being made, to equip the sewage treatment plant with a sludge septicity. A sludge septicity would, besides the energy gained from the decomposition gas improve the acceptance of the agricultural sludge usage, because

- the sludge is biologically stabilized and thus an unpleasant odour is excluded,
- a homogenization of the sludge is achieved,
- a lime stabilization is no longer necessary and thus the sludge can be applied to light soils which contain high pH value

- a nutrients management for the fertilizer "sludge" is easier to achieve, because can still be added to different nutrients the sludge after digestion.

Sludge treatment

Excess sludge-flotation:	1 basin, surface 140 m^2, air-performance max. 44 m^3/h. Sludge amount max 100 m^3/h
Sludge storage tank:	2 circular, covered storage tanks, dim. 16 m, volume each 1.300 m^3
Sludge dewatering:	1 chamber filter press, 165 plates 2x2 m, 1.150 m^2 filter surface 16.5 m^3 filling volume
Waste air treatment:	For dewatering buildings, storage tanks, storage conditioning tanks and screen-house a biofilter is used.

Block heating power station

2.3.3 Laboratory

The lab in the Sewage Plant Steinhof carries out investigations on ground, surface and wastewater as well as soil and sludge. With the exception of a few i.e. dioxines and furans, all other components relevant to the environment can be analysed. The following focal points are realized.

Self-supervision for

- Sewage Treatment Plant Steinhof and fecal sludge acceptance
- water of infiltration in sewage treatment plant
- Surface flooding operation
- Sludge dewatering
- Sewage treatment plants Waggum and Leiferde
- Main oil separator Ölper

The self-supervision is carried out by means of 4.500 samples per each 20 single parameter annually.
Indirect discharge supervision according to the Wastewater Statute of Braunschweig and Indirect Discharge Regulations of Lower Saxony for industrial enterprises in Braunschweig

The testing size amounts to 1.250 with about 10 individual tests per sample.

Tests during research projects of the City of Braunschweig and the Sewage Utilization Association of Braunschweig with about 1.400 tests and about 15 individual tests per sample.

Tests of ground water and soil samples for the definition of the amount of damages, as well as accompanying tests with the sanitation proceedings of contaminated soil as well as the support of investigating agencies (police and public prosecutor's office) with annually ca. 450 samples with 5 to 15 single tests per sample.

In all about 7.600 samples with about 128.000 parameters are analyzed annually. That means a determination of more than 500 parameters per working day.

2.3.4 Block heating power station

The Sewage Utilization Association Braunschweig has built a new block heating power station on the grounds of the sewage farm Steinhof, where the landfill gas of the adjacent central garbage landfill of Braunschweig is used as fuel. In this plant, the environmentally damaging garbage landfill gas is transformed into a less harmful state and at the same time the energy of the gas is utilized.

Garbage landfill gas results from chemical and bacteriological processes, which decompose the organic contents of the garbage in a domestic garbage plant and lead to a long term mineralization of the garbage. The main contents are Methan (CH4) and carbondioxide (CO2) as well as hydrogen, nitrogen and hydrogen sulphide in a total sum of <5%.

Gaseous organic carbohydrates as trace elements are contained in the garbage landfill gas. The sum of almost 500 different compositions, is about 1 to 2 gram per m^3 gas. Among these tracer elements, there are several chloride compositions, which change into hydrochloride acid during burning. That is why a gas pre-cleaning plant has been built in order to protect the engines from harmful burning-residue.

During planning, usable garbage landfill gas of about 1500 m^3/h was taken into consideration. Thus is the equivalent of an energy amount of about 700 l fuel per hour

The plant for suction and utilization of the garbage landfill gas consists of the following main parts:

- gas conveyor (suction and compression station with gas collection net in the garbage landfill and
  gas transport pipe)
- gas cleaning plant for the removal of organic carbohydrates from the landfill gas
- gas mixing plant for mixing of landfill gas, natural gas and air
- gas utilization plant (block heating power station) with 6 gas internal combustion engine - generator units

The internal combustion engines are run in slow motion, in order to achieve the lowest emissions of nitrogen oxide and carbonmonoxide. The engines are fixed with generators, which produce electricity. The maximum power of the plant is 6 x 450 kW, the equivalent of 2,7 MW electrical power.

The waste heat of the engines as well as the residue of exhaust gas is used at the moment for heating purposes. A major part of the heat, however, goes into the environment via radiator without being used.
The complete plant is operated fully automatic from the central leading mechanics and thus can operate without permanent supervision personnel.

The maximum electrical power which is needed at the installations on the sewage plant area Steinhof amounts to about 3,2 MW. That means that electrical energy has to be bought from outside(Electricity Authority Braunschweig). During poor turn-out periods it is possible, however, to deliver electrical power back to the Electricity Authority. Through Energy saving measures and switching off of aerating aggregates, the use of energy is kept low, as the accounting terms of the Electricity Authorities always aim on output peaks which are expensive.

The block heating power station (BHPS) has to function organizationally and economically as an energy cost center. That means, the BHPS buys the necessary energy (landfill gas), natural gas, electric outside energy and sells the produced energy in the shape of electricity and heat to the single consumer. (Sewage treatment plant, fecal station, laboratory, sludge dewatering, surface flooding treatment, water of infiltration purifying plant). This organization is still under construction.

BHPS:
6 modules, each 460 kW electric power
1 thickener station
1 gas cleaning plant
1 gas mixing plant
1 heat performer for producing district heating

2.3.5 Water of infiltration cleaning plant

The city of Braunschweig manages a highly dense garbage landfill in the community of Watenbüttel since July 1967, as a central waste water disposal plant. Domestic garbage and industrial garbage similar to the domestic one from the 260 000 inhabitants of Braunschweig is delivered to this landfill.

After the second extension around the cast fields II and IIa the building permit for the 3. cast fields was applied for in 1990. The permission was given on the condition that the cleaning plant for water infiltration was established and managed. The cleaning plant for water of infiltration has to deal with the infiltration

quantities and - qualities from the old cast fields I, II, IIa as well as from the new cast fields III. The locality of the landfill and the infiltration cleaning plant permits the water of infiltration to be conveyed into the communal sewage treatment plant of the Association of Braunschweig after cleaning.

The experience of other plant operators has shown that all water of infiltration are specifically different. For this reason the Institute of Housing Estate Water Supply and Distribution of TU Braunschweig-Prof. Kayser-was commissioned to test procedure combinations, especially for the water of infiltration of Braunschweig which are capable of fulfilling the law-enforced demands.

The fundamental principle of each clarification is to transform a considerable portion of the problematic contents into an environmentally friendly shape. This demand can only be achieved by the process combination, consisting of biological stage and chemical oxidation with biological follow-up treatment.

For this reason, the variation of biology, chemical oxidation with ozone and UV light, and discharging the treated water of infiltration into the communal sewage plants, was chosen.

The plan, to choose a process for the water of infiltration cleaning, which produces almost no residuals, is proven to be correct after about 1,5 operation years.
To what extent the introduction of UV- light can be of further use, with the higher concentrations of infiltration water in the landfill will tell in future.

