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Exposure Visit and Seminar 3 - 14 October 1994: Objective, Methodology, Programme and Material

Descriptive report

IRC International Water and Sanitation Centre

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A Background

In order to alleviate problems in states in Central and Eastern Europe (CEE) and the former Soviet Union (FSU) regarding quality and quantity of drinking water, the Netherlands Ministry of Housing, Spatial Planning and the Environment (VROM) has in 1992 taken the initiative to identify areas and means for transfer of Dutch expertise for this purpose.

VROM has contracted IRC International Water and Sanitation Centre (IRC) in The Hague to study the need for transfer of information and expertise on water supply and sanitation.

A part of the assignment was an exposure visit to gain an impression of Dutch sector experiences and a seminar which was organized in September 1994 for representatives of four CEE countries (Bulgaria, The Czech Republic, Romania and The Slovak Republic) in the Netherlands together with their hosts. The participants came from relevant Ministries of their countries or were managers of large water supply or sewerage utilities.

During the seminar it became obvious that the objectives, the structure and the programme as well as the material produced and presented during the event was very valuable for all participants. To learn from the experience of organizing this exposure visit and seminar VROM asked IRC to develop the material, to collect it and to present it as a report. This activity can be seen in context of the recently held Ministerial Drinking Water Conference, as a follow-up activity to promote exchange of experiences and information in the sector.

B Overall objective

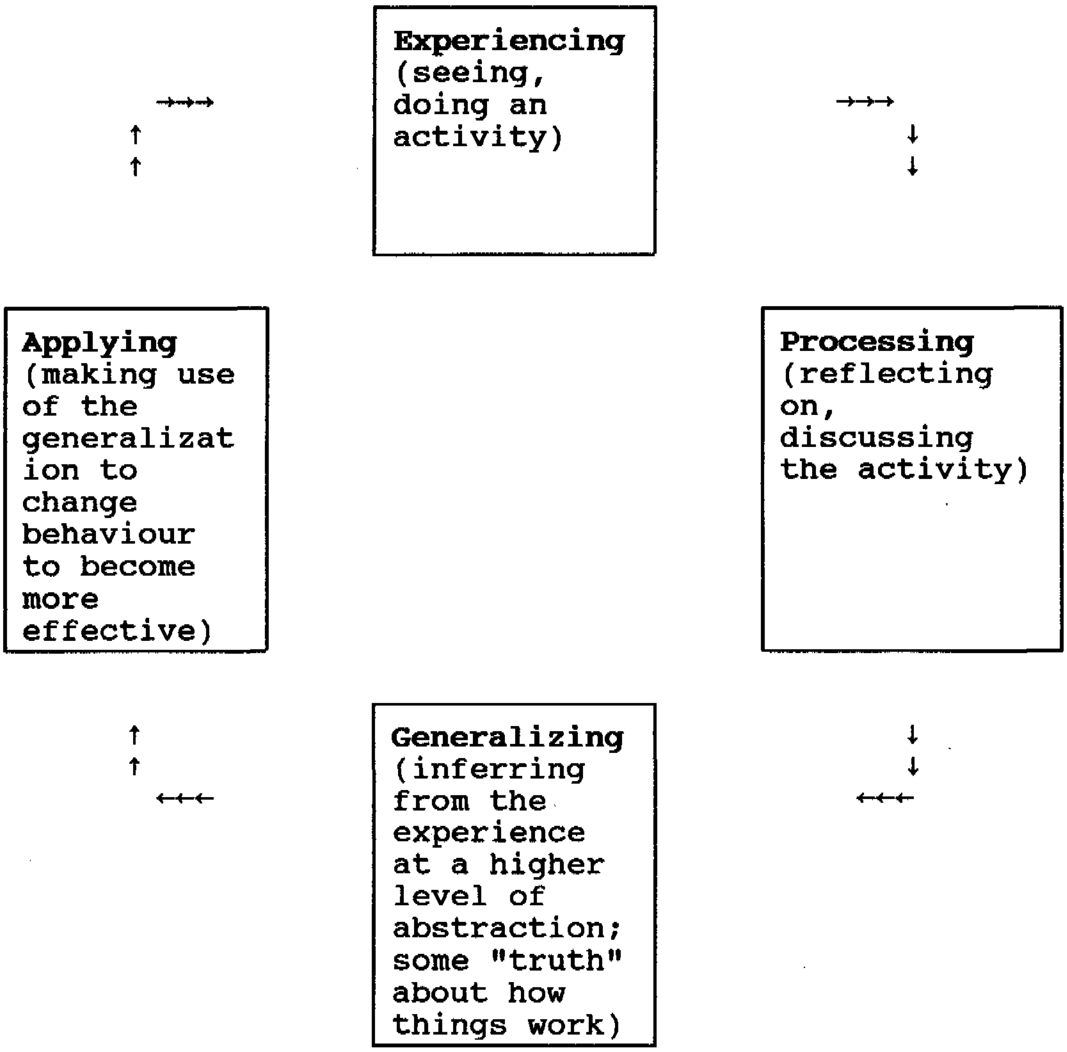
The overall objective of the exposure visit and seminar was to expose the participants from Bulgaria, the Czech Republic, Romania and the Slovak Republic to the Dutch water and sanitation sector and to exchange experiences gained in the Netherlands and the four countries in transition. Recommendations for possible future cooperation were expected as well, based on the exposure visit, discussions in the seminar and working groups in the seminar.

The idea behind the exposure visit was to show how the Dutch water and sanitation sector is managed and operated in a market economy to support a change of management and financing practices in the four countries after the political change.

The content of the programme was selected on the basis of a desk study, a mission to Slovakia and Bulgaria and an exchange of views among the participants. From the above studies it became clear that these countries have technically skilled people, the basic infrastructure and sufficient water resources. They are, however, lacking knowledge on how to sustainably manage these resources. They also lack the experience of using the resources in a cost-effective manner. Thus it was concluded that knowledge related to management operation and financing of water and sanitation systems were the essential issues to focus upon in the programme. Within these issues there were also few aspects that needed special attention, such as relations between legislation and control mechanisms, public relations, integrated water resources management and pollution control.

C Programme of the Exposure Visit and the Seminar

The programme was designed to correspond to the adult learning cycle to achieve the overall objective of it.



The cycle starts from experiencing, continues with processing, followed by generalizing and is concluded by applying.

Each day was designed according to the adult learning cycle. The introductory part consisted of a small number of lectures which guided the discussions and the observations/experiences, which followed. The first week had an emphasis on the professional level and the second on the decision-making level.

The objective, procedure and material presented to the participants is given below.

Day 1, Monday, Introduction

Objective

To make the participants feel welcome for the exposure visit and to clarify what participants and coordinators could expect from each other and from the programme during the two week event.

Procedure

The participants and representatives from the Ministry of Housing, Spatial Planning and Environment and from the IRC International Water and Sanitation Centre introduced themselves to each other. The programme of the two weeks was presented and the expectations of the visit were discussed. It turned out that three of the participants wanted to visit another three sites, which could be arranged as an extended programme for the three participants.

In the evening a dinner was arranged for all the participants and the representatives of the hosts. During the informal dinner the participants had an opportunity to get to know each other and the coordinators gained a clearer idea of the aspects the participants would like to discuss at the various sites.

Material

Exposure Visit and Seminar Programme.
Tourist information about Holland.

Key-issues

Introduction of the event / getting to know each other / clarifying expectations.

Day 2, Tuesday, Presentations on water and sanitation sector status in participating countries

Objective

To present the water supply and sanitation conditions in the five participating countries and to introduce and discuss together the major issues to be dealt with during the programme.

Procedure

The four country delegations presented state-of-the-art information on water supply and sanitation. From the Netherlands a number of persons from the water sector had been invited to share information on their organizations and place in the overall Dutch water sector, touching on issues such as legislation, water and sanitation management, investment policy and tariffs, information sources in the sector and water boards and elections. After their presentations the participants had an opportunity to ask questions as well as to tell how these things work in their countries.

Material

IRC (1994) Background papers. Exposure Visit and Seminar Water, Sanitation and Environment, The Hague, 3 - 14 October, 1994.

Key-issues

Introduction to the sector status in the countries / discussion on focal points.

Day 3, Wednesday, Regional water supply system - Gelderland

Objective

To gain an understanding on how Dutch regional water supply systems are designed, constructed and managed. The emphasis was given to client/consumer orientation and to the set-up of a socially controlled commercial company as well as the relationships between the water supply system and other actors in the sector, such as legal institutions and the users.

Procedure

The participants visited N.V. Waterleiding Maatschappij Gelderland, a regional water supply system. The managers of Gelderland gave lectures about their system, showed the participants one of the production units and participated in the concluding discussion. The visit was very much appreciated by the participants. They got a good idea on how the system is managed and operated and what problems this system is facing and how the problems are being tackled. The presentation on consumer relations was of special interest to the participants

Material

WMG (1994) Water supply company Gelderland, Cooperating in finding solutions for groundwater management problems in Gelderland.
Ir. S. van Dongen, Distribution. WMG

Key issues

Regional water supply organization / self financing principle / consumer relations.

Day 3, Wednesday evening, Visit to a consultancy firm - DHV

Objective

To get an understanding how a private consultancy firm is working in the Dutch water sector, which tasks they undertake, financial management, expertise, etc.

Procedure

The representatives of the company introduced their enterprise and gave lectures about their projects and contractual procedures. After discussion where the participants and their hosts clarified their positions towards consultancy in the sector, a demonstration of computer aided design was made. The hosts offered a dinner to the participants to conclude the visit.

Material

DHV (1994) DHV Integrated sewer management system
DHV (1994) Broadening horizons and setting the trends
DHV - Description of project areas

Key issues

Role of an international consultant / technical competence / role of the client.

Day 4, Thursday morning, Sewage treatment plant - Delfland

Objective

To get an understanding of how a Dutch sewage treatment plant is managed, operated and financed.

Procedure

The participants were introduced to the overall organization and management of Hoogheemraadschap van Delfland, to the government requirements they have to follow and to how a specific water treatment plant is managed and operated (The Nieuwe Waterweg). The participants also had an opportunity to visit the treatment plant described to them.

Material

Hand-outs related to the Waste water treatment plant - The Nieuwe Waterweg.

Key issues

Line of responsibility in sanitation and drainage / control mechanism from the point of view of an executing agency.

Day 4, Thursday afternoon, Big local water supply system - Watercompany Europoort

Objective

To get an understanding how a big local water supply company is structured, organized and managed as well as its relations to other actors in the water sector.

Procedure

A visit was made to a water treatment plant in Rotterdam/ Beerenplaat where the visitors were presented with information on the ownership, organization, management and income generation of the plant. After the presentations, the production units were described through lectures and a guided tour through the Beerenplaat.

Material

Information brochures on the Baanhoek, Beerenplaat and Kralingen Production Units.

Key issues

Role of an independent, communally owned commercial water company.

Day 5, Friday morning and mid-day, Case study - workshop

Objective

To become aware about similarities and differences between the Netherlands and the four countries when it comes to organization, financing, management and public relations of the water sector.

Procedure

Four Dutch specialists presented one case each on management, financing, public relations and organization aspects of a local water supply company. These highlighted the cooperation between different actors, sectors and different administrative levels. After the presentations the participants were divided into four groups with one Dutch specialist in each to answer questions and to stimulate discussion where organization of the sector in the Netherlands and in the four countries were discussed.

Material

N.V. Watermaatschappij Zuid-Holland Oost (1994) General management of water supply in South Holland by WZHO.

Key issues

Generalization of the experiences of the previous days.

Day 5, Friday afternoon, Milieukontakt - a non-governmental organization active in the sector

Objective

To introduce an alternative, informal control mechanism of the water sector in the Netherlands. To become familiar with twinning arrangements between non-governmental organizations in the Netherlands and in the participants' countries.

Procedure

A representative of the Milieukontact Oost Europa gave a lecture and facilitated a discussion on the role, activities and influence possibilities of a non-governmental organization in the Netherlands and its contacts to the countries in Central and Eastern Europe.

Material

No material

Key issues

Role of the public opinion / cooperation between NGO's.

Weekend

Objective

To give the participants an opportunity to see and to experience the Netherlands on their own.

Procedure

No programme was arranged. The participants had received tourist information on the Netherlands when they arrived. During the wrap-up discussion some suggestions were made for the weekend but it was left open for the visitors to decide their own programmes.

Key issues

Recreation

Day 6, Monday morning, Legislation - Ministry of Housing, Spatial Planning and the Environment and the Ministry of Transports and Public Works

Objective

To get to know the legal framework and the control mechanisms related to water and sanitation in the Netherlands and how they are enforced.

Procedure

The legislation and control mechanisms of water supply and sanitation in the Netherlands were described in lectures by the Ministry of Housing, Spatial Planning and Environment and the Ministry of Transport and Public Works.

Material

Ministry of Transport and Public Works (1991) Water in the Netherlands a time for action. National policy document on water management.
Ministry of Transport and Public Works (1994) Annual report Rijkswaterstaat 1993
Ministry of Housing, Spatial Planning and Environment (1994) Drinking water in the Netherlands
Ministry of Housing, Spatial Planning and Environment (1994) National Environmental Policy Plan 2. The environment: today's touchstone. Summary.

Key issues

Lines of responsibility / division of tasks.

Day 6, Monday afternoon, Dutch Governmental Institute for Inland water management and waste water treatment (RIZA)

Objective

To be informed and understand how the formal control mechanisms are used in the Netherlands in order to ensure good water quality and quantity.

Procedure

Lectures were given on the variety of control mechanisms RIZA is making use of and how they are cooperating with the Ministries, the water authorities and the public.

Material

RIZA (1993) Protection against flooding
RIZA (1993) Inland water information and warning centre
RIZA (1993) International
RIZA (1992) Rivers
RIZA (1992) AWZI - 2010 treatment of industrial waste water
RIZA (1993) The Netherlands
RIZA (199?) Institute for inland water management and waste water treatment
Rus, J. (1994) Enforcement of the surface water pollution act

Key issues

Enforcing legislation.

Day 7, Tuesday morning and afternoon, Sewage treatment and management - Hollandse Eilanden en Waarden

Objective

To increase the insight into Dutch methods of sewage treatment including aspects on latest technology and how it is financed.

Procedure

First, lectures were given on the wastewater treatment in this area and how the plants are managed. Then, presentations followed on the technology used. Afterwards the participants visited a sewage treatment plant and a sludge incineration plant.

Material

No material

Key issues

Example of a sewerage system and sludge treatment.

Day 7, Tuesday evening, Visit to a consultancy firm - IWACO

Objective

To get a second exposure to how a private consultancy firm is working in the Dutch water sector, which tasks they undertake, financial management, expertise, etc.

Procedure

A general introduction to IWACO and three project specific presentations were given. One of the project descriptions covered one of IWACO's projects in Bulgaria. From this discussion a lot of important questions were raised such as how local partner organizations are chosen by Dutch agencies and what the conditions for both partners should be in a contract.

Material

General information on IWACO

Key issues

Comparison of consultancy companies (re: DHV)

Day 8, Wednesday, Role play on environmental degradation

Objective

To obtain an insight into the formal and informal aspects of a governmental project such as, planning, decision-making and implementation in a large environmental project in the Netherlands. To see how various actors and opinions can be involved in such a project and how difficult it is to successfully reach a solution.

Procedure

The participants were explained the objectives and procedure of the role play. Then representatives of each actor/interested party in the real case of the Hollandse Ijssel playing their role, explained in detail the point of view of the interest group they represented, and then the ways how they had influenced the process of planning the mitigation measures of the pollution. The case was further enlightened in a debate which followed.

Material

IHE (1994) Rehabilitation of the river Ijssel

Key issues

Model of decision making and mitigation actions in a western democracy.