2.4 Agricultural sludge utilization

The sprinkler irrigation of the wastewater and thus the recycling of the water contents has begun with the foundation of the Association. The soils in the Association territory were and are especially suited, as they possess a high moisture- holding capacity. The mainly sandy soils have great water retaining capacity and therefore are dependent upon a steady addition of water and nutrients for their plant growth as it is done by the sprinkler irrigation of treated effluent and excess sludge. By the continuous addition of nutrients and organic substances, the soil quality has improved.

It has been made possible to extract sludge completely or partially by the extension of the sewage plant. After the conditioning of this sludge and dewatering in a chamber filter press, the sludge with a dry matter of about 30% is storable.
The introduction of the sludge-legislation has limited the amount of sludge utilization on agricultural land. This was another reason for the sludge dewatering plant being built, to extract excess sludge. During the planning of the dewatering plants, the possibility of extraction of the sludge thus reducing the heavy metals of the wastewater, was not needed. Through direct discharge supervision of 250 industrial enterprises, in the meantime almost 500 in Braunschweig, the heavy metals load could be reduced far below the permitted limit values of the regulation for effluent. After the completion of the dewatering plants, the sludge was deposited for a while until 1991 on the landfill.
This is not recommendable for the excellent sludge from the sewage plant Steinhof. The committee has decided to set up a sludge department which should organize the agricultural sludge utilization outside the Association area. In the first 6 months of 1992 nearly 7.000 t of sludge were delivered to the area of Merseburg for the restoration of opencast mining areas. During this time the area acquisition by the Association started successfully and the deliveries could be stopped already in June 92. Since then the entire sludge is utilized agriculturally.

2.4.1 Quantities and qualities

Tab. 1 Average sludge amount in t dry matter annually

Sludge	Sprinkler irrigated in the Association area	Spread outside the Association area
8.000	4.300	3.700

The sludge amount for the area of the Steinhof sewage treatment plant, amounts to 75g DS/person/day or 62g/EWG/day.

The graphical presentation of nutrient contents, as well as heavy metals and AOX-contents show the values of the dewatered sludge. The excellent quality is clearly seen compared to the regulations Abf.KlärV. In spite of it the agricultural sludge utilization is publicly criticized. One of its reasons are the exact testing and supervision rules, which show each possible contamination. Contrary to the sludge fertilization, this documentation with other fertilizing systems is not necessary and thus not refutable although the pollution is much higher as for example in raw phosphates and in some composts.

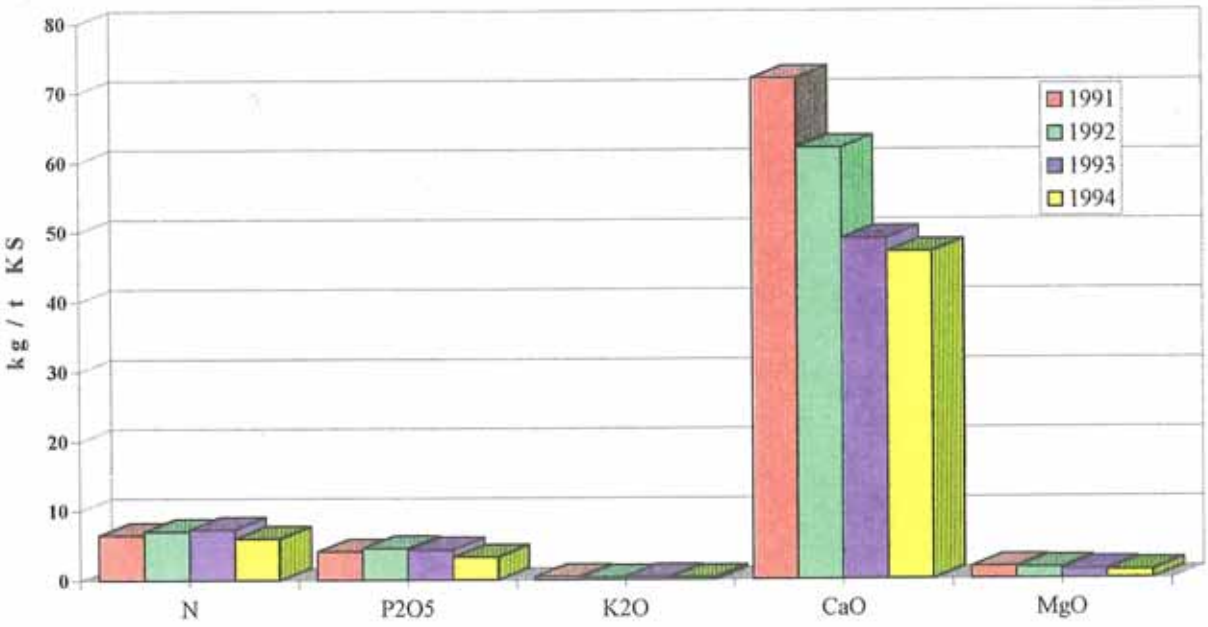
2.4.2 Farms and wing areas

Tab. 2 shows a survey on the regional utilization. It is preferable to utilize the sludge as near as possible to the sewage treatment plant. There is the problem of acceptance, however. For example, landowners such as churches and monasteries and the fund of the "Braunschweig Foundation" refuse the use of sludge. These refusals have signal function for many enterprises who also refuse a sludge fertilization referring to the "public" land owners. The emotionally based advertising of food plants which advise the consumers not to use sludge on the contract fields, has a negative effect on other enterprises, which use good quality sludge on arable land.

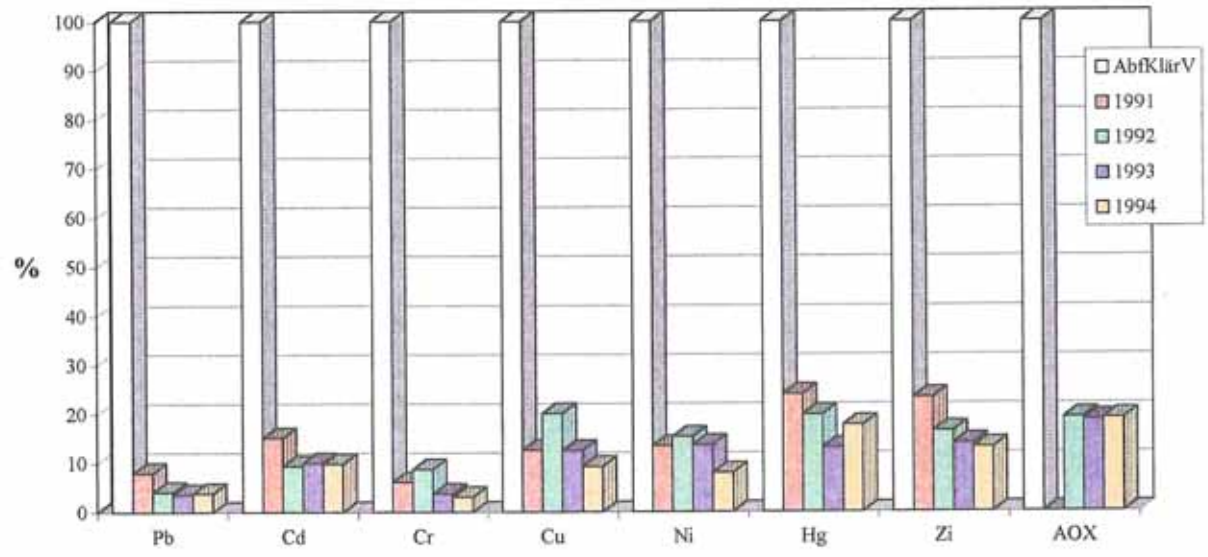
Tab. 2 Sludge utilization in the single districts in t (fresh matter)

Year	1992	1993	1994
District:			
Braunschweig	137	1.227	370
Celle	342	401	2.391
Gifhorn	3.916	4.403	7.827
Goslar	228	374	0
Hannover	0	196	739
Haldensleben	0	5.727	3.301
Helmstedt	410	849	3.368
Klötze	0	1.670	161
Peine	446	1.313	825
Salzwedel	3.206	2.068	416
Wolfenbüttel	0	1.037	174
Wernigerode	0	419	0
Agricult. utilization	8.682	19.995	19.571
Restoration	6.948	0	0
Totals	15.630	19.995	19.571

Nutrients contents in the sludge 1991 - 1994



Heavy metals and AOX contents in the sludge 1991 -1994



The wastewater Association Braunschweig has signed sludge utilization contracts valid till Dec. 94 with 104 industrial enterprises.

Tab. 3 Summary of contracts, enterprises and areas using sludge

		1992		1993		1994	
Date of contrac t	Number of contract	ha	Enterprises	ha	Enterprises	ha	Enterprises
1992	60	631	33	879	37	419	16
1993	16			544	7	313	8
1994	28					411	18
Total	104	631	33	1423	44	1143	42

The above mentioned areas don't necessarily comprise the entire cultivated areas. The sludge fertilization is always planned into the total rotation of crops. Besides, the amount of sludge is limited for 3 years, as regulated in the sludge legislation. Thus, it is applied for example after the harvest of cereals, before the planting of sweet turnips, according to the soil results.

2.4.3 Sludge utilization costs

Tab. 4. Cost overview

Year		1992	1993	1994
Sludge:				
Fresh matter	t FS	16.258	19.995	19.571
Dry matter	t DS	3.154	3.871	3.597
Costs:				
Total costs	DM/t FS	86,70	65,20	75,08
Total costs	DM/t DS	447	337	409

Total costs DM/t DS refer to the original content of dry matter in the sludge , the lime share is not mentioned in the above index.

The following index shows the cost comparison to alternative solutions, for example the disposal into the landfill of the City of Braunschweig. About 3,2 Mi. DM are saved for the consumers.

Cost comparison for 1994		
	Agr. utilization	landfill of the City of Br.
DM/t FS	75	239
DM/t DS	409	
Total costs, DM/year	1.509.430	4.677.469
Additional costs, DM/year	-	3.209.644

2.4.4.Technology

The disposal of the sludge according to the newest technology demanded new investments. Special spreaders, combined with high performance tractors, had to be bought. Adequate loader capacities had to be created to meet the performances.

Vehicle stock(sludge reuse)

Wheel loader:

• Liebherr 541	160 PS	3,2 m^3 scoop
• Hannomag D 35	110 PS	2,1 m^3 scoop

Tractors:

• MB-Trac 1600	160 PS
• Ford 8830	186 PS
• Ford 8830	186 PS

Special spreaders:

• 3 Piec. Tebbe	11,5 m^3

2.5 Sewerage

2.5.1 Sewerage

After the establishment of the Association of Braunschweig many of the communities in the vicinity of the sprinkler area, then still independent, had decided to supply the domestic and industrial wastewater to the Association for agricultural utilization. The Association agreed and took over the planning and the building of the plants. The communities after having applied became members at the wastewater Association Braunschweig. The assignment was done by the Administration President in Braunschweig acting as Board of Control of the Association.

During the District and Administration Reform, in 1974 the joined municipalities, such as Papenteich, Meinersen and single community Wendeburg were given the task, besides others, of the disposal of the wastewater. The following municipalities, besides Braunschweig as wastewater suppliers of the Association:

1. Joined community Papenteich

Community Meine with the districts Meine, Grassel, Abbesbüttel
Bechtsbüttel, Wedelheine, Wedesbüttel, Ohnhorst, Gravenhorst
Community Rötgesbüttel with the district Rötgesbüttel
Community Adenbüttel with the districts Adenbüttel, Rolfsbüttel
Community Vordorf with the districts Vordorf, Rethen, Eickhorst
Community Schwülper with the districts Groß-Schwülper, Rothemühle, Walle, Lagesbüttel
Community Didderse

2. Single community Wendeburg
with the districts Wendeburg, Bortfeld, Harvesse, Neubrück, Rüper, Meerdorf

3. Joint community Meinersen
Community Hillerse with the district Hillerse

The communities have commissioned the Association Braunschweig with the task of:
planning and building of the communal sewerage system:- mainly separating system in three communities a mixed system;
the conveyance to the Association area, including the necessary pumping stations;
the financing of all building operations;
acceptance and utilization of the wastewater.

The Association commissioned different engineering offices with the planning and supervising. These activities were carried out partially by its own office.

The communal sewerage networks were entrusted to the communities when finished. The Association, however, has agreed to the maintenance, upkeep and extension by the municipalities own request.

The pipework and pumping stations are owned by the Association.

Recently changes were being made regarding the competence for the communal sewerage system. The joint community Papenteich and the single community Wendeburg passed their sewerage system onto the Water Association Gifhorn on 1.4.1995. Meinersen followed on 1.6.1995.

This is the reason why the Water Association Gifhorn has become a member of the Water Association Braunschweig instead of those above mentioned. The Association of Braunschweig will, however continue the maintenance, upkeep and extension of the communal sewerage system.

After the take-over of the communal sewerage system by the Water Association Gifhorn, the duties of the Water Association Braunschweig have not changed.

2.5.2 Pumping stations and transport pipes

After the wastewater disposal of rural communities as an Association task was admitted into its statute, a general plan for the connections of the surrounding communities was made. The government, the former Water Dev. Depart. the present Public Dep. for Water and Waste all consented to this. This agreement was the basis for all future plans.

The building of pumping stations and transport pipes was necessary for the further utilization of the communal wastewater runoff within the Association territory.

Below are listed the existing plants within the territory Association.

Association plant	
Pumping stations with building - pumps in dry installation with building - submersible without building - submersible pumps	 17 8 18
Transport pipe lines pipe lines by gravity DN 200-500 pressure pipe lines DN 100-250-500 + return pipes	 17 km 20 km
Total costs	24,5 Mi. DM

2.5.3 Pressure pipe system to the sewage plant (return pipe)

The wastewater from the communities, arriving at the Sewage Plant Braunschweig was used unpurified until 1988/89 for sprinkler irrigation. The Braunschweig wastewater passed through the wastewater pre- treatment plant after the installation in 1979, which was extended in two stages till 1985. As a central plant, it is now called "Sewage Treatment Plant Steinhof".