Day 9, Thursday, The Seminar, first day

Objective

To allow the participants to express their views and to exchange information on what they have learnt during the two weeks. To stimulate them to think of possibilities how they could benefit from the acquired experiences when back in their own countries and to discuss the possibilities of future cooperation between their own countries and the Netherlands.

Procedure

The participants presented what they had learnt from the visits and lectures during the exposure visit through reflecting on their impressions versus their country reports. The coordinators gave feed-back and raised questions to further stimulate ideas for the transfer of information and technology. A presentation of financing possibilities and procedures was given to stimulate the group work by a representative of the PHARE-project (EU). The participants were divided into two groups which addressed institutional and technical issues, and managerial and financial issues. The workshop ended with country specific recommendations for cooperation between the countries.

Key issues

Applying the experiences gained during the exposure visit.

Day 10, Friday, The Seminar, second day, and wrap-up

Objective

To clarify what kind of follow-up could be expected from this exposure visit and seminar. To receive feed-back from the participants of the exposure vist and seminar programme.

Procedure

The day was opened with a summarizing presentation by the coordinators. In this connection the follow-up process was also described. It was followed by presentations on experiences on twinning and training cooperation from the point of view of the Netherlands Association of Water Works and Universities.

Finally an evaluation was made of the programme.

The exposure visit and the seminar was closed and the official thanks extended.

Material

The final report of the project will be sent to the participants.

Key issues

. Wrap-up and follow-up / social aspects

J.J. van Soest:

WATER LAW IN THE NETHERLANDS

Organization: central government and lower authorities

Water Boards

In The Netherlands, water management has been for centuries a topic of interest for central and local government. Already in the early Middle Ages the making of polders and the construction of dikes in these "Low countries near the sea" was a task for government. The typical dutch institute of "Water Boards" took care of this matter. The responsible authority in these Boards is not being chosen by general elections, but by and amongst the ground owners: they have to bear the financial burden and are certainly the most interested party.

Central Government

The important task of Central Government in this matter was originally laid down in the Constitution. Afterwards, it was worked out in many Acts. Most prominent is now the Act on Water Management, although there are Acts covering other spheres of interest, e.g. spatial planning and environmental protection, that are also important in this field.

Provincial Authorities

Above the Water Boards are the Provincial authorities. They are chosen by general elections. They are also deeply rooted in history: before the French Revolution (that had also its effects in The Netherlands) they were practically autonomous. After this Revolution Central Government took over most of their functions, but their control over the Water Boards remained.

Municipalities

Also the Municipalities have a task in water management. Generally they are responsible for the sewerage systems. Sometimes they are also owners of local canals and harbours. The big harbours of Rotterdam and Amsterdam are under municipal supervision. The municipal boards are formed by general elections. Municipalities belong to the same government layer as the above mentioned Water Boards. They are both controlled by provincial governments.

Central Government: supreme control, control and management

In The Netherlands the Minister of Public Works is entrusted with the supreme control over water management. Generally speaking, this task is coordinating. For the execution of this task he disposes of a State Service on Water Management (Rijkswaterstaat). This large Service consists of several departments, amongst which are the Department of Integral Management of Sweet Waters and Sewage Water Treatment RIZA and the Department on Tide Waters (Dienst Getijdewateren). some other Ministries are also partially entrusted

with water management, e,g, the Ministry of Defence. The Ministry of Housing, Spatial Planning and Environmental Protection (VROM) is entrusted with the care for groundwater protection. Co-ordination takes place in the Interministerial Commission on Environmental Protection. As an independent high-level advisory body there is also a Council on Water Management, consisting of specialists in this field.

Under direct control of central government are the big rivers, the estuaries and the big shipping canals. Regulations concerning this control have been made by law.

Provinces: supervision and management

The control of the Provinces over the Water Boards (and the Municipalities) is equally regulated by law. For the Water Boards these are the Provincial Act and the Act on Water Management. The Province can establish new Water Boards and change existing ones under approval of the Crown (Queen and Ministers). They can equally under Crown supervision make reglementations for the Boards. The Boards need provincial approval for their ordinances (Keuren). The Municipal Act regulates the control of the Provinces over the Municipalities.

The provinces control also ground excavations by licensing. They have the general management of ground- and surface waters, insofar as it is not entrusted to others. Regulations concerning this management are laid down in the Ground Water Act, tne Water Management Act, the Waste Water Act and in Provincial Ordinances.

For the management of ground- and waste waters they dispose of Advisory Committees.

Water Boards: supervision and management.

The tasks of the Water Boards are restricted to water management. This contains, generally speaking, the dikes. the polders and their water levels, sewage purification and canals and (dike-) roads of local interest. They control the maintenance obligations of ground owners and -users. They let them pay taxes for their management coasts.

Communities: management

Because the communities deal with all public interests in their areas, they deal also with water management: construction and maintenance of sewerage systems, canals and harbours. Where the interests are coupled with those of the Water Boards, they have to function in mutual agreement.

Operational management of surface- and groundwaters

Act on Water Management

This Act contains regulations on water management in general and on quantitative management of surface waters.

The **General management** is contained in a Government Note. This Note gives:
1. an indication of the most important functions of the surface waters belonging to the central system of water management.
2. Indications for further definitions of water management systems.
3. In connection with the above mentioned functions, indications on the further development of the water management systems or parts thereof, with deadlines.
4. An indication on the measures, needed for this development.
5. An indication of the financial, economic and spatial consequences of this development.

The Government Note has to be revised every four years.

There are also Government Notes on Spatial Planning and on Environmental Protection, prepared by the Minister of Housing, Spatial Planning and Environmental Protection. These Notes are also important for water management. They are, therefore, prepared in close cooperation with the Minister of Public Works.

For the surface waters under their direct supervision the Ministers of Public Works and of Housing, Spatial Management and Environmental Protection make a management plan, wherein are indicated:
- their different functions;
- the program for their development and protection, with deadlines;
- the management systems under normal and abnormal conditions;
- the finances, needed for the management and the execution of the program.

Also this plan has to be revised every four years.

The provinces make also their general Water Management plans, wherein are indicated:
1. The most important functions of the regional water systems;
2. measures for their development and protection;
3. a program for groundwater management and its financing;
4. nature and scope of other planned measures;
5. financial and economic consequences of the program.

Other bodies responsible for water management, like the Water Boards and the Municipalities, are equally obliged to make management plans for the surface waters under their control.

Next to the Water management Act, there are other Acts important fot water management.The most important Acts are: the Act on Spatial Planning, the Act on Environmental protection and the Act on the Protection of Nature.

The Water Management Act contains, as mentioned, also rules on **management of surface waters.** Management tools are:
- registration of affluent and effluent water quantities;
- regulation of water levels;
- management agreements between authorities entrusted with water management;
- licenses for water abstraction;
- regulations for abnormal conditions.

Waste Water Act

This Act prohibits the discharge of polluting substances (solid or fluid) into surface waters without a license. The discharge of some listed very noxious substances is, however, in accordance with directives of the European Communities, restricted to very low levels.
For the waters under central government control the State Service on Water Management is the licensing authority, the other waters are under control of the Provincial Governments. In most cases the Provinces have, however, their licensing task delegated to the Water Boards.
The costs to prevent pollution (i.a. by sewage purification plants) are compensated by levies at the charge of polluting industries. They are taxed according to the polluting load of their discharges. Household discharges are taxed at the cost level of three inhabitant equivalents; one-person households are on request taxed for one equivalent. For industries the levies are a strong incentive to reduce their waste water discharges.

Ground Water Management

Quantitative management

This is regulated in the Ground Water Act, under supervision of the Minister of Housing, Spatial Planning and Environmental Protection. Control on ground water abstractions is entrusted to the Provincial Authorities. Practically every abstraction above 10 m3/h needs a provincial license. A Central Technical Committee, consisting of experts in this field, is availible for consultation by the Provincial Authorities. There are also provincial Water Committees, consisting of delegates from groups with interests in water affairs. They have i.a. an advisory task in licensing of ground water abstractions.

Qualitative Management

This is partly regulated in the Act on Environmental Protection, regarding the protection of ground waters for public water supply, by provincial ordinances.
This Act contains also regulations on plans and programs on soil- and ground water protection, to be made by central and provincial government.
The Act on Soil protection contains rules on general protective measures, to be made by Royal Decree. Quite a lot of these protective measures have in the meantime been issued.
The Act on Spatial Planning plays also a role in ground water protection, because in regional spatial plans, made up by the Provinces, ground water protection areas are mentioned to be kept free from building activities etc.

Water management and Public Water Supply

At the end of this summary it may be useful to make mention of public water supply as an activity, whose interests are strongly connected to water management.
Public water supply makes use of (sweet) ground waters, as well as of surface waters. Two thirds of water demand is covered by ground waters, one third by surface waters.
Regarding grondwaters, the protection of both the quantity and the quality is for public water supply important. Because of the limited availability and also because of the interests of nature, licenses for ground water abstraction are limited.
Increasing pollution, especially by manure, makes ground waters of good quality scarce.
Surface waters are availible in large quantities. Their quality, however, leaves much to be desired: by storage, under or above ground the Water Companies improve their quality. Finally, they purify these waters with far-reaching technology.
It is therefore of utmost importance that public water supply gets an adequate attention in the water management plans.

Presentation
of the Paper "Water Law in The Netherlands" on October 4th, 1994

Introduction

When you start visiting our country you will find several things different from your own experience: this country is flat, only in the eastern and southern parts are some hills. Larger parts of Holland and Zeeland , in the west, are below sea level. If you started your visit at Amsterdam Airport, it is nice to know that it was at about 6 meters below sea level.
This is a land of polders, dikes, canals, windmills and sluices. Most parts of Holland and Zeeland have been conquered on the sea. This conquering started already in the Middle Ages. So the first legal measures were against flooding. Tampering with dikes was met by capital punishment: the body of the evil-doer was buried in the dike. More interesting, however, were regulations concerning the maintenance and the financing. At first, new works and maintenance were executed by the farmers themselves, who made therefore agreements between each other. Later on, the maintenance was professionalized and the Water Boards were created. In most cases, they administrated a whole polder and divided the maintenance costs equally between the farmers, according to the value of their lands. In this way, they had an administration independent from higher government. The control was in the hands of those who paid the most. "Interest, ~~administration~~ payment and control" is the triplet on which management of the Water Boards is based up to this day.

If there were only Water Boards, water management could be very simple. But you realise very well that the large works, dikes, sluices, canals, water purification plants, pumping installations ask for measures on a national scale.

The actors in water management

Central Government
Since the beginning of the 19th. century, the Ministry of Public Works with its service of "Rijkswaterstaat" is dominant in water management. Rijkswaterstaat controls the large rivers, Rhine and Meuse, with their branches and the estuaries, the sea coasts, the Wadden and the large shipping canals. These tasks are executed in accordance with other Ministries, among which the Ministry of Environment (VROM) andthe Ministry of Agriculture are dominant. Over the other actors in water management. the Provinces and the Water Boards, the Ministry of Public Works, together with the other Ministries, has control in virtue of the many Acts that you can find in my summary.

The provinces
There are now 12 provinces in the Netherlands. They originated from the 16th. century after we had won the Spanish War. Then they were practically independent and had only a war league with each other in the "States-General".

This is still the name of the Assembly of our two Chambers of Representatives, that have the control over our government and must approve of all Laws. Although the Provinces lost their independence, they have still large tasks in water management.

In the first place, they have the administration of surface waters of secondary importance , among which are also shipping canals, brooks etc.

Secondly, they control the Water Boards, and can give directives to their management.

In the third place, they have a direct responsibility for ground water management. They decide on licenses for ground water abstractions.

The Water Boards

I mentioned already the old and still important tasks of the Water Boards. Their new task is now waste water purification. They build and control waste water purification plants all over The Netherlands, in behalf of municipal discharges of waste waters. Only some large industries have their own purification plants. The Water Boards recover their costs by taxation and by subventions from Central Government, Central Government covers these subventions by taxation of waste water discharges into the waters that are under its control. Waste water purification is not a direct task of Central Government.

The Municipalities

One of the most important tasks of the municipalities in the field of water management is the care for the municipal sewerage systems. They are also responsible for the financing of these systems and they recover the costs by taxation of the citizens.

Drinking water supply was originally also a municipal task. Because of reorganisation of drinking water supply into larger units, most municipalities are now shareholders in regional water supply companies.

In the large harbours, that are under municipal control, drinking water supply of the ships is also one of their tasks.

Bottlenecks in Water Management

Everywhere people like to hear about difficulties encountered, that could not yet adequately be solved. I shall in this respect not disappoint you.

Quantitative Water Management

In 1953, a big flooding of sea water inundated large parts of Zeeland and Zuid-Holland. As a consequence, large enclosure dikes have been built at the entrances of sea water in the estuary. One of these enclosures is a technical miracle: with some 30 sluices it lets in the sea water in normal situations. As a consequence the estuary of the Oosterschelde remains salt. In stormy weather with a high tide these sluices can be closed, thereby preventing the penetration of high sea water levels into the hinterland. Nevertheless, high water levels can still happen in these low countries. Last month, some parts of Noord-Holland were practically flooded by abundant rainfall, that could not be discharged into the IJssel-Lake because its high water level.

Qualitative Water Management

Most waste waters are now being purified. Their quantity has been reduced because of the discharge costs paid by industry. But our large rivers carry still lots of waste waters. Especially in the Meuse there is still plenty of waste water being discharged by Belgian industries and municipalities. For the Rhine the situation has been improved since in 1986 there has been reached an agreement between the bordering States on its quality.
Nevertheless, also here the situation is still not perfect because there are percolations of noxious substances that can be harmful in small quantities.

Quantitative Management of Ground Waters

This management is, as I pointed out, in the hands of the Provinces. But ground water levels are not only influenced by abstractions, but also by regulation of surface water levels. The farmers like to have the soil rather dry for the use of their cultivating machines. But when it comes to crop growing, the ground water table must be adequately high. Then they claim damages from the water companies that use the ground waters, although the dryness is for a large part caused by surface water regulation. This situation is of course also damaging nature conservation areas.

Qualitative Management of Ground Waters

To protect ground waters against pollution is a very difficult task. The cleaning of polluted soil is very expensive. Where the ground water is polluted under large waste depots or on the premises of chemical factories. the pollution can only be isolated but not be undone. But we are trying to reduce the risks of ground water pollution, e.g. by a better control of storage tanks for petroleum or chemical products, and by avoiding risky installations in the neighbourhood of ground water abstractions for drinking water supply.
For drinking water supply the situation becomes, however, gradually more difficult because of excess manuring. As a consequence of this excess manuring the sodium level, also in deeper ground water layers. is rising.

We are here together to learn from each other, not only by information but also by discussion. Perhaps our difficulties are a good start!

J.J. van Soest

THE NETHERLANDS

I Historical background

1. In the Netherlands, located in the delta of three major European rivers (the Rhine, Meuse and Scheldt), water played a dominant role in the course of history. About 1000 A.D. there was not enough food from fishing and hunting so people began to exploit the peat and clay areas in order to produce agricultural products. Due to the continous lowering of the groundwater table in order to keep the land suitable for agriculture a still continuing subsidence process was started making the land more and more vulnerable to flooding. In the 12th century to protect themselves against flooding and to control the water table in the water courses behind the dikes, the farmers began to construct dikes on a large scale. The basic principle of the Dutch inhabitants was: "He, who does not want to stem the water with a dike, must leave his property". In a modified form this principle still applies today.

2. In the 13th century many tidal creeks and water courses were dammed. Many towns ending in 'dam" like Amsterdam, Rotterdam etc date from this period. Besides the concern for the local dikes, it also became necessary to control the water table in the tidal creeks and water courses behind the dikes and dams. As the control of dikes and watermanagement could no longer be exercised by the local societies, the need for a regional organization arose. In the 13th century the local societes began to elect representatives to the meetings of the regional water organizations. The election system was and still is based on the rule: extent of interest, payment of tax in the cost of the water control defines the representation. These organization based on democratic principles (called waterschappen - water boards) were recognised by the rulers of the different states in the Netherlands. The rulers gave large competences to the water boards: regulation, levies for construction and maintenance and justice in all water related affairs.

3. Later on, when the subsidence of the land had reached a level at which gravity drainage was no longer possible, polders were made behind the dikes' inner embankments. From the polders the water was artificially drained by windmills. The polders got their own local water board. In the course of time the creation of polders and embankments increased and that was the reason for the existence of more than 2500 water boards in the first half of the 20th century. In 1991 as a result of reorganization the number of water boards decreased to some 130. Without the efforts of the water boards the present shape of the Netherlands would have been very different. It was a foreigner who stated: God created the world but the Dutch shaped the Netherlands.

4. In the 17th century the need for an organization on a superstate level arose. But it wasn't until 1798 that a national agency, the Rijkswaterstaat as part of the ministry of Home Affairs, was created in order to take care of all water-related affairs on a national level.
Today the system of water boards, state control by the provinces over the water boards and supervision by central government is laid down in the Constitution. Within this constitutional framework the water boards are still functional governmental bodies and the provincial organs define and supervise the tasks of the water boards. The general supervision of water related institutions by the central government is prepared and exercised by the national agency, the Rijkswaterstaat, nowadays part of the ministry of Transport, Public Works and Water management.

5. It would be difficult to expound the system of water control in the Netherlands without explaining the word "waterstaat". One cannot go far in this country without encountering this ubiquitous word. This untranslatable term provides a clue to the technical, organisational and administrative structure of flood protection, watermanagement and navigation in the country. Translated literally, "waterstaat", means 'the state of the water'. In other words, it has to do with the system of controlling and managing the quantity and quality of water, and the relationship between such variables as water levels, discharge volumes and water quality. This information about the historical background is a prerequisite to understanding the present role of water in the Netherlands.

II Physical and economic setting

6. The Netherlands has a land area of 31.800 sq.km and a population of about 15 million. About 7.700 sq.km have been wrested from the sea and inland waters by reclamation, drainage and careful watermanagement; in former days by the water boards and entrepreneurs and in the 19th and 20th centuries mainly by the national government. The landscape of the Netherlands is almost entirely flat. 60% of the land would be flooded daily by sea and rivers if dikes did not offer protection; 30% is even lying below mean sea level. About 71% of the country 's total land area consists of cultivated land, of which almost two thirds is pasture and the remainder is used for arable land and horticulture. The climate is moderate and marine with cool summers and mild winters. The average imput of the waterbalance of the Netherlands is 25% precipitation, 65% Rhine water, 8% Meuse water and 2% from other transboundary rivers; on the output side stands 16% evaporation and 84% discharge into the sea.

7. With a GNP/year of $223 billion ($15,170 per capita), the economy is highly developed. It is based on private enterprise, however many regulations and permit requirements affect most aspects of economic activity. The trade and financial service sector contributes over 50% of the GNP. Due to the transport and production of oil products and the export of natural gas, a trade balance surplus is achieved. The highly mechanized agricultural sector employs only 6% of the labour force, but provides large surpluses for export and the domestic food processing industry. Agricultural and horticultural products account for approximately 25% of total export earnings.

III Political system

8. The Netherlands are a constitutional, decentralized, unitary state with a parlimentary system and a monarchy. The head of state is the Queen, who has no public or political power. The Queen and central government form the Crown. The Dutch parliament consists of two chambers. The (Second) Chamber of representatives is directly elected by the people and defines the national governement's policy. The (First) Chamber of Reflexion is elected by the provincial councils, who are directly elected by the inhabitants of the provinces. The Netherlands have 12 provinces, about 700 municipalities and 130 waterboards (1991). The provincial government is responsible for the transformation and execution of directives approved on a national level into measures to be undertaken by the provincial authorities, the municipalities and water boards. The supervision of municipalities and the water boards in all aspects is exercised by the provincial governments; in the case of interprovincial (transboundary) water boards the supervision is exercised by the participating provincial governments. The general supervision of the provincial authorities is

exercised by the national government. The regulations and financial aspects of the provincial authorities, regional water boards and the local governments are consequently stepwise under the control of central government.

9. The water boards are a decentralized form of functional government, dealing with water affairs only. The boundaries of the water boards are mainly defined by natural and artificial drainage systems. The tasks of the water boards can differ. Some water boards are only responsible for flood protection whereas others are responsible for the quantative or the qualitative management of local and regional surface water. Since the fifties the central government has strived for the concentration of local and regional tasks. The policy of the eighties was to strive for "all-in water boards", with flood protection and quantative and qualitative water management under one controlling agency. Both policies explain the strong decrease in the number of water boards in the last four decades (from 2500 to 130).

10. The administrative structure of the water board is regulated by its "regelement", the provincial government defined "constitution". The water board is administered by three organs, the general assembly, the executive board and the chairman. The assembly is the principal organ of the water board. Its exact composition and way of election is regulated by the provinces. They grant the water boards permission to make regulations.
In the founding articles which the provincial council must lay down for each water board within its own province (in the case of transboundary water boards by the provincial councils concerned) they define not only the territory in which it operates and what task it has, but also the members of the assembly and the number of seats to be held by the various groups interested in the work of the water board.
The voting system is based upon the system mentioned under 2: The extent of interests defines the amount of payment and the degree of representation. It follows from this that the division of seats does not depend on the results of elections but is prescribed in the founding articles of the water board. The elections serve to produce individual members and not to determine the rationing between different interest groups in the assembly.
The assembly draws up the by-laws of the water boards, takes decisions on budget, levies taxes on landowners and polluters in its area. The executive board, composed of a small number of members of those entitled to attend the assembly, is responsible for the day-to-day administration and implements the decisions of the assembly. The chairman chairs both the assembly and the executive board and has certain powers of his own. The chairman is appointed by the Crown.

IV. Flood protection and water resources institutions

11. In the Netherlands flood protection and water resources management is the task of public authorities and not of private persons or institutions. This can be historically explained, but is also a conscious political choice. The central government is responsible for the general policy on flood protection and quantitative and qualitative management of all surface water and ground water. The minister of Transport, Public Works and Water management prepares and executes this policy. In addition this minister is responsible for state-managed waters (the rivers and canals of national importance, the great lakes and the territorial sea).
By constitution and law the provinces are responsible for the non-state managed waters and the groundwater. The provinces have delegated tasks and responsibilities with respect to flood control and the quantitative aspects of surface

water to ~~appoximately 120~~ water boards.
Three provinces did not delegate the qualitative aspects of surface water management. The others delegated it to 22 existing and 8 new water boards.

A. Legislative Area

12. Many acts of the Dutch Parliament and submitted bills concern the administrative infrastructure and the competences in water (related) affairs. From an international point of view some of the Acts of Parliament are important in regards to flood control and water management. The policy instruments of these laws generate licenses and charges, but also comprise prohibitive and restrictive measures. The dates indicate the point of time when the law was formulated or revised. Many laws are from an older date but were adapted according to the changing needs of society in the course of time.

a. Waterstaatswet 1900

This law put into force in 1900, establishes the general rules of the administrative structure concerning all water related issues.
It describes the structure of the national agency competent for public works and watermanagement, the Rijkswaterstaat, part of the ministry of Transport, Public works and Water management. This law gives the provisions for the supervision of national government on lower water administrations, for the foundation of waterboards by the provincial government as well as for the supervision of these boards. The law also describes the competences of the administrations on every level concerning flood control, by threatening inundations and on new construction, maintenance and improvement of public works and watermanagement activities.

b. Watermanagement act 1989

This law defines the planning structure for water resources on a national, provincial and waterboard level. To conform the planning structure a national policy document on watermanagemant has to be drawn every 4-8 years. Taking into account this document the provincial governments also have to draw up provincial policy documents every 4-8 years and the waterboards have to submit water control plans in which policy and operational watermanagement are described. The law also contains regulations on the connections between policy documents on physical and environmental planning. The law also contains provisions about the quantitative water management as decrees on water levels, water agreements between two or more water authorities, registration and licencing of supply discharges, extractions of water quantities, competences in extreme circumstances, supervision and final provisions.

c. Pollution of surface waters act 1970

This is a general law to prevent the pollution of surface waters.
Each province has to establish a set of supplementary regulations particularly those that deal with the delegation of their competences to the water boards. The present situation is that the central government implements the law for the state-managed waters.
Three provincial governments exercise the competences by themselves and nine provinces delegate their competences to existing or newly created water boards.
The law further defines the license to emit substances into the surface water, the procedure to decide about emissions, to appeal against a decree,

regulations about levies on emissions, competences of police and penal provisions. The levies being based on the principle "the polluter pays".

d. Grondwater act of 1982

This law delegates the major responsibility for groundwater extraction by pumping to the provinces on supervision at a national level. The supervision can be exercised by instructions from the national government to be implemented into the provincial policy document on watermanagement. This law defines provisions on registration, licencing, appeals against decrees, regulations about levies on extraction, competences of policy and final provisions.

e. Soil Protection Act 1986

This law defines the control on soil degradation and groundwater pollution. A number of (water-related) activities -notably, the discharge of waste water into the soil, the abstraction of groundwater - are viewed as a source of hazard to the productivty and stability of the soil. As a result these activities are subject to regulatory restraints and the people responsible will be held liable for the damages resulting from the degradation of the soil. As for the protection of groundwater quality, the Act mandates the drawing up of provincial groundwater quality control plans; and directs provincial governments to lay down rules restricting land use in designated groundwater catchment areas.

f. Delta act 1958

This law formulates the principles to protect the Netherlands against storm surges by closing estuaries and the reinforcement of the dikes and dunes according to safety standards approved by the Central Government and Parliament. In 1977 a similar regulation was announced for the dikes along the delta branches of the Rhine and the Meuse.

B. Regulatory and Operational Area

13. The Ministry of Transport, Public Works and Water management bears the general responsibility for the policy of the central government in the fields of flood protection, quantitative and qualitative water management and navigation, and formulates the policy in these fields in the Netherlands.

14. The goals of its third National Policy Document on Water Management for the period 1990-1994 are: (a) to have and maintain a safe and habitable country as the prior condition and (b) to develop and maintain healthy water systems which guarantee sustained use. An important characteristic of the new policy concerning water management is the broader consideration of coordination across all the policy documents on water management.
Another important issue of the document is the desired administrative organization of water management at regional and local levels:

- as far as possible the forming of water boards per hydraulic unit (this is to be promoted by the provinces),
- as far as possible bringing flood protection, quantity control, quality control and (where appropiate) waterway management all under a single control (i.e. main waters in the hands of the central government, remaining waters in the hands of regional water boards).

a) Flood Protection and Water Quantity

Administration	Regulatory	Planning (incl. data collection)	Design and construction	Operation and maintenance
Central Goverment level	1)	2)	3)	3)
State/Provincial Level	4)	5)	6)	6)
Basin Level*				
Regional Water Boards	7)	8)	9)	9)
Municipal Level**				

*) The boundaries of the waterboards are based on the natural or artificially controlled drainage systems.

**) The territory of the waterboard covers several municipalities or parts of municipalities. The administrative boundaries of the provinces and municipalities do not coincide with the natural boundaries of the water boards.

1) <u>The Central Government</u> supervises the provincial Governments and indirectly waterboards and municipalities. The central Government is also the court of appeal for the waterboards against decisions made by the provincial Governments. The supervision covers the responsibility for flood protection, the national, provincial and indirectly regional and local management of all surface waters and groundwater including waterworks and structures. The supervision is preventative and repressive, prepared and executed by the Rijkswaterstaat, a line unit of the Minister for Transport, Public Works a[illegible] Watermanagement. Advisory commissions assist the Central Government in the mentioned fields.

2) The Central Government is responsible for the national flood protection policy (including coastal defence),the national strategic planning of the watermanagement (surface and ground water) and for the strategic and operational planning of national surface waters according to the watermanagement act of 1989 together with the water quality aspects. These tasks are prepared by the Rijkswaterstaat.
A staff unit of the Minister for Physical Planning, Housing and Environment prepares long term plans for public watersupply.

3) The Rijkswaterstaat with its regional and functional units is responsible for the major dams and barriers offering flood protection, erosion control by the sea, the quantitative and qualitative water management of the central state managed waters and the navigation on the central state managed waters. These waters concern the main rivers, main shipping canals, estuaries and the territorial sea.
For abstraction of water from surface water administered by the central Government a permit is required.

4) The Provincial Authorities (Assembly and Government) finds and formulates the tasks of the waterboards. The Provincial Governments have the supervision over the regional water authorities (the waterboards) and the municipalities. The provincial Government is also the court of appeal for municipalities, citizens and companies against decisions of the waterboards. Advisory commissions assist the provincial Government in their duties.

5) Provincial Governments are responsible for the strategic planning of the regional and local surface waters and groundwater. The headlines of this planning, concerning both water quantity and quality, have to be formulated in one provincial policy document, the provincial water management plan. The provincial Governments have the competence on all groundwater issues. They also formulate plans for the public water supply and the conditions for the organization. At present the public watersupply is served by provincialy related water supply companies.

6) Most of the provinces have entrusted the waterboards with the direct control and operation of watermanagement works and structures. Non-state shipping waters are under the control of the provincial Governments. Several provincial Governments have delegated the navigation task to the water boards.
The provincial Goverments grant permits for groundwater extraction taking into account the provincial watermanagement plan.

7) According to their provincialy defined mandate, the Waterboards are responsible for flood protection and/or the management for the quantitative (and the qualitative) aspects of the regional and local surface waters.
The waterboards have the compentence to lay down regulations on all water related issues (including the finance of the activities by taxes and levies) in order to manage their entrusted tasks.

8) According to the Water management Law the water boards must draw up water management plans especially those concerning the operational aspects of the surface water.

9) The water boards are responsible for implementing and maintaining dikes and structures necessary for flood protection, drainage, discharge and the provision of surface water.

b) Water Quality

Administration	Regulatory	Planning (incl. data collection)	Design and construction	Operation and maintenance
Central Goverment level	1),10),11)	2)		3)
State/Provincial Level	4),10),11)	5)	6)	6)
Basin Level				
Regional Water board level	7),10),11)	8)	9)	9)
Municipal Level			12)	12)

1) <u>The Central Government</u> supervises the provincial Governments and indirectly the waterboards. The Central Government is also the court of appeal for the waterboards against the decisions of the provincial Governments. The preventative and repressive supervision is prepared and executed by the Rijkswaterstaat, a line unit of the Ministery for Transport, Public Works and Watermanagement. Advisory commissions assist the Central Government.

2) The Central Government is responsible for the national strategic planning of the watermanagement of surface waters and for the strategic and operational planning of national surface waters according to the Watermanagement Act of 1989, a policy document with water quantity and purification objectives. These tasks are prepared by the Rijkswaterstaat.
The Ministery for Physical planning, Housing and Environment sets the standards for the quality of surface water used for the public watersupply, bathing and other proposes.

3) The Rijkswaterstaat with its regional and functional units is responsible for the qualitative water management of the Central State managed waters, estuaries and the territorial sea.
For emission of substances into the waters administered by the Central Goverment a permit is required.
The Ministry of Physical Planning, Housing and Enviroment bears the responsibility for assuring the adequacy of public drinking water supplies. Inspectors of the ministry supervise the public water supply companies. (The monitoring of the water quality at the intake and the delivery as drinking water is done by the companies and checked by Central state laboratories).

4) <u>Provincial authorities</u> (provincial assembly and Government) have the responsibility for the water quality of the non- Centrale state managed surface waters and the ground water. For historical reasons, in nine provinces, the task has been entrusted to existing water boards or new special quality water boards; three provinces have set up their own provincial waterquality department. The Central Government's policy is to entrust flood protection, water quantity and water quality of the regional and local surface waters to one regional water board (all-in water boards). When the water quality has been delegated to water boards the supervision is exercised according to 1).