According to the Garbage Law and the Sludge Regulation - Utilization of Sludge in Agriculture and Forestry - according to explanations. of. MU and of ML 19.8.1986 -, the disposal of raw sludge on soils used for agricultural, forestry and gardening, is not permitted. The Sewage Association of Braunschweig has therefore built a return pipe line in 1988 and 1989, which makes it possible to supply to the sewage plant the wastewater of the communities through a 13 km pressure pipe system. The wastewater from the communities is treated together with the wastewater from Braunschweig and is transported by gravity to the 4 pumping stations for sprinkler irrigation. Now no untreated water is used for irrigation.

The total installation costs, pressure pipe system, a newly built pumping station, rebuilding of different already existing pumping stations amounted to

4,15 Mi. DM.

The Sewage Association of Braunschweig is paid an administration fee for its planning and building operations of sewerage, which is calculated from the sum of the building costs.

For the acceptance and utilization of the communal wastewater, as well as for the upkeep of channel networks, of pumping stations, transport pipes and operating costs, the Association charges the communities or the now relevant Water Association Gifhorn the following payments in 1995:

Upkeep of network	0,92 DM/m^3
Sewage treatment plant Steinhof	0,71 DM/m^3
Sprinkler irrigation incl. sludge utilization	0,54 DM/m^3
Total:	2,17 DM/m^3

The incoming communal wastewater is constantly measured and the accounts are settled at the end of the year.

The extension of the channel net work in the municipalities is mostly completed. Newly developed built up areas are being connected to the existing channel nets.

The general plan of the Sewage Association Braunschweig from 23.09.1966 with its supplements from 1973 and 1978 was thus almost realized.

2.5.4 Local networks

In 1967, parallel to the Association installations, the building of the local sewerage system started. The main projects were mostly finished in 1985 and costs settled with the communities. Building costs amounted to ca. 87,8 Mi. DM until then. Through the development of new housing areas in nearly all communities and the incoporation of Rötgesbüttel, as well as the localities of Ohnhorst and Gravenhorst of the Meine community in 1993/94, the building activities of the Wastewater Association are being continued. In 1995 the locality of Rolfsbüttel of the Adenbüttel community shall beconnected to the Association. The following Tab. shows the installed plants and the builbing costs:

	Pipe-width DN	Pipe-length run. m	Connections Pieces	Construction costs DM
Dirty water - main pipes	150-400	140.700		44.930.000 ,-
Dirty water - domestic connections	150		6.850	16.350.000 ,-
Rain water - main pipes	150 - 1.000	115.800		33.150.000 ,-
Rain water - domestic connections	150		5.500	9.400.000,-
Mixed water - main pipes	200 - 600	260		320.000,-
Mixed water - domestic connections	150		28	150.000,-
Total costs				104,3 Mi..

After completion of each single building phase, the Wastewater Association settled accounts with the communities from 1.04.1995 with the Water Association of Gifhorn.

The number of connected inhabitants is at the time being about 29.500.

Local pumping station

3.1 Sewage Association of Braunschweig

Headquarters: Neubrück

Corporate body of public law

Association meeting

Members: 434 agricultural landowners as wastewater customers
City Braunschweig, Joint communities Papenteich u. Meinersen. Community Wendeburg, in total altogether 26 communities as water supplier

Task: Election of the Association Committee

Committee

13 members with 35 votes: Agriculture: 19; City of Braunschweig 14, Communities 2

Tasks: - Regulation of the budget
- Changing of decrees and plans
- Consultation of Board of Management....
- Election of Board of Management

Board of Management

8 members: Association chairman and 7 councilors

Task: - Setting up of the budget
- Taking up loans
- Placement of contracts
- Preparation of committee sessions

The following are invited to the meeting:
- Board of Control, District Government Braunschweig
- Technical Experts Board, StAWA Braunschweig
- Agricult. Exp. Board, LWK district office Braunschweig

Operation
Association farmer: (management)

Employees: 66

Sewage plant
Plant management contract with Braunschweig
Employees: 48

Field operation
Main sprinkler irrigation master
(Management of work)
-Sprinkler irrigation operation
4 Rainfall masters
-Sewerage operation
Maintenance and repairing
-Sludge utilization
Transport and disposal
-Workshop operation

Sprinkler irrig. control

Administration
- General administration
- Accountancy
- Technical Department
- Sludge Department

3.2 Board of Management 1995 and representatives

Board of management members	Representatives
1. Prof. Theodor Eggers, Meine	Theodor Eggers jun., Meine
2. August Rautenberg, Volkse	Eberhard Asche-Baumgarten, Leiferde
3. Heinrich Krüger, Wipshausen-Horst	Heinrich Holste, Groß-Schwülper
4. Dr. Günter Olfe, Leiferde	Hilmar Brennecke, Rietze
5. SGD i.SG Papenteich Gerhard Schulz, Meine	GD Hans Peter Reupert, Wendeburg
6. Councilor Dr. Ulrich Barkow, Braunschweig	Councilor Walter Sabathil, BS
7. Gov. building surveyor Dr. Klaus-J.Beckmann, Braunschweig	Building dir. Klaus-Jörg Radünz, Braunschweig
8. Mayor Werner Steffens, Braunschweig	Councilor Klaus Winter, BS

3.3 Committee 1995

Committee members	Representatives
Jürgen Holste, Groß-Schwülper	Olaf Genter, Groß-Schwülper
Hans-Dieter Dralle, Rothemühle	Werner Wiezoreck, Rothemühle
Günter Jacke, Harvesse	Heinrich Rautmann, Harvesse
Klaus Meinecke, Harvesse	Eckhard Gliemann, Harvesse
Helmut Feldmann, Neubrück	Heinrich Reinecke, Neubrück
Eckbert Bösche, Didderse	Heinz Rolfs, Didderse
Hans-Heinrich Müller, Didderse	Hermann Plack, Didderse
Heinrich Blickwede, Hillerse	Günter Büttner, Hillerse
Rolf Busse, Hillerse	Adolf Blickwede, Hillerse
Heinrich Dannheim, Hillerse	Heinz-Henning Gaus, Hillerse
Heinz Stöter, Hillerse	Bodo Löffler, Hillerse
Heinz-Robert Köhler, Volkse	Ernst Höper, Seershausen
Richard Hening, Volkse	Wilhelm Redecke, Volkse
Hans-Jürgen Fricke, Wipshausen	Heiko Sonnenberg, Wipshausen
Helmut Kemmer, Wipshausen	Heinrich Klages, Blumenhagen
Herbert Munzel, Wipshausen	Hans-Wilhelm Gödecke,Wipshausen
Hermann Lüer jun. Rietze	Karl-Adolf Hering, Rietze
Ernst-August Bunkenburg, Seershausen	Heinrich Hacke, Seershausen
Richard Prause, Ohof	Friedhelm Brand, Ohof
Mayor Albert Grove, Wendeburg	Friedrich Wilhelm Bratherig, Wendebg.
SGB Uwe Peter Lastin in mun. Schwülper	SGD Robert Janzen I. SG Meinersen
Municipal Managerial Dir Hans Ochmann, BS	Town chief advisor Volk, Braunschweig
Councilor Karl-Heinz Gerecke, Braunschweig	Councilor Dieter Oppermann, BS

3.4. Managing director

	Representative
Dipl. Ing. agr. Hans Lenssen - 1996 -	Herbert Blickwede
Dipl. Ing. Friedrich Seeßelberg - 1997 -	

3.5 Association board since 1954

Association chairman:

Farmer Alfred Jacke,
Harvesse 1954-1955

Farmer Harry Blume,
Wipshausen 1955-1964

Prof. Dipl. Ing. Theodor Eggers,
Meine since 1965

Board members since foundation:

Farmer Hans-ULrich Brandenburg,
Harvesse 1954-1959

Government building surveyor Ernst Rode,
Braunschweig 1954-1960

Farmer Heinrich Meyer,
Eickenrode 1954-1969

Councilor Willi Könnemann,
Braunschweig 1961-1963

Department directors:

Prof. Dipl. Ing. Theodor Eggers
Meine since 1954

Farmer August Rautenberg
Volkse since 1974

Mayor Werner Steffens
Braunschweig since 1972

Farmer Heinrich Krüger,
Wipshausen since 1979

Government building surveyor
Dr. Klaus J. Beckmann
Braunschweig since 1990

Farmer Dr. Günter Olfe,
Leiferde since 1994

SGD Gerhard Schulz
Meine since 1994

Councilor Dr. Ulrich Barkow
Braunschweig since 1994

Government building surveyor Prof. Willi Schütte,
Braunschweig 1961-1965

Councilor Herrmann Sonnenberg,
Braunschweig 1964-1970

Councilor Fritz Schmidt,
Braunschweig 1964-1971

Farmer Karl Genter,
Groß-Schwülper 1965-1978

Government building surveyor Dr. Konrad Wiese,
Braunschweig 1966-1990

Master-farmer Richard Hering,
Volkse 1969-1973

Managing directors:

Dr. Horst Ewert
Neubrück 1956-1982

Hans Lenssen
Celle since 1983

The Association Committee since 1954

Representatives of the agricultural members:

Rothemühle:

Dieter Dalle	1954-1978
Willi Wiezoreck	1979-1990
Hans-Dieter Dralle	since 1991

Groß-Schwülper:

Hermann Schaper	1954-1965
Heinrich Holste	1966-1988
Hermann Meyer	1986
Jürgen Holste	since 1991

Harvesse:

Otto Krüger	1954-1960
Willi Gliemann	1954-1965
Albert Pollmann	1954-1965
Jürgen Gliemann	1966-1985
Günter Jacke	since 1966
Klaus Meinecke	since 1986

Neubrück:

Karl Kemmer	1954-1970
Kurt Heine	1954-1975
Helmut Feldmann	since 1976
Rudolf Bösche	1971-1990

Didderse:

Theodor Heuer	1954-1960
Heinrich Eggers	1954-1965
Otto Müller	1954-1970
Gerhard Oelmann	1965-1970
Hermann Plack	1971-1990
Werner Eggers	1971-1990
Eckebert Bösche	since 1986
Hans-Heinrich Müller	since 1991

Hillerse:

Heinrich Pahlmann	1954-1965
Hermann Kalberlah	1954-1960
Heinrich Blickwede	1954-1970
Heinrich Busse	1961-1970
Walter Hentschl	1966-1970
Kuno Grobe	1971-1990
Rolf Busse	since 1971
Heinrich Blickwede jun.	since 1971
Heinrich Dannheim	since 1976
Heinz Stöter	since 1991

Wipshausen:

Werner Brennecke	1954-1960
Alfred Gebhardt	1954-1965
Heinrich Claus	1954-1970
Martin Schmidtke	1966-1972
Helmut Kemmer	since 1970
Oswald Blume	1972-1985
Herbert Munzel	since 1979
Hans-Jürgen Fricke	since 1986
Hans-Wilhelm Gödecke	1986-1990

Wipshausen-Horst:

Heinrich Krüger	1954-1960
Heinrich Brennecke	1961-1975
Heinrich Krüger jun.	1976-1978

Rietze:

Hermann Lüer	1954-1980
Hermann Lüer jr.	since 1981
Karl-Adolf Hering	1986-1990

Volkse:

Karl Hering	1954-1960
Richard Hering	1960-1968
August Rautenberg	1960-1973
Günter Olfe	1964-1990
Heinz- Robert Köhler	since 1976
Richard Hering	since 1986
Dr. Günter Olfe jun.	1991-1993

Seershausen:

Wilhelm Meinecke	1954-1960
Friedrich Hacke	1961-1975
August Bunkenburg	1966-1973
Albert Schrader	1974-1975
Ernst-August Niebuhr	1976-1985
Ernst-August Bunkenburg	since 1986
Heinrich Hacke	1986-1990

Ohof:

Adolf Borsum	1961-1970
Richard Prause	since 1965

Representatives of the communities:		Representatives of the City of Braunschweig:	
Director of the local authority Meyer, Wenden	1968-1969	Senior administration executive Eberhard Blank	1954-1956
		Councilor Heinz Schefzyk	1954-1960
Mayor Theodor Heuer Didderse	1969-1976	Municipal Managerial Dir.Theo Backofen	1956-1985
Mayor Gustav Zimmermann, Hillerse	1970-1972	Councilor Bernhard Schneemann	1961-1964
		Councilor Konrad Evers	1964-1972
Community director Gerhard Schulz, Meine	1976-1993	Senior council executive Guenter Jaenicke	1972-1985
Mayor Albert Grove Wendeburg	since 1977	Municipal director Hartmut Awe	1986-1991
		Councilor Hans Ewers	1986-1990
SGD Peter-Uwe Lestin Gross-Schwülper	since 1994	Councilor Walter Sabathil	1991-1993
		Municipal Managerial Dir. Hans Ochmann	since 1992
		Councilor Karl-Heinz Gerecke	since 1994

3.6 Personnel

The administration and organization is managed by the farmer of the Association who has a Master degree in agriculture supervises the day to day tasks, especially the daily intake and distribution of the wastewater, in consideration of the water and agricultural needs and he has to meet the standards and conditions of the Board of Control.
There is a chief sprinkler irrigator, four master sprinkler irrigators, a master electrician as well as a master of workshop who are responsible for the sprinkler irrigation.
The sludge utilization is organized and performed by an agro-engineer with the support of a certified farmer.
The Wastewater Association Braunschweig has 67 employees

	Full time employees	Part time employees
Administration	7	5
Workshop	7	
Sprinkler irrig. and agriculture	47	1
Total	61	6

3.7 Management condract with the city of Braunschweig

The Wastewater Association Braunschweig is the owner and manager of the Sewage Treatment Plant Steinhof, which was built by it. The operation management of the Sewerage Treatment Plant has been assigned to the city by an operation management contract. The necessary personnel is supplied by the city, who is its employer. The operation of the sewage Treatment Plant is done by 48 employees.

4. Finance administration

The finance administration of the Association has expanded since 1981 due to overtaking of tasks and huge investments, especially in the Sewage Treatment Plant Steinhof.