5) Provincial Governments are responsible for the strategic planning for the regional and local surface waters together with the water quantity written in one provincical policy document including purification objectives taking into account the national policy document.

6) As far as the provinces did not delegate the water quality task to water boards, they are responsible for the public purification stations and water control activities.

7) <u>Water boards</u> can - depending on the properties of their water systems - formulate additional requirements.

8) Water boards have to draw up plans for water quality control activities including plans for the purification of waste water from households and industry.

9) The water boards are responsible for the public purification stations for waste water and water control activities in their territory.

10) Water may not be discharged which cannot meet the stipulated conditions of quality and type of pollutants.
Permits for the discharge of waste water are issused by the authority that is responsible for the water quality management of the water bodies into which the waste water will be discharged. Natural and other corporate bodies can appeal against the granting of such permits.

11) The principle of "the polluter pays" is applied (by tax) on all discharges

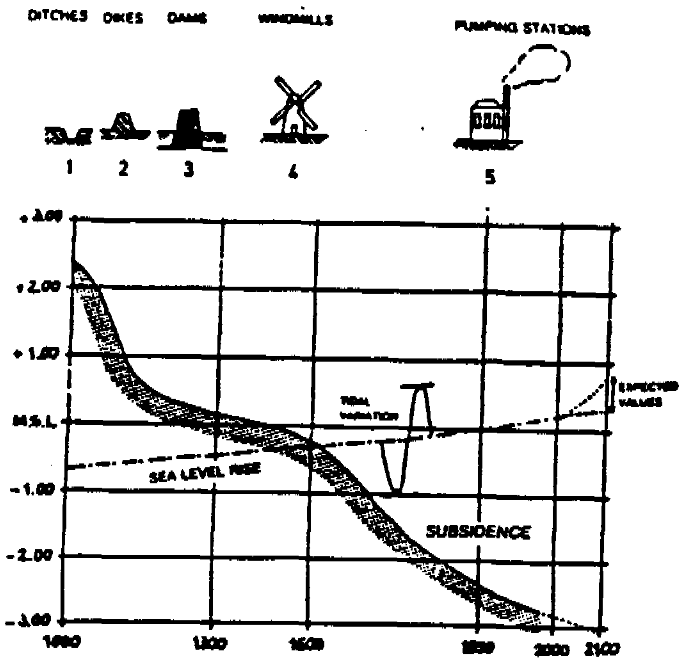
of waste water. Someone who discharges a great deal of polluted water pays a high amount. For companies, the amount of tax depends on the amount of organic waste, where the discharge of heavy metals is permitted, the tax is also leveed on the amount. For households the tax is standarized.
The quality control activities of central government are partly financed by the yield of taxation, the other part of the yield subsidises the construction of new purification plants.
The quality activities of the three quality controlling provincies and the water boards are fully financied by the yield of taxation.

12) Municipalities' task is confined to the construction and maintenance of sewage systems.

C. Financing

13. - The cost for main flood protection dams and storm surge barriers, as well as for quantitative watermanagement activities on a central level is financed by the central governments'budget.
- The cost for flood protection by dikes and the regional and local quantitative watermanagement exercised by waterboards is financied by taxation based on the rule: Extent of interest, amount of taxation, degree of representation (Owners of land and building property; someone who has much land pays more and the same applies to the value of built property).
- The cost of the qualitative watermanagement activities on the central Government level is partly financied by the yield of the levies on waste water discharges into central state managed waters.
- The cost of the flood protection, quantitative and qualitative watermanagement on a provincial level is financed by the general budget allocated by the central government.
- The cost of the qualitative watermanagement activities on (provincial) regional and local level is financied by the yield of the levies on waste water discharges into regional and local surface waters.

Note: It should be mentioned that the method of financing water resource activities has to be refined. This is because the system of improving both water quantity and quality is complicated especially where water quantity and water quality is not entrusted to the same authority. In such cases it is unclear who charges and who is charged for the measures. For the time being these problems are unsolved in the Netherlands.



SCHEME OF THE DEVELOPMENT OF MEAN SEA LEVEL
AND SUBSIDENCE OF THE LAND IN COURSE OF HISTORY.

fig. 5

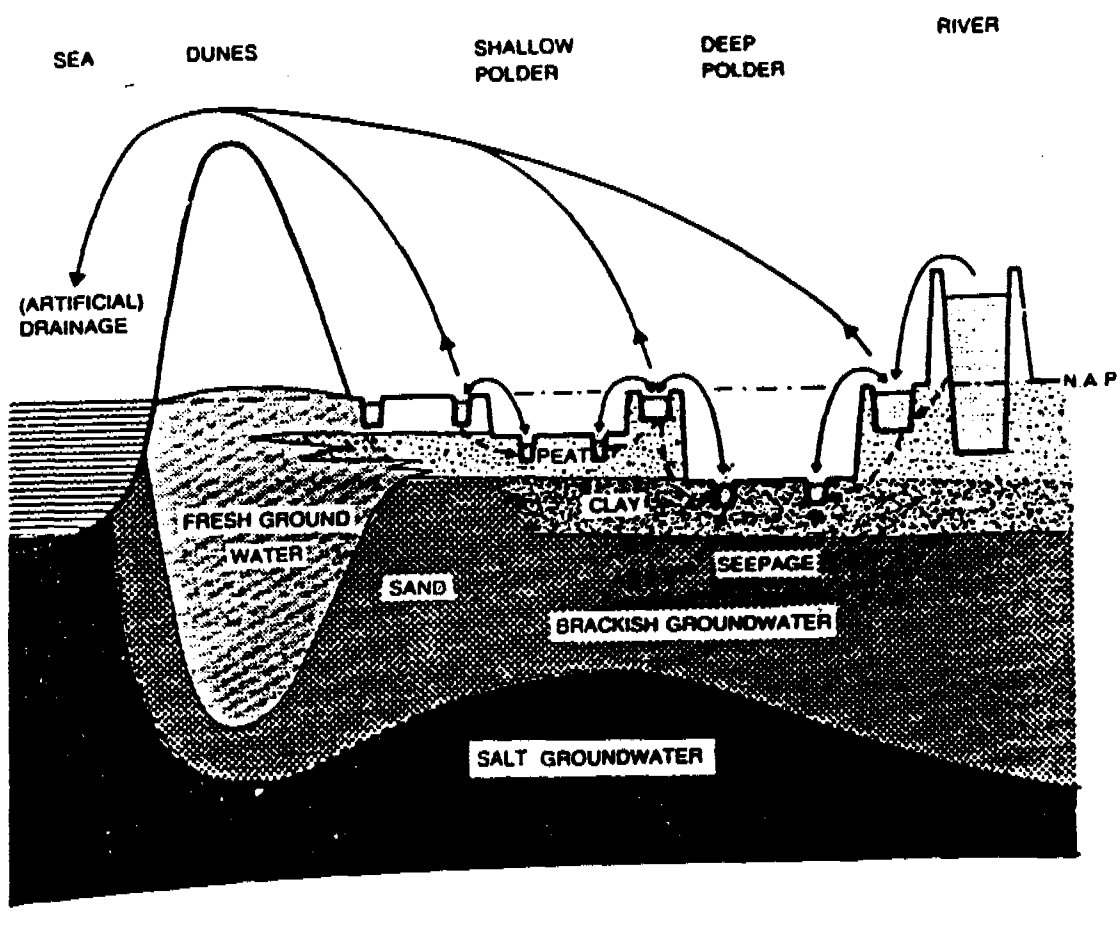


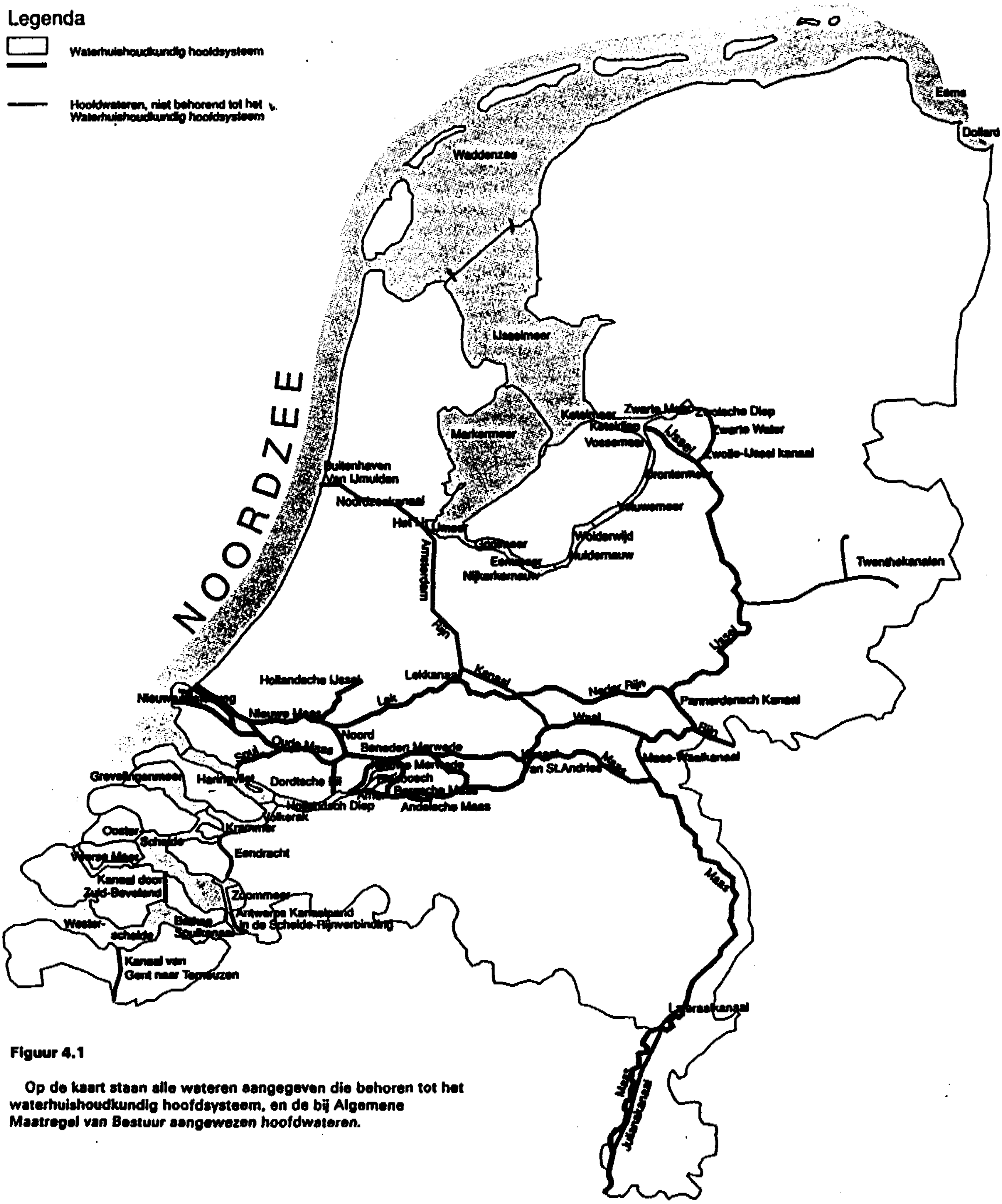
fig. 6 SCHEME OF DRAINAGE AND WATER SUPPLY

WATERHUISHOUDKUNDIG HOOFDSYSTEEM

Legenda

Waterhuishoudkundig hoofdsysteem

Hoofdwateren, niet behorend tot het Waterhuishoudkundig hoofdsysteem



Figuur 4.1

Op de kaart staan alle wateren aangegeven die behoren tot het waterhuishoudkundig hoofdsysteem, en de bij Algemene Maatregel van Bestuur aangewezen hoofdwateren.

YEARLY COSTS (DFL)

Maintainance of dikes	700 MLN
Water quantity managemant	900 MLN
Water quality management	1200 MLN
Sewerage	1500 MLN
Groundwater	20 MLN
Shipping routes	600 MLN
Drinkingwaterproduction	2000 MLN +
fl.	6,920 MLN

(partly estimated)

FUNDING

waterquality:	the polluters pay
waterquantity:	those who have an interest in it pay (waterboards) general taxes (State,prov.,municip.)
sewerage:	partly payd by those who are connected partly general taxes new building projects: in groundprices
groundwater:	generally costs are low; levies however not at the level of costs
shippingroutes	general taxes, special tax for recreational vessels ~~planned~~ canceled
dikes, wiers:	general taxes/inhabitants

WATERMANAGEMENT IN THE NETHERLANDS

4 PERIODS

PERIOD I

- PROTECTION AGAINST FLOODINGS

PERIOD II

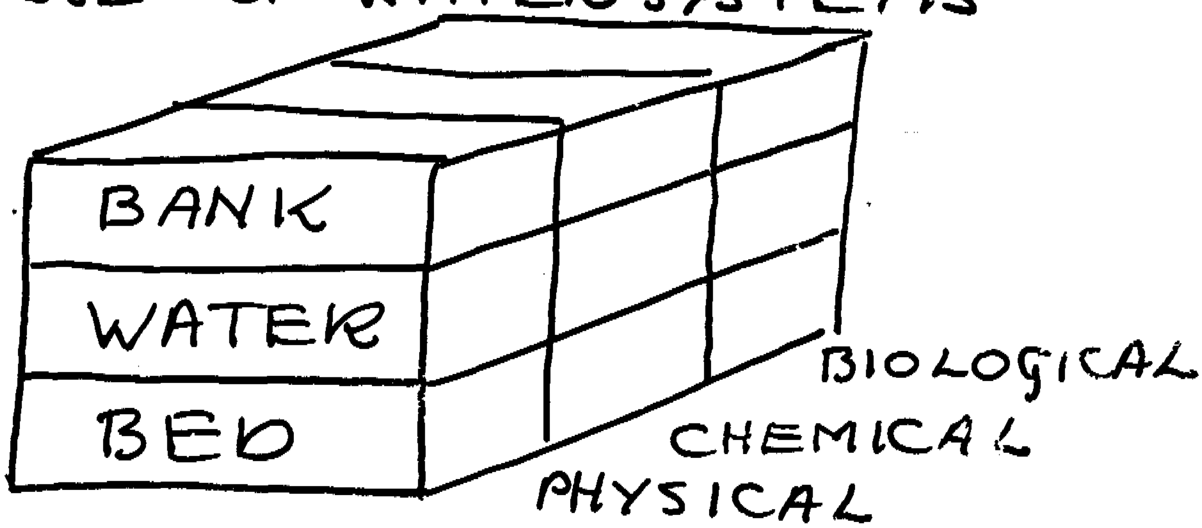
DRAINAGE AND WATER SUPPLY

PERIOD III

PROTECTION OF WATER QUALITY

PERIOD IV

INTEGRATED CARE FOR THE CONDITION AND USE OF WATERSYSTEMS



WATERSCHAP NOORD- EN ZUID-BEVELAND

Water, Sanitation and Environment Exposure Visit and Seminar
4th October 1994 International Water and Sanitation Centre.

WATERBOARD AND ELECTIONS

The relationship between a waterboard and the taxpayer in Zeeland.

In order to illustrate recent developments relevant to the waterboards in The Netherlands it will be necessary to explain the organisation in general of the waterboards and their backgrounds. This covers the first part. The second part will deal with recent legislation on waterboards.
This legislation has adapted the organisation of Dutch waterboards to the developments in society and has improved democratic control.

General outline.

Waterboards in The Netherlands have nothing to do with the supply of drinking-water. Drinking-water is supplied by publicly owned private companies. The supervisory directors of these companies are appointed in general by provincial government.
Democratic control on the supply of drinking-water is therefore indirect.
Waterboards (Waterschappen) in The Netherlands have two functions. The first, and most important function, is to protect the country against inundation caused by high seas and high waterlevels in the rivers. More than half of The Netherlands is located below sealevel. Therefore the function of the Dutch waterboards cannot be overemphasized. The second function is to maintain good quality and an adequate level of the surface waters. This includes the purification of all waste waters.

History.

In 1815 The Netherlands became a kingdom and the country received its first constitution. From that moment on the duties of the municipality, the provincial- and the state government were carried out by democratically elected bodies.
The waterboards in The Netherlands were founded in the 13th an 14th century and were controlled from the beginning by a democratic body. Democracy in those days had other standards than nowadays. The number of votes a person had in the controlling body of the first waterboards depended on the number of acres of land that person possessed. Nowadays nobody would agree with such a voting system. But in the 13th and 14th century this was, from a democratic point of view, much better than public control in local government. In those days citizens had no voice or vote in local government.
A person with one acre of land had a voice in the government of the waterboard and also one (small) vote. Waterboards in The Netherlands are governmental bodies, or what we call the functional democracy, as opposed to the municipalities, the provincial and state governments, which are governmental bodies of the general democracy.
Waterboards in The Netherlands have a limited but very important task. Our waterboards are organised such that they are governed and controlled by those groups in society which have a direct and lasting interest in the functioning of the waterboards.
Many centuries ago at the start of the functioning of the waterboards, the landowners were the only group which had a direct and lasting interest in the functioning of the waterboard. Because they payed tax, they appointed the governors and they exercised the "democratic" control. This system has functioned more or less unchanged until the second world war. At that time there were around 2000 waterboards each with their own taxsystem.
Just before the second world war, we realised that the waterboards not only protected landowners, but also property owners against flooding. Therefore it was logical that they

should also pay tax for maintenance of seadikes, riverwalls and pumps. And again, as a logical consequence the propertyowners could appoint governors on the waterboards and could participate in the democratic control.
Both landowners and propertyowners now had the right to participate in the governing of the waterboards, but how to compare their votes? In those days we decided that for voting and for taxpaying a certain value of property was equal to one acre of land.

For an understanding of the Dutch system of waterboards one should realise that this institution has been rooted in Dutch society for many centuries. Our constitution tells us that the governing bodies of the kingdom are state government, provincial governments, municipalities, waterboards and others.
History has taught us that protection of its inhabitants and their properties against high seas and high river waterlevels can best be organised through separate governmental bodies.

Recent Developments.

Now I arrive at the second part of my lecture. This part deals with recent developments.
As from the 1st of January 1992 a new law is in force. This law introduces two new categories of inhabitants with a direct and lasting interest in the work of the waterboards.
Every inhabitant or citizen living or working in a protected area has an interest in the work of the waterboard. Therefore every inhabitant must contribute to the cost and at the same time have the right to vote or even stand as a candidate for a member of the board.

The second new category of inhabitants with a direct and lasting interest in the functioning of the waterboards are the tenants of land. This category is relatively small. With the introduction of the law on the quality control of surface water a new fifth category was introduced, namely the industrial pollution of surface water.
To summarize as a consequence of the recent change in the legislation relevant to waterboards five categories of inhabitants can be indicated.
These categories all have a direct and lasting interest in the functioning of the waterboards. Their interest is not equal, and the degree of interest depends on the situation within the borders of the waterboards.

Recent Elections.

There are various main groups of voters such as "landowners", "propertyowners", "tenants of land", "inhabitants", and "users of polluting factories".
In the province of Zeeland direct elections were held for four of the five above mentioned categories. The fifth categorie, which are the companies causing industrial pollution put forward their own representatives by appointing people through the Regional Chamber of Commerce.
These direct elections were a gigantic task. The first and only place where this was done, until now, is in the province of Zeeland. We are proud to say that the elections have been a success. We consider them successful, because the average turnout was about 60 % not sufficient but roughly equal to the figures for the election of the town councils. The most important reason for organising these elections was that we wanted to improve the democratic legitimacy of the waterboards in Zeeland. Zeeland is a province which has suffered many inundations throughout its history. The inhabitants are generally well aware of the importance of properly functioning waterboards, as a consequence it was expected that the elections be a success. We can say that it could be a stimulating example for other parts of the country.

The waterboards have made a great effort in enlighting the general public about the coming elections for the representative bodies of the waterboards in Zeeland.
The task of the waterboards and the system of the elections has been explained to numerous groups like schools, trade unions, notaries, chambers of commerce, organisations of housewives, owners of campsites, they all received the necessary information. Two so-called election leaflets have been distributed to the general public. Local and regional newspapers and radiostations had programs and articles for the coming general and direct elections for the waterboards. We were grateful for this free publicity. The 18th of January was the day of the nomination of the candidates. A large number of candidates made themselves available for the elections. Our waterboard which has 30 seats in its representative body 92 candidates stood for election. It was impossible for me as dike-reeve to receive them all. So at the last moment we decided that the dike-reeve and the deputy would both see candidates when they submitted their nomination forms. A large number of women put forward their candidacy. Roughly 25 % of the candidates were women.

In the election of members for the town-council, the provincial council and for parliament we use lists such as Christian Democrats, Socialists, Liberals, Communist, Green Party etcetera.
In the election system for the waterboards there were no such lists, each candidate stands for election in his or her own right. Those candidates who received most of the votes were elected. From the democratic point of view this system has it's advantages.

In the past, elections for the waterboards were extremely low-key. Often the number of candidates was equal to the number of members to be elected. But this year, due to the addition of new groups of voters with a direct and lasting interest in the functioning of the waterboards, and due to the fact that the elections were direct, the elections and the campaigns of the candidates was lively. We had never experienced this before. Candidates campaigned during the weekly market; they were interviewed by local radio, and many candidates produced their own leaflets.
Also I had a discussion on local radio with four of the candidates about their programmes. The style of the campaign was gentlemanlike, nobody said anything negative about other candidates.

The elections for the waterboards were organised on the same day as those for the town-councils. Where possible, they were held in the same buildings as the elections for the town-councils. Pollingstations were not combined as up to now the Dutch law prohibits this.
Although it is not proven, one may assume that turnout for both elections was due to this combination.

Motives of the voters were analysed scientifically by research workers.
For the waterboards the outcome of this analyzes was very hopeful.
55% of the voters' opinion was: they considered the work of the waterboard important and wanted to have influence on it's functioning.
Owners of buildings or houses were entitled to vote, but most of the houses are owned by man and wife together. For administrative reasons the voting papers were addressed to the men. Most of the women complained they called it discrimination, although it was clearly stated nevertheless man or wife could vote. Next time this must be organised differently.

Democracy, and also elections, cost money. We consider this not as relevant. But. one should know the cost: These elections cost ƒ 3,-- per inhabitant. Hopefully the next election will be cheaper.

Some remarks.
As explained the elections for the town-councils and the waterboards were held on the same day. Where possible the polling-stations were in the same building but separated from each other. However, the voting system was different, for the town-councils one votes for a party. for the waterboards one votes for a person. A completely different system.
The waterboards did everything they could to inform the general public but many voters were still confused.
Many inhabitants could vote for more than one category, for example someone who owns some acres of land and also a house could must vote for a candidate in the category "Inhabitants" as well as for a candidate in the category "landowners", and for a candidate in the category "propertyowners".
To avoid confusion we used different coloured votingpapers for the various categories.

I hope you now have some understanding of our waterboards' elections. We are happy that the introduction of new legislation relating to elections has been a success in the province of Zeeland.

U:\WP\BOARD

SEVEN WATER BOARDS IN ZEELAND

Rural water resources management in the Province of Zeeland, The Netherlands.

The Provincial Government decides on the number of the rural water management boards in its area and determines the size of the basin they will manage. Zeeland now has seven water resources management boards. In the past, they could have up to 40 committee members. This has now been reduced by law to 25. The Boards are responsible for maintaining water resources, preserving and controlling water quality and quantity, treating waste water, allocating water for different uses, ensuring safety from flooding, protecting the environment, nature management, afforestation, providing and maintaining recreational provisions, etc. Each Board represents five categories of rural landusers: landowners with buildings, landowners without buildings, producers of domestic and industrial waste water, non-farming inhabitants and tenants.

Every four years the people in these categories elect their own representatives. Each Board has male and female representatives. The number of female members has increased over time. Before the elections, the candidates' names, pictures, background and interests in/commitment to certain aspects of water resources management are published in a newspaper, which is sent to every voting household. Voters within the households are the persons in whose name the property is registered. However, if husband and wife are joint owners, as is often the case, they have to decide among themselves whom they want to vote for and who will be the one to bring out their joint vote. These aspects are also explained as part of the consumer information.

The costs of water resources management are financed through two type of taxes the water pay: water pollution control tax, which depends on the size of water use and the level of pollution (the larger and more polluting, the more has to be paid), and the land tax, related to the size of the landholding. Every year the Boards can adjust the level of the tax. The Boards are accountable to the consumers and the Province. Meetings are public and covered by the press. The seven Water Boards are united in a Provincial Water Association. Since a few years the Association prepares annual policy plans. It also owns and manages a water quality control laboratory. Provincial and municipal governments also make use of this laboratory.

WHO MAY VOTE? MAN OR WOMAN?

"For those who receive a voting card for land with or without buildings it is advisable to discuss in advance which householder will vote. The card has been addressed to the person in whose name the land or building is registered. However, when the marriage is in community of property, man and wife are both entitled to vote. Together they can cast one vote per category. They will have to decide jointly whom of them will vote. Depending on what the couple owns, they can also cast two votes, e.g. the husband for unbuilt land and the wife for land with buildings. The partners will have to tell the voting office who will vote for which category. Those categorized as inhabitants will not have this problem: here husband and wife each get their own voting card." (Translation of information on gender and voting given to the consumers)