4.1. Investments since the Association foundation (position 31.12.94):

Sprinkler irrigation	59,1 Mi. DM
Sludge utilization	1,4 Mi. DM
Sewerage - Association Plants	24,5 Mi. DM
Sewage Treatment Plant	123,0 Mi. DM
Block Heat Power Station	21,0 Mi. DM
Total investments	229,0 Mi. DM

4.2 Development of fees

Due to the extension of the works and the enlargement of the Treatment Plant, the contributing volume increased considerably, as shown in the following numbers:

Year	1965/66	1975	1985	1995
Farmers	284.670 DM	365.500 DM	373.810 DM	345.900 DM
Braunschweig	593.500 DM	1.608.665 DM	8.352.080 DM	38.657.121 DM
Communities	-	1.101.600 DM	3.245.800 DM	4.600.774 DM
Total	878.170 DM	3.075.765 DM	11.971.690 DM	43.603.795 DM

4.3 Budget development (Administration budget)

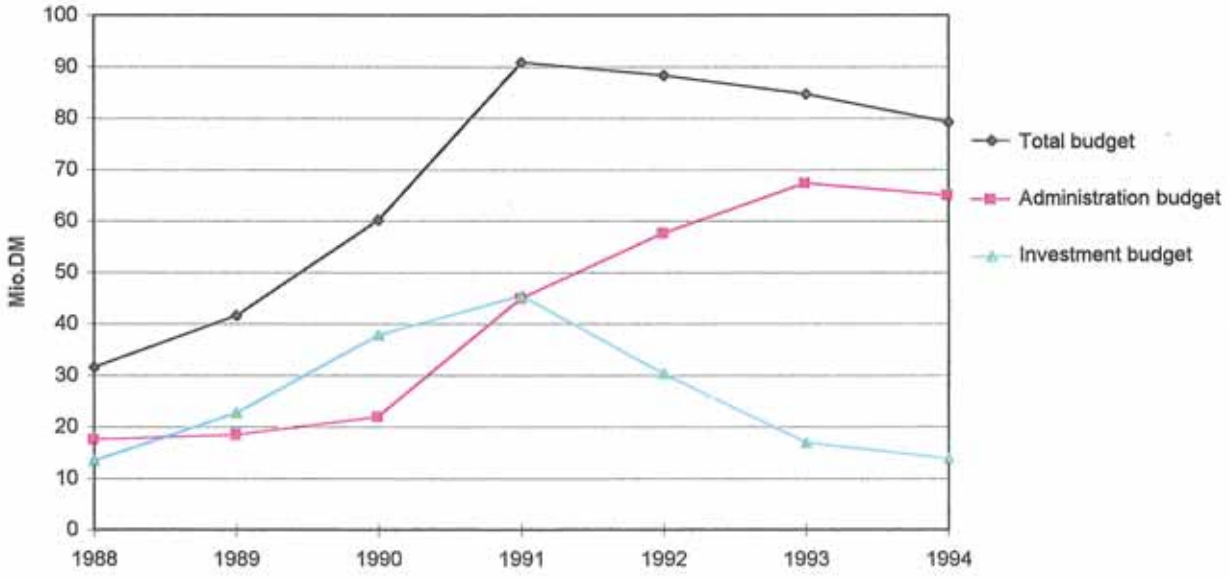
Because of the under 4.2 mentioned reasons, and of the development of the computer system , the budget has changed significantly:

In thousand DM

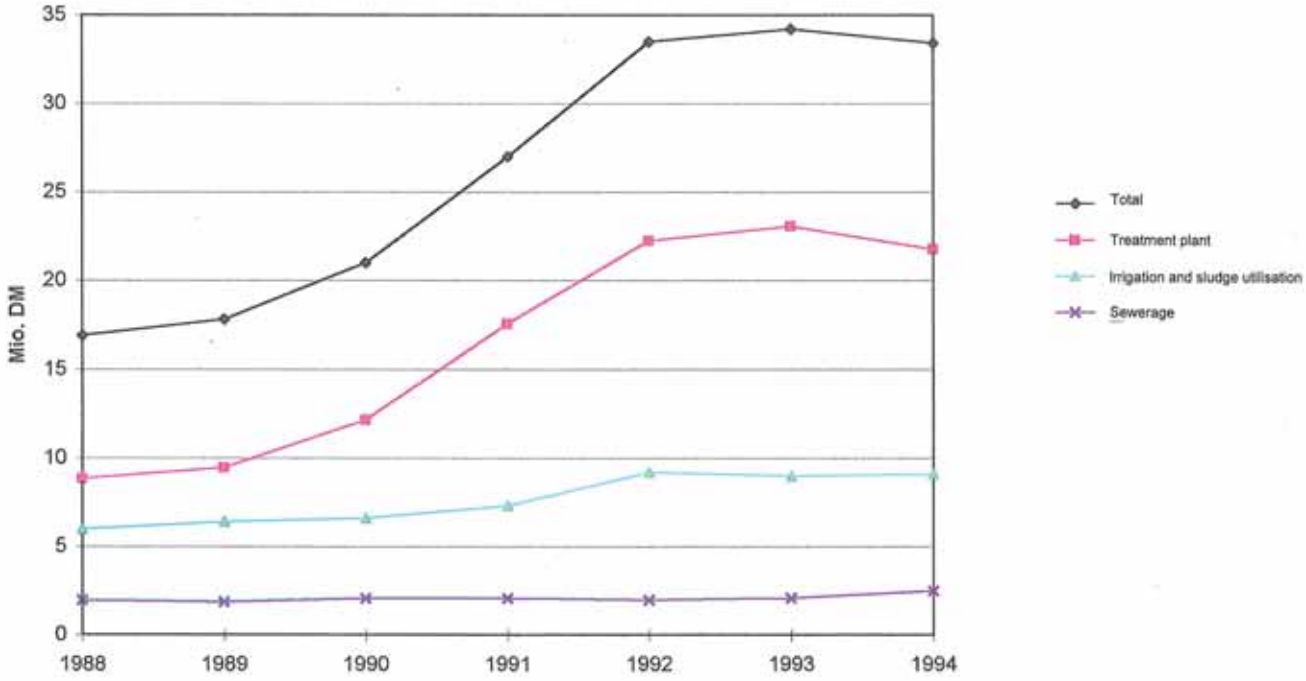
Year	1965/66	1975	1985	1995
Sprinkler irrig.[1]	1.838	3.142	8.615	10.770
Sewarage[2.1]	-	1.725	4.090[2.2]	2.636
Treatment Plant[3]	-	-	2.911	23.648
Agriculture[4]				827
Industrial enterpr. operation[5]	-	-	-	528
Garbage water of infiltration[6]	-	-	-	6.956
Contribution effective budget	1.838	4.867	15.616	45.365
General financial management[7]				22.013
Total budget	1.838	4.867	15.616	67.379

[1] since 1992 with sludge utilization
[2.1] since 1969
[2.2] Still with depts service community local network
[3] since 1979
[4] for 1985-1989 in sprinkler irrigation plan included.
[5] since 1990 separate plan, before in sprinkler irrigation included.
[6] since 1991
[7] since 1991

Budget development since 1988



Contributions of members since 1988



5. Environmental impact

When the Association was founded, the now common terms "recycling" and "environmental protection" were unknown. The concept of the Association, to return water, organic substances and nutrients to the natural cycle, was at that time pointing to the future and fulfilling a need, which 40 years later was to find expression in the "Cycle Economy Law". The sewage Association Braunschweig can refer to 40 years experience. The works were constantly improved to the present high standards.