WMG

WATERSUPPLY COMPANY GELDERLAND

cooperating in finding solutions for

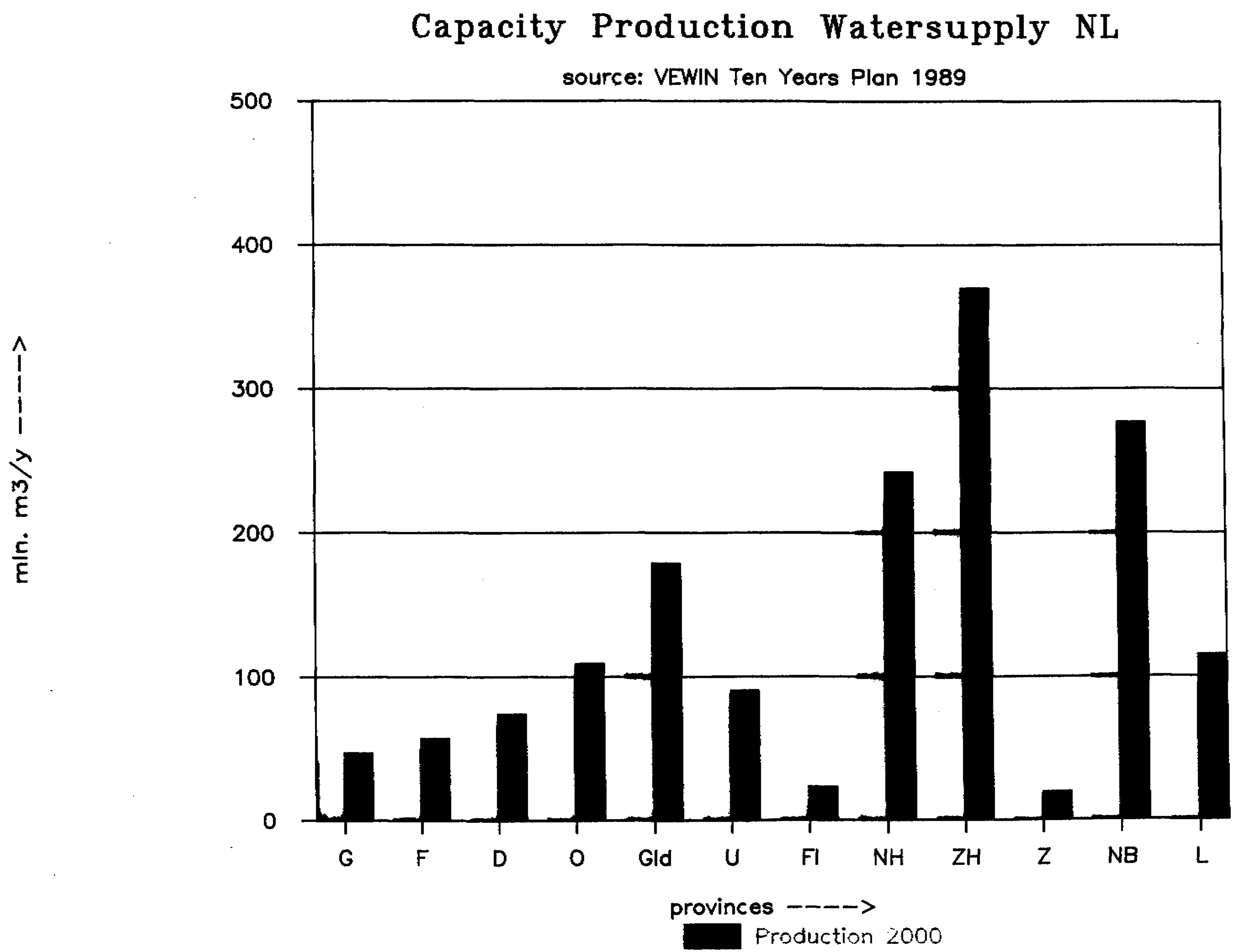
GROUNDWATER MANAGEMENT PROBLEMS IN GELDERLAND

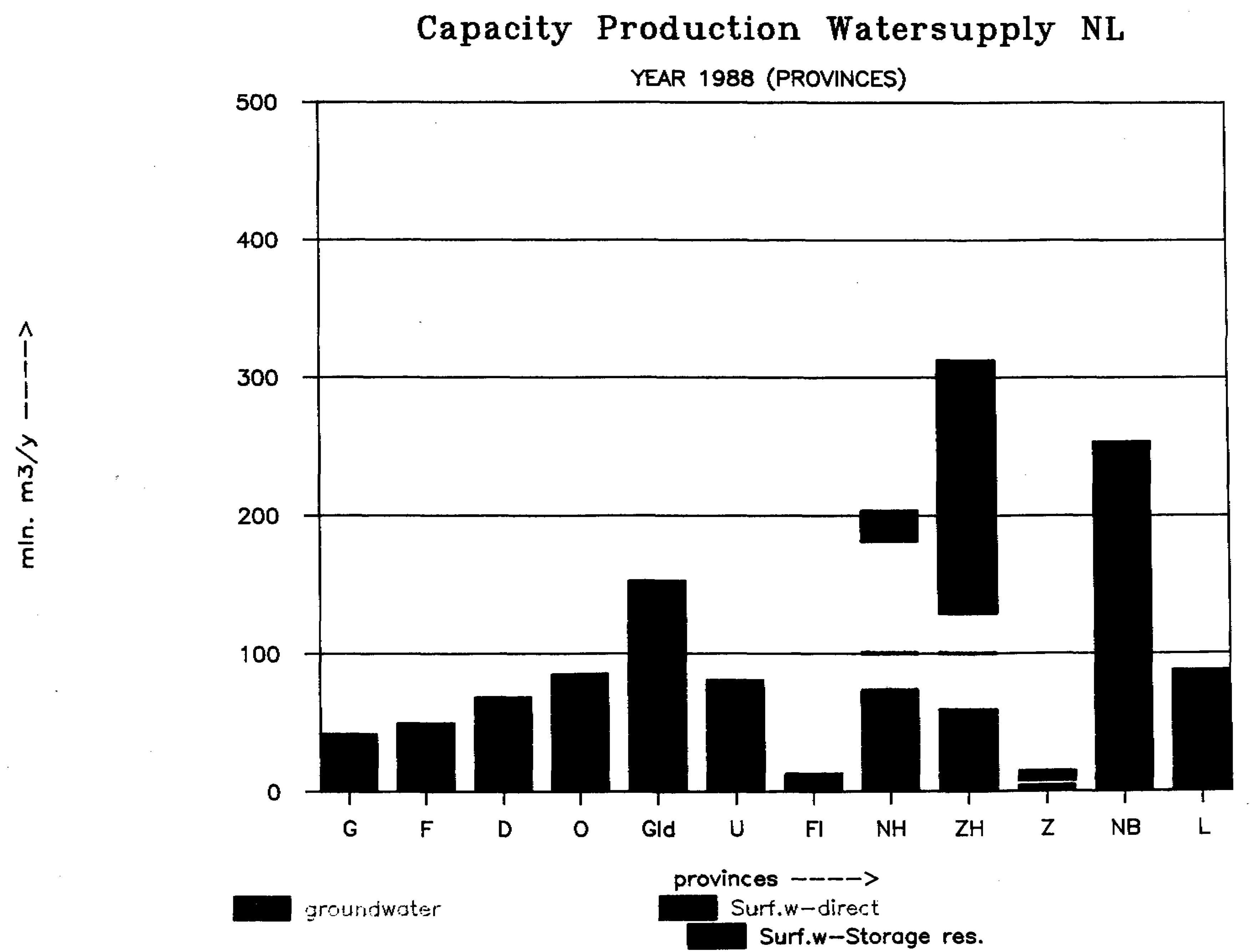
ir.H.Vaessen d.d.05/10/94

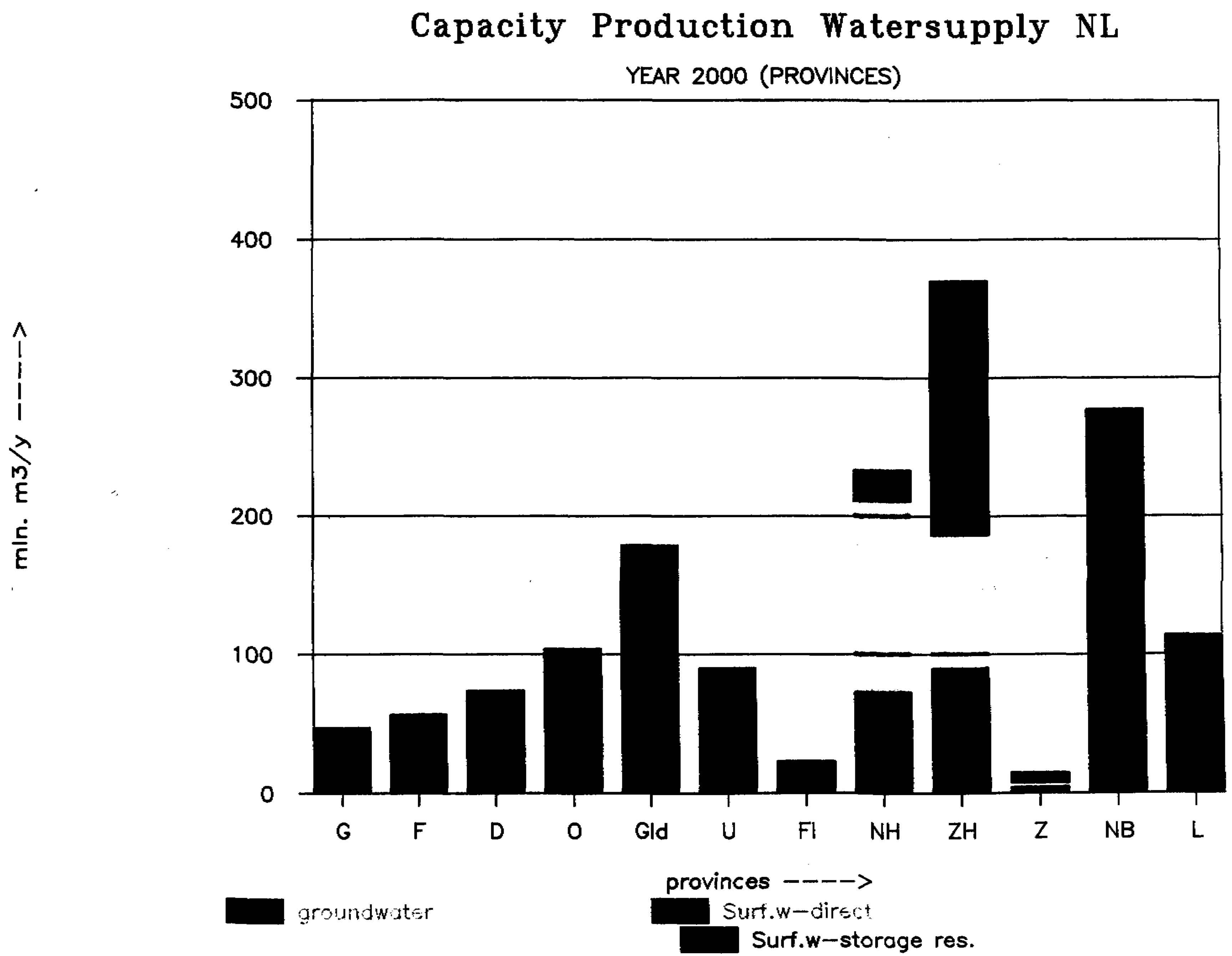
PLANNING WATER SUPPLY NL

* BDIV (draft 1993): National Policy Plan on public water supply
* VEWIN: Waterworks Association 10-Years Plan (1989)

- water demand NL in 2000: 1600 Mm3/y
- sources: groundwater: 1080 ,,
  surface water direct: 43 ,,
  surf.water infiltration: 245 ,,
  surf.water storage res: 232 ,,

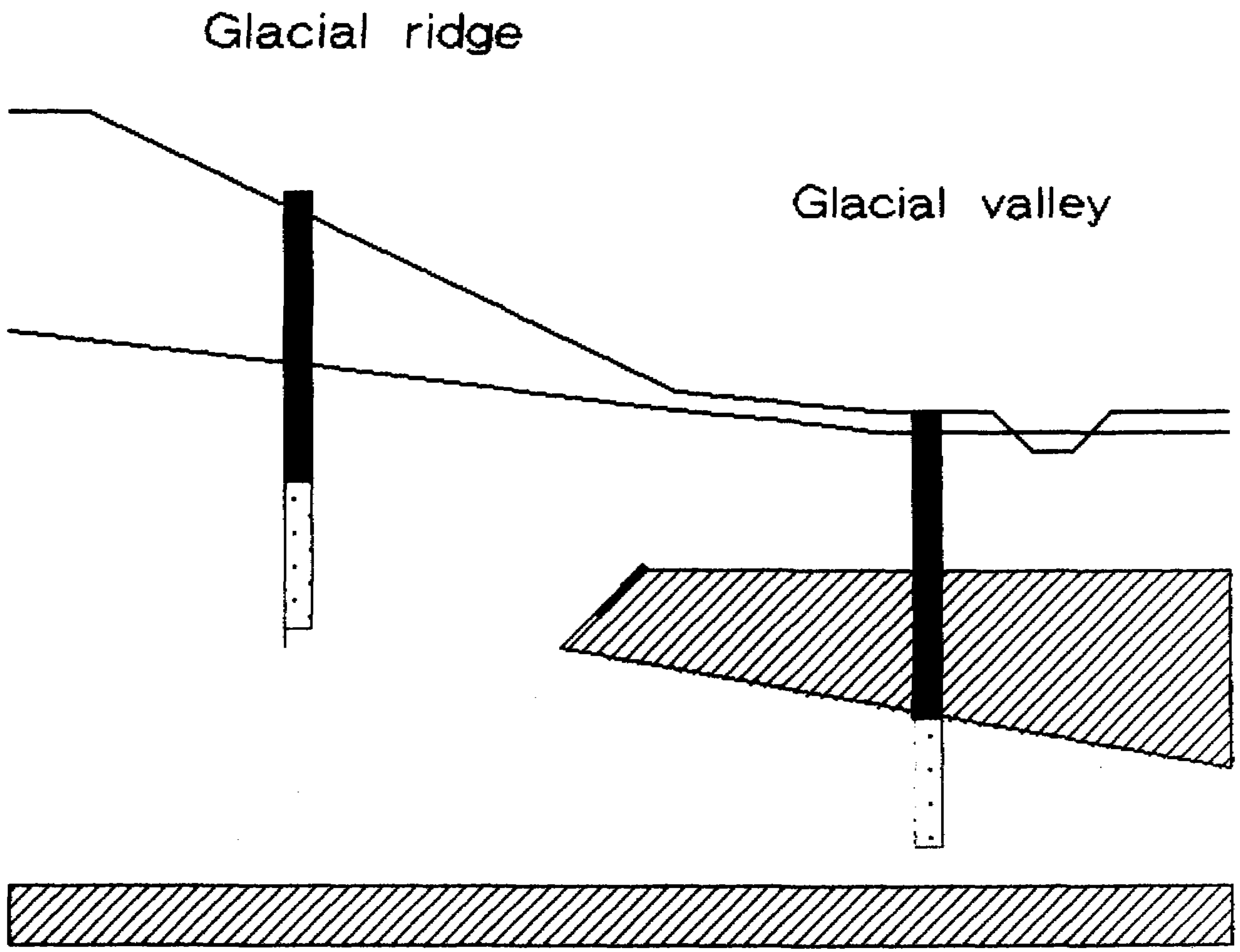

Capacity Production Watersupply NL
source: VEWIN Ten Years Plan 1989
500
400
300
200
100
0
mln. m3/y ----->
G
F
D
O
Gld
U
Fl
NH
ZH
Z
NB
L
provinces ----->
Production 2000

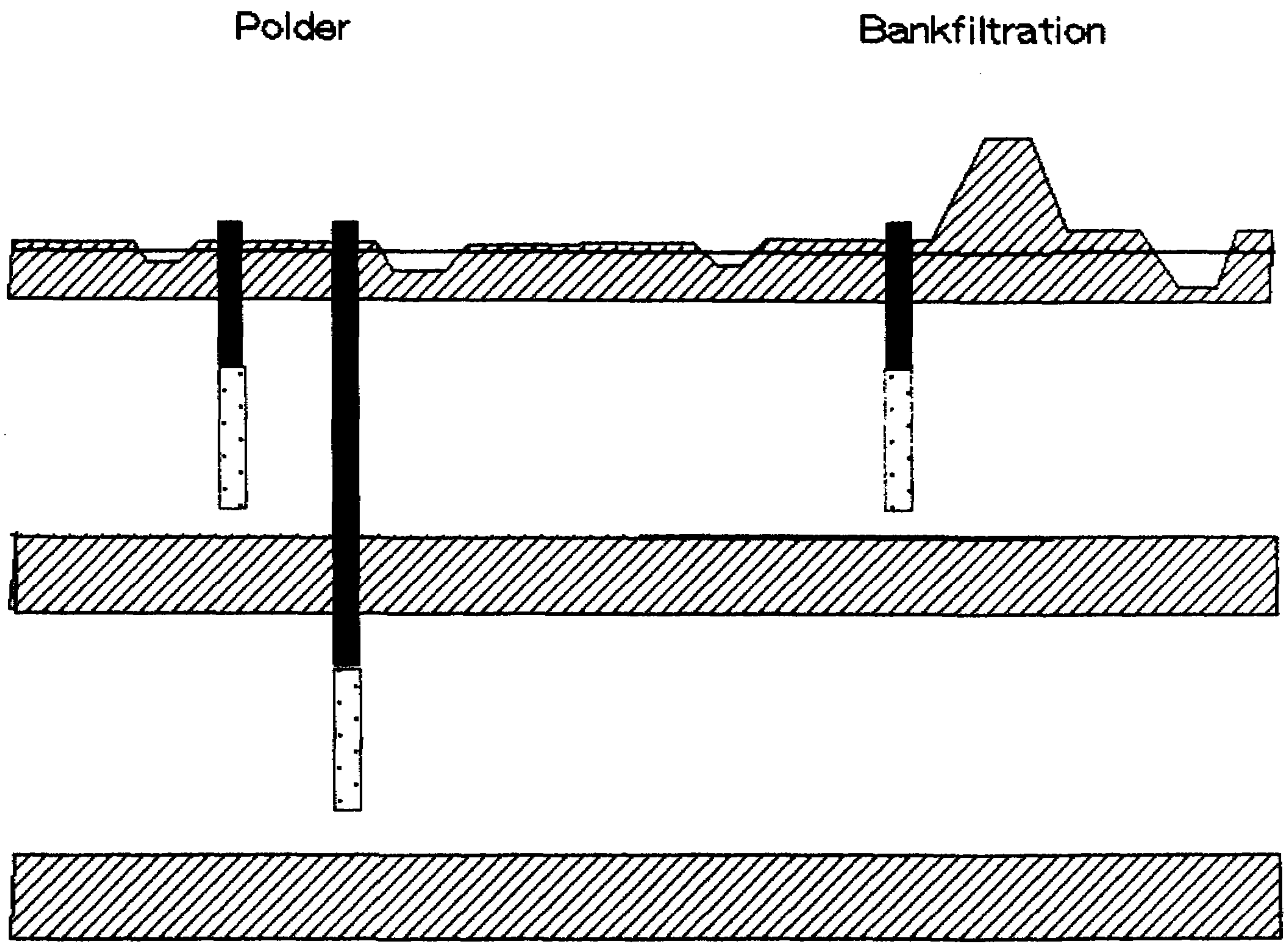

Capacity Production Watersupply NL
YEAR 1988 (PROVINCES)
500
400
300
200
100
0
mln. m3/y ----->
G
F
D
O
Gld
U
Fl
NH
ZH
Z
NB
L
provinces ----->
groundwater
Surf.w-direct
Surf.w-Storage res.


Capacity Production Watersupply NL
YEAR 2000 (PROVINCES)
500
400
300
200
100
0
mln. m3/y ----->
G
F
D
O
Gld
U
Fl
NH
ZH
Z
NB
L
provinces ---->
groundwater
Surf.w-direct
Surf.w-storage res.