5.1 Water quality

Up until the completion of the sewage treatment plant Steinhof the wastewater had been purified through soil treatment after the mechanical treatment only. The soil works as a bioreactor, which includes all the functions of a biological purification. The now existing sewage treatment plant protects the soils from harmful substances, particularly those from industrial areas. This can only be achieved by controlling the potential discharges of harmful substances into the soil, as it has been done consequently for the last 12 years. The results of these measures are illustrated obvious in the diagrams.
With the additional soil treatment of the treated water, which is still done, the positive effects on the soil are used further. Thus the water, before reaching the groundwater or the Oker through the drainage and ditches , is purified the results being similar to that being achieved almost only by a filtration plant.

The water quality of the Oker, as presented on the back cover sheet, has been considerably improved through the wastewater soil treatment. Only the residual pollution from treated sewage water, could considerably pollute the Oker - especially at low water flow.

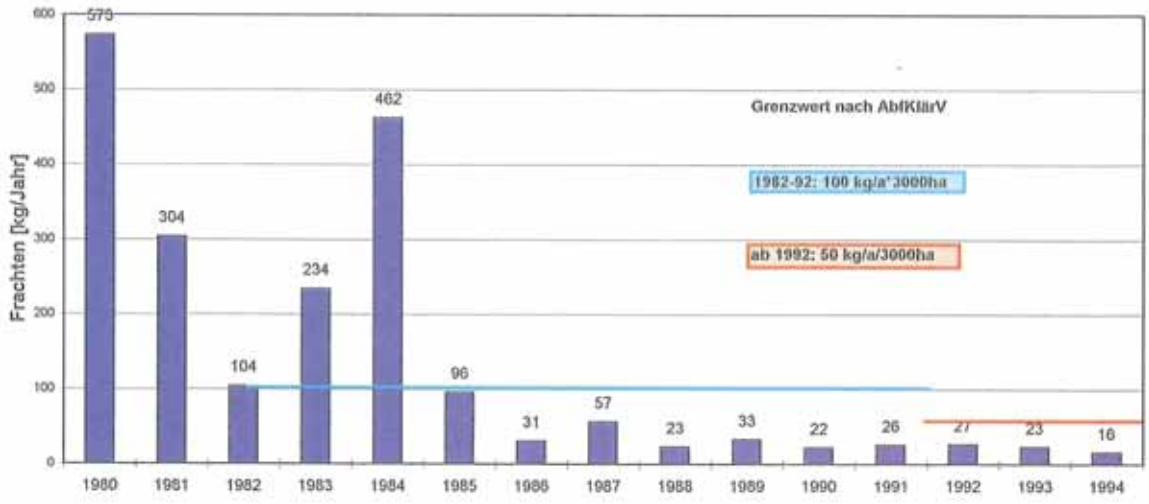
The following table gives information about the purification of the sewage treatment plant - two ways operation - and about the soils, based on the drainage ditches to the Oker channel Volkse and about a groundwater observation borehole.

Values 1994	NO_3-N mg/l	NH_4-N mg/l	P mg/l	CSB mg/l	BSB_5 mg/l
Treated effluent					
a) poor nutrient operation	3,4	1,10	0,70	33	3,8
b) rich nutrient operation	19,4	1,70	7,90	350	27,0
Oker channel Volkse	13,7	1,14	0,09	17	3,0
Borehole 3	2,3	0,07	0,04	18	3,9

5.2 Groundwater impact

The reuse of treated wastewater through the sprinkler irrigation on the fields causes an additional groundwater recharge. This fact based on the mentioned water qualities can be regarded as positive. It can be stated, that most of the water used in the city area of Braunschweig, is returned into the hydrological cycle in the surrounding area.

Cadmium-load in wastewater (1980-1994)



Sprinkler

5.3 Hedges

An essential task of the Association is the planting and maintenance of the hedges. As already mentioned in the Association area chart, 100 km hedges are maintained over an area of 70 ha.
The hedges which protect roads and buildings from sewage spray, possess a great ecological and cultural value:

- Noise and sight protection: Hedges play an important part for the protection against noise and exhaust fumes as green zones along the roads.
- Wind protection: Based on measurements wind is slowed down up to a distance corresponding 20 to 30 times the height of the hedge. So the light sand soil is protected from wind erosion.
- Habitat: For many animals the hedges are a biotope, for small animals in the soil or for birds as nesting place.
- Network: As linear landscape element the hedges lead to a network for habitats. Along the hedges for example a part of the migration movement of toads take place.
- Landscape: The landscape in the Association area is characterized by the hedges. Through the parceling of the agricultural areas and through the green areas along the roads the visual impression is considerably improved.

Review - Outlook

The soil treatment of the wastewater is the oldest method of wastewater disposal. It has been applied well into this century in many cities in the form of surface flooding. Only in some cases this natural method is further used and improved. The reduction in available areas for the extension of the surface flooding areas for the accommodation of the increased wastewater and the developments in the sewage treatment technique are the main reason for this.

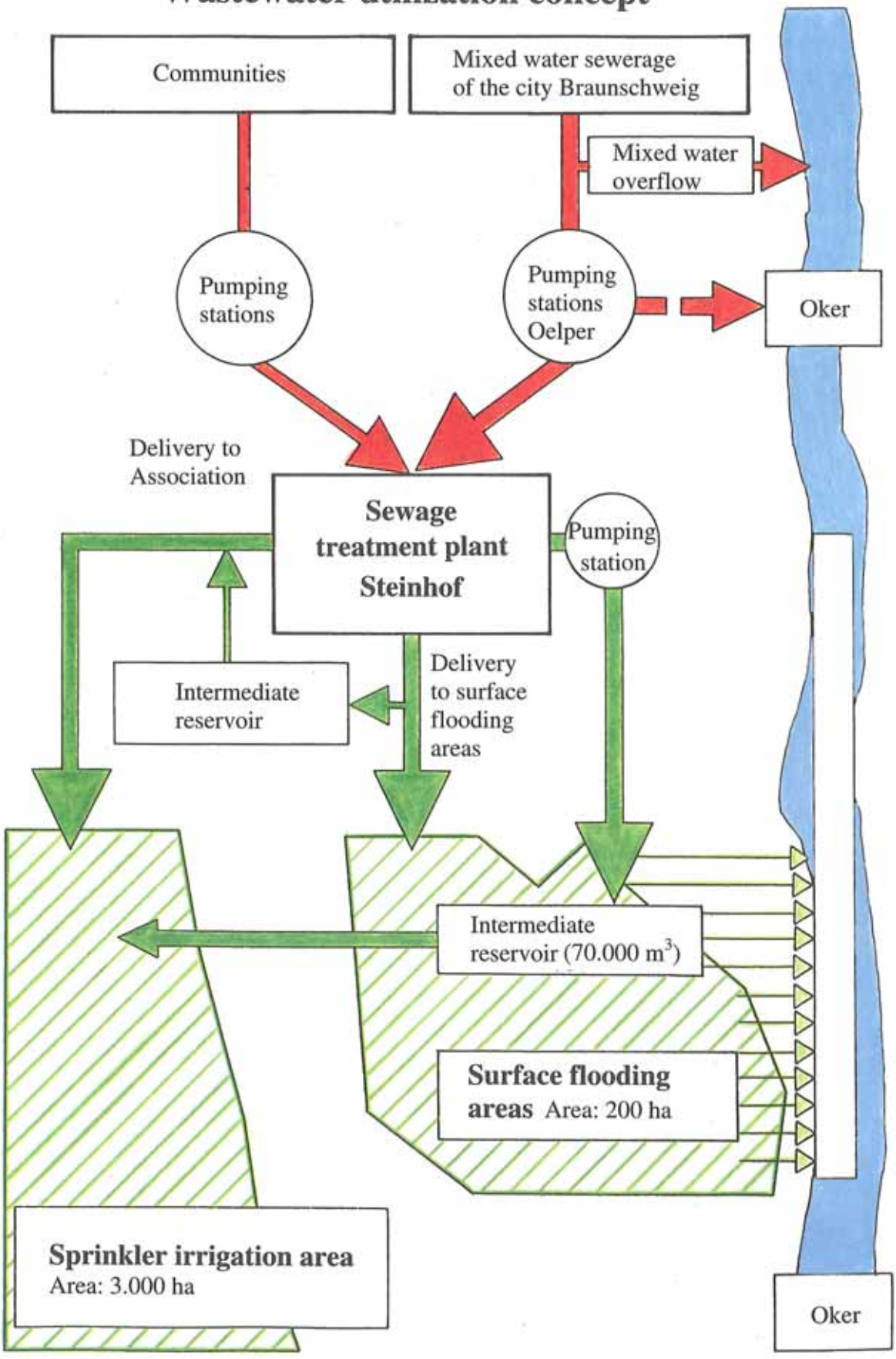
The Sewage Association of Braunschweig has with perseverance maintained and improved this system in cooperation with the city of Braunschweig. The wastewater irrigation has improved as the population has increased and odour nuisance was eliminated. Many problems were solved, many difficulties have been overcome.