CHARACTERISTICS WELLFIELDS WMG

* underground: sedimentary deposits
* partially deformed by glaciers
* sand- and clay-layers
  (aquifers and aquitards)
* 4 wellfield-types:
  R: Glacial Ridge
  V: Glacial Valley
  P: Polder
  B: Bankfiltration


Glacial ridge
Glacial valley


Polder
Bankfiltration

WELLFIELD TYPES WMG

	(number)
* Glacial Ridge	9
* Glacial Valley	3
* Polder	6+1
* Bankfiltration	1
	----- +
total	20

GROUNDWATER PERMITS

WMG in Mm3/y

* Glacial Ridge	28
* Glacial Valley	26
* Polder	25
* Bankfiltration	4
	------+
total	83

(3 Mm3/y temporary 5y)

code wellfields WMG
as represented in graphs
Rawwater quality 1975-1992

Glacial Ridge type

R1	Muntberg	(Groesbeek)
R2	Eerbeek	(Brummen)
R3	Elburg	(Elburg)
R4	Epe	(Epe)
R5	De Haere	(Elburg)
R6	Harderwijk I	(Harderwijk)
R7	Harderwijk II	(Harderwijk)
R8	Putten	(Putten)

Glacial Valley type

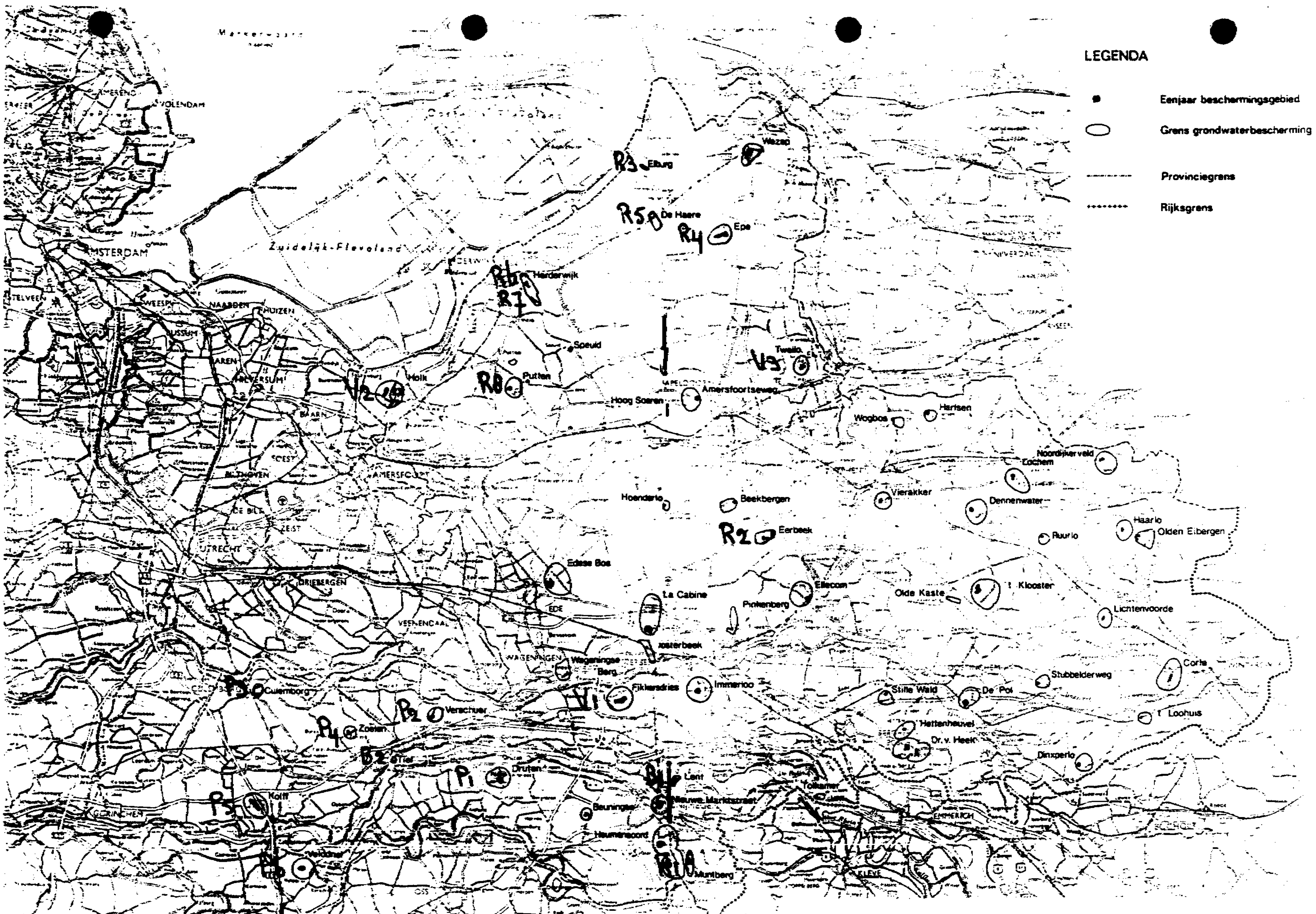
V1	Fikkersdries	(Heteren)
V2	Holk	(Nijkerk)
V3	Twello	(Voorst)

Polder type

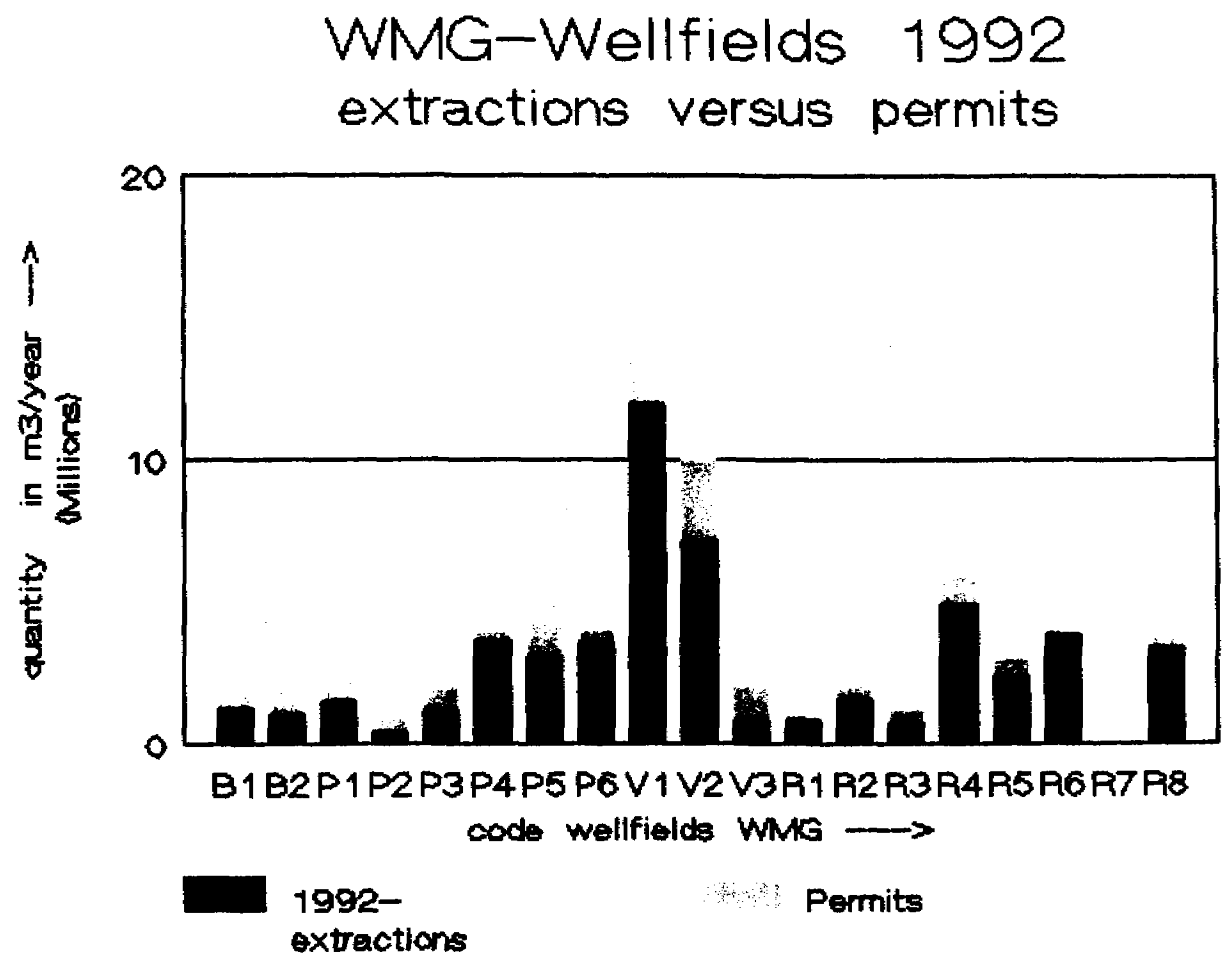
P1	Druten	(Druten)
P2	v.Verschuer	(Lienden)
P3	Culemborg	(Culemborg)
P4	Zoelen	(Buren)
P5	Kolff	(Neerijen)
P6	Velddriel	(Maasdriel)

Bankfiltration type

B1	Lent	(Elst)
B2	Tiel	(Tiel)

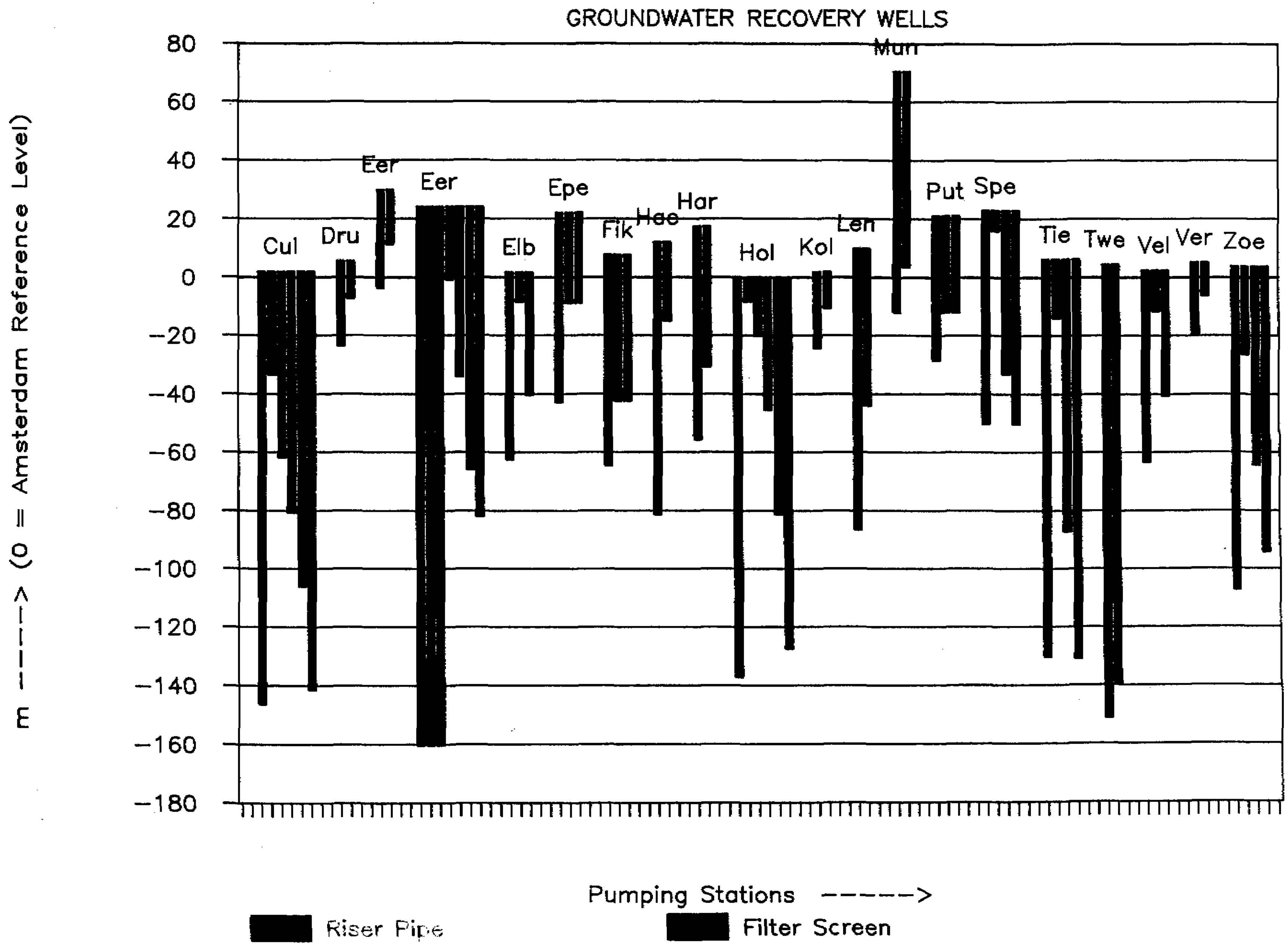


Berekende beschermingszônes drinkwatervoorziening Gelderland



WMG-Wellfields 1992
extractions versus permits
20
10
0
quantity in m3/year ---->
(Millions)
B1 B2 P1 P2 P3 P4 P5 P6 V1 V2 V3 R1 R2 R3 R4 R5 R6 R7 R8
code wellfields WMG ---->
1992-extractions
Permits

NV.WMG – DEPTH of FILTER SCREENS



GLACIAL RIDGE TYPE

* High oxygen content
* Low hardness
* Acidification (Al)
* More vulnerable (pollution) occasionally high nitrate
* Drying-up wet areas

GLACIAL VALLEY TYPE

* Oxygen free
  (low Fe, Mn, NH4)
* Low hardness
* Less vulnarable(pollution)
* Becoming brackish
  (upconing)
* Less drying-up problems

POLDER TYPE WMG

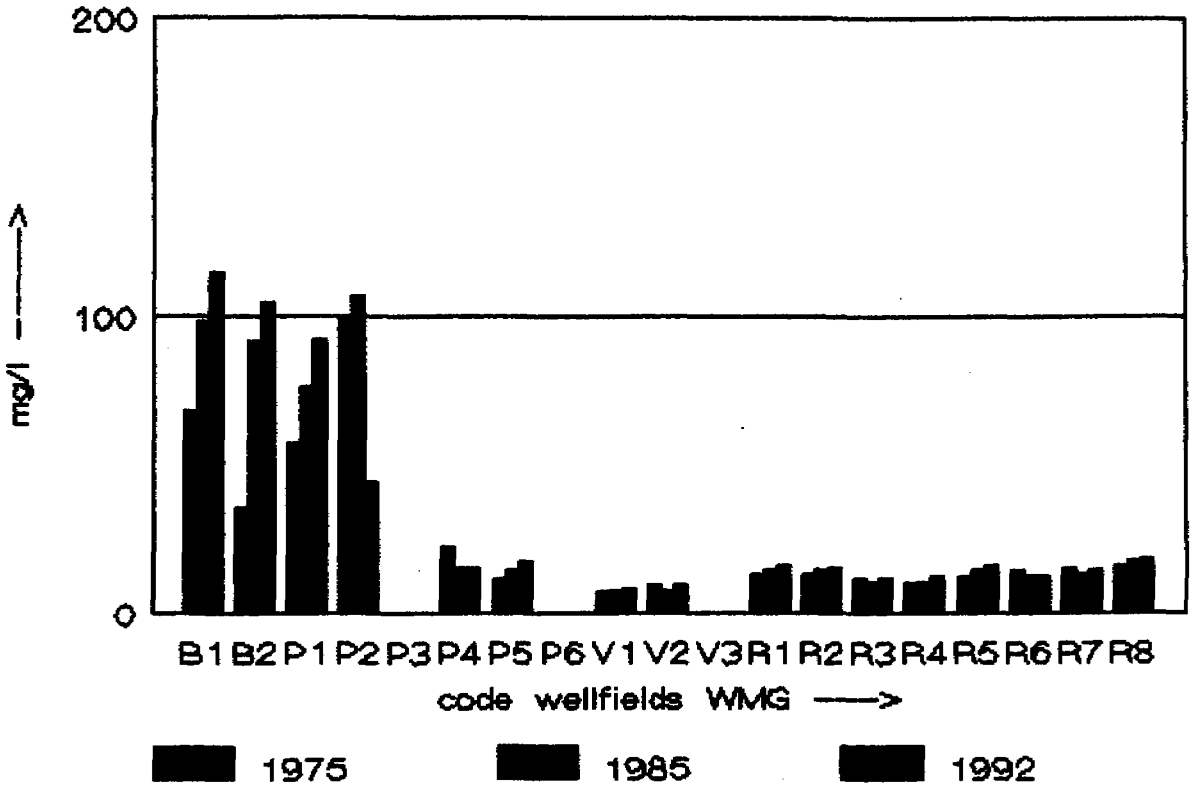
* oxygen free
  (high Fe, Mn, NH_4)
* High hardness
* Less vulnerable (pollution)
* Polder level control
* Less drying-up problems
* Soil setting problems

BANKFILTRATION TYPE

* Oxygen free
  (high Fe, Mn, NH_4)
* High hardness
* Chloride (river)
* Pesticides (bentazon)
* Timelag river quality
* Calamities river pollution
* No drying-up problems