The sprinkler irrigation area after 4 decades represents itself as an area, in which agriculture and landscape in particular, are brought in harmony. Surely the ideal system of the anti-spray protective hedges along housing estates and roads as well as the anti-wind protective hedges have contributed to this. One can only wish for such hedges bordering the roads and residential areas everywhere.

The agricultural utilization of the treated wastewater and the sludge is the objective of the Association also in the future decades. It is necessary for achieving this objective in the future - as up to now - to muster up all one s strength regarding the refinement and improvement of this system. It can only be hoped, that this will not be destroyed by unfounded ideas, laws and regulations.

Sewage Utilization Association
Braunschweig

Wastewater utilization concept



after Dr. Sowa

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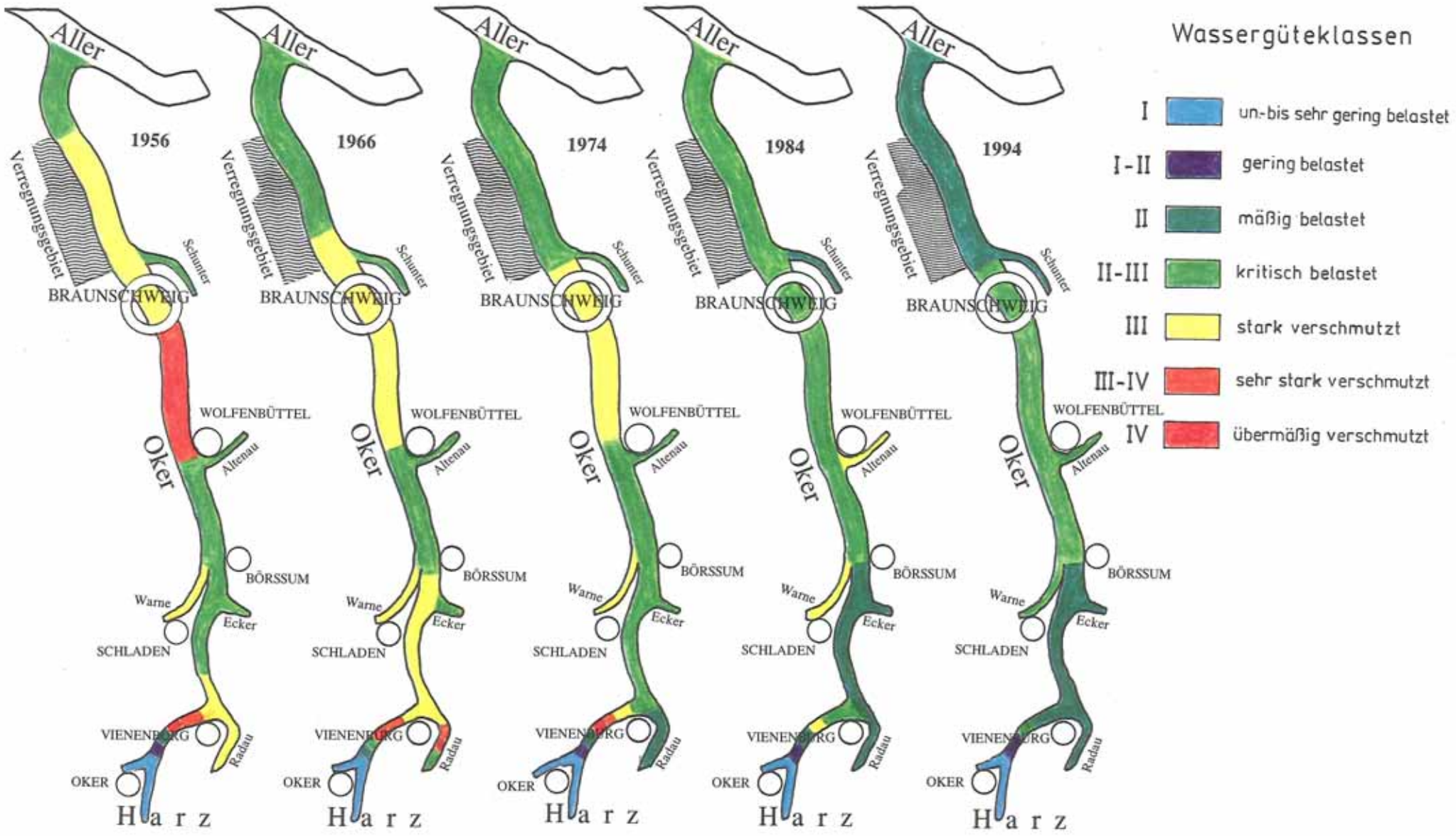
Aller
1956
1966
1974
1984
1994
Verregnungsgebiet
Schunter
BRAUNSCHWEIG
WOLFENBÜTTEL
Oker
Altenau
BÖRSSUM
Warne
Ecker
SCHLADEN
VIENENBURG
Radau
OKER
Harz
Wassergüteklassen
I un-bis sehr gering belastet
I-II gering belastet
II mäßig belastet
II-III kritisch belastet
III stark verschmutzt
III-IV sehr stark verschmutzt
IV übermäßig verschmutzt