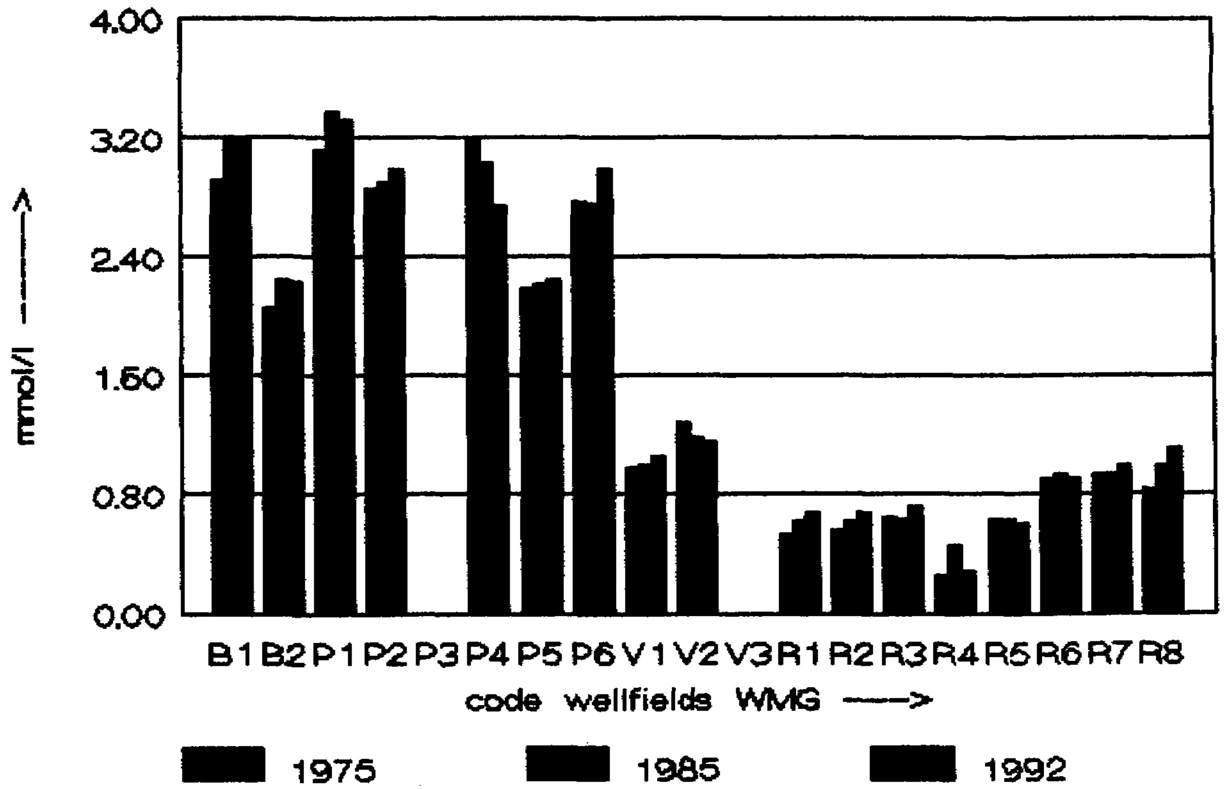
RAWWATER QUALITY 1975-92

chloride content in mg/l



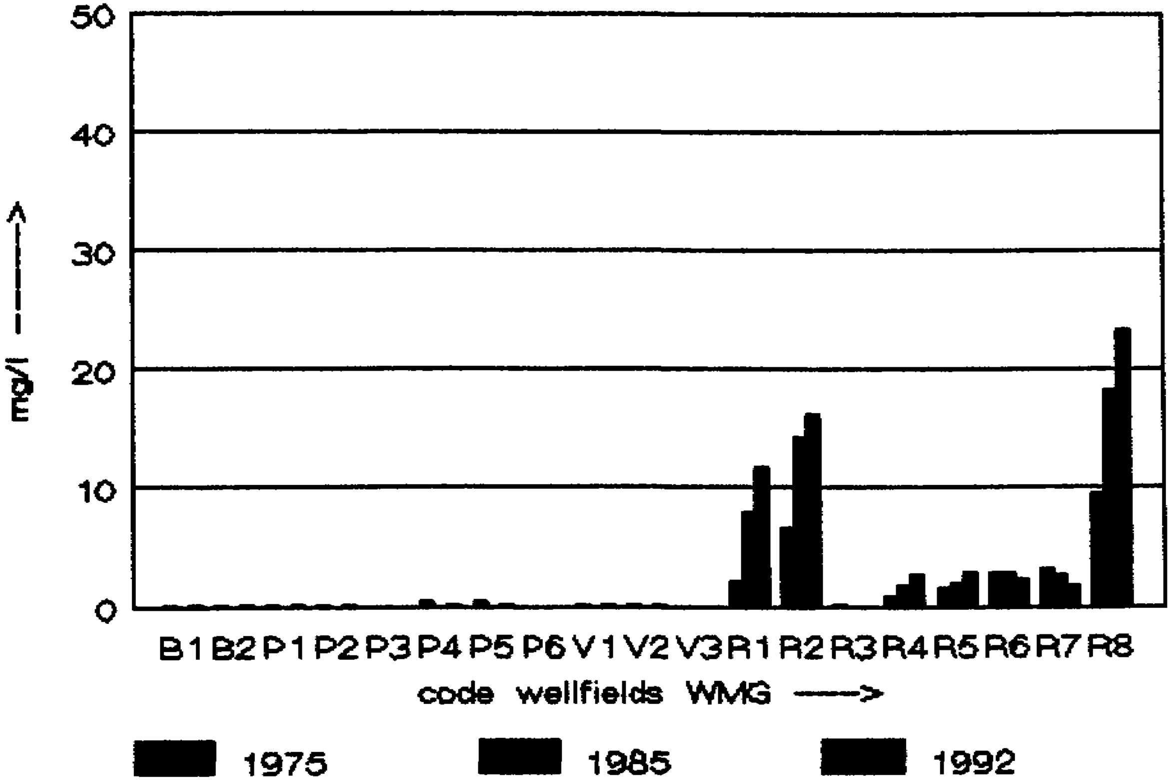
RAWWATER QUALITY 1975-92

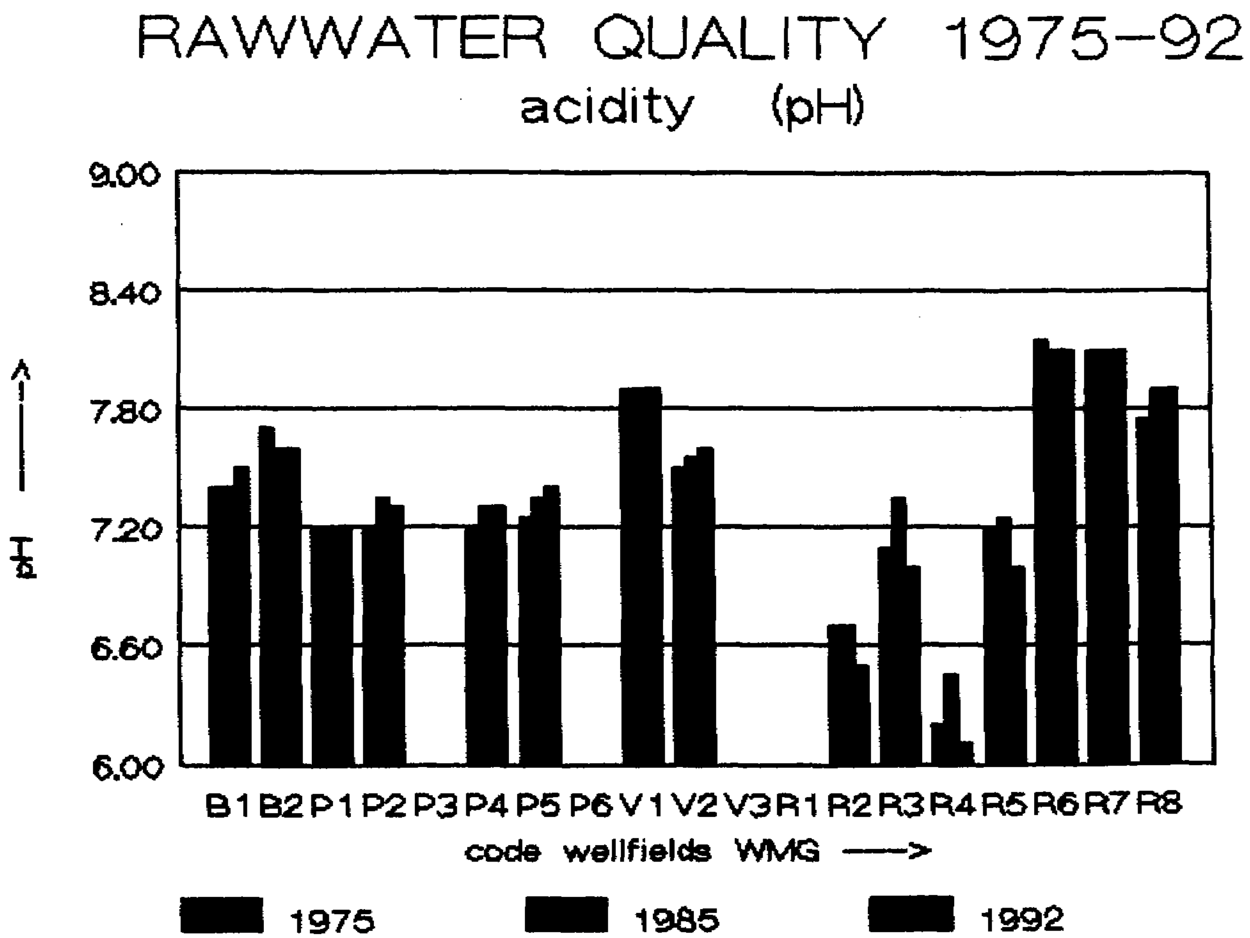
total hardness in mmol/l



RAWWATER QUALITY 1975-92

nitrate content in mg/l




RAWWATER QUALITY 1975-92
acidity (pH)
9.00
8.40
7.80
7.20
6.60
6.00
pH →
B1 B2 P1 P2 P3 P4 P5 P6 V1 V2 V3 R1 R2 R3 R4 R5 R6 R7 R8
code wellfields WMG ——>
1975
1985
1992

GROUNDWATER PROTECTION

1-, 10- and 25-year zones

Regulation on Groundwater Protection Zones Gelderland
(legal measures on provincial level)

* 1-y ZONE <u>WMG</u> :
  - no agriculture (changing landuse)
  - afforestation
  - nature development

GROUNDWATER PROTECTION

* 10/25 year zones <u>WMG</u> :
  - Financial compensation agriculture manuring/pesticide use
  - Sewer systems installed (25%)
  - Piped gas supply (replacing oil fuel equipment)
  - Damming up polder ditches
  - Cleaning-up after calamities (traffic accidents, oil spill)

GROUNDWATER PROTECTION

WMG measures:

* Monitoring: 200 observation wells with 1000 filters
* Extra water treatment steps:
  Lent: bentazon removal
  Epe/De Haere: Al removal
* Relocations wellfields:
  vertical: Eerbeek/Culemborg
  horizontal: Zoelen (Kerk-Avezaath)
* Closing wellfields: Tiel and in future Lent and Van Verschuer

Tackling Drying-up problems

Gelderland:

* Water Management Plan (1991)
  - Water supply with groundwater (water conservation)
  - Extraction Limits (quota) : WS: 170 \ IND: 85 Mm3/y
  - Reserve areas River Area
  - Reduction low valuable use of groundwater (industries)
  - Restoration of wet nature

Tackling Drying-up problems

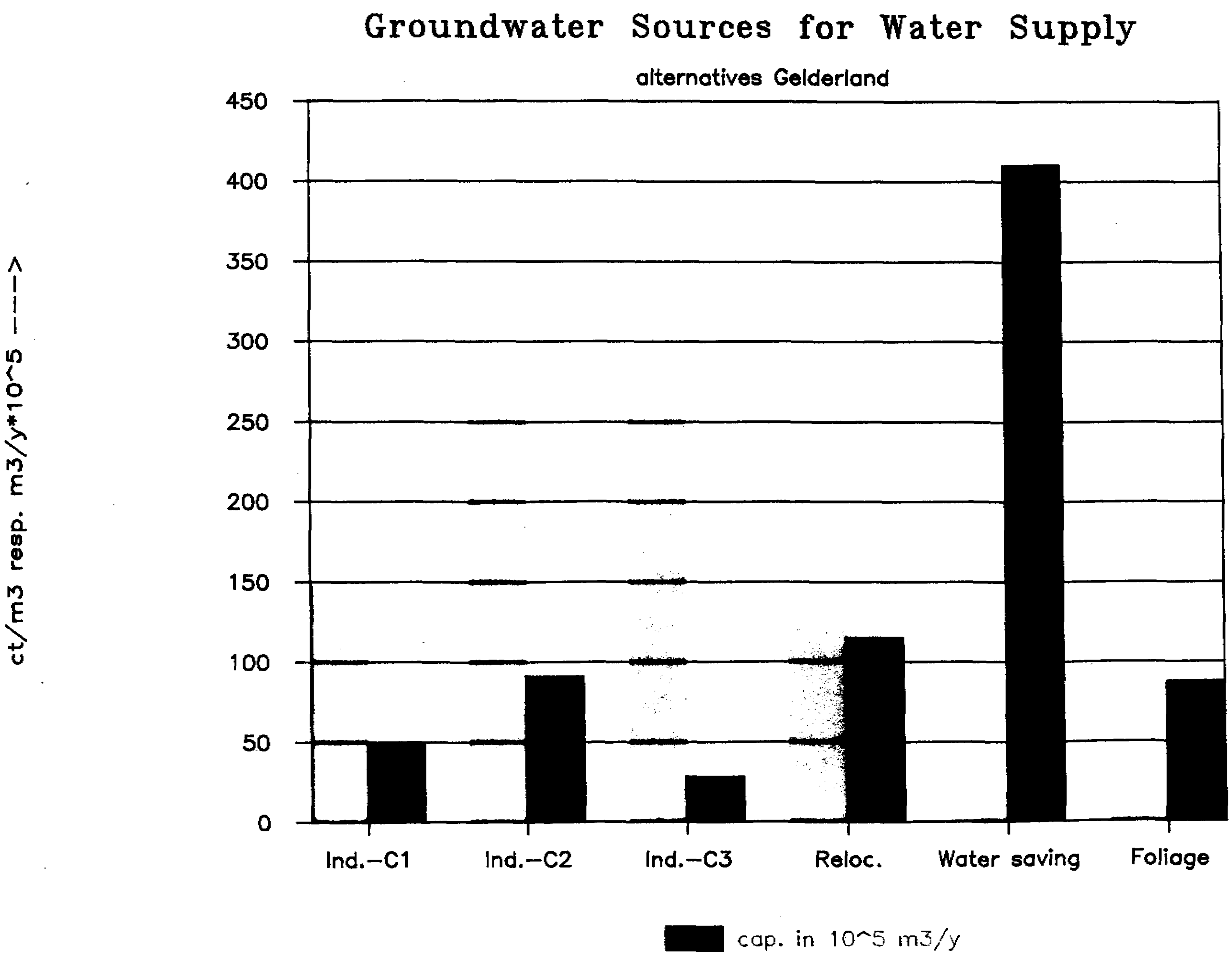
Gelderland:

* Working out plans (1991-1994)
  - transfer groundwater from industrial use to water supply
  - surface water supply industries
  - financial compensation industries
  - 3 pilot studies Veluwe area
  - relocation wellfields with drying-up effects
  - water conservation (saving)
  - reduction forest evaporation

Tackling Drying-up problems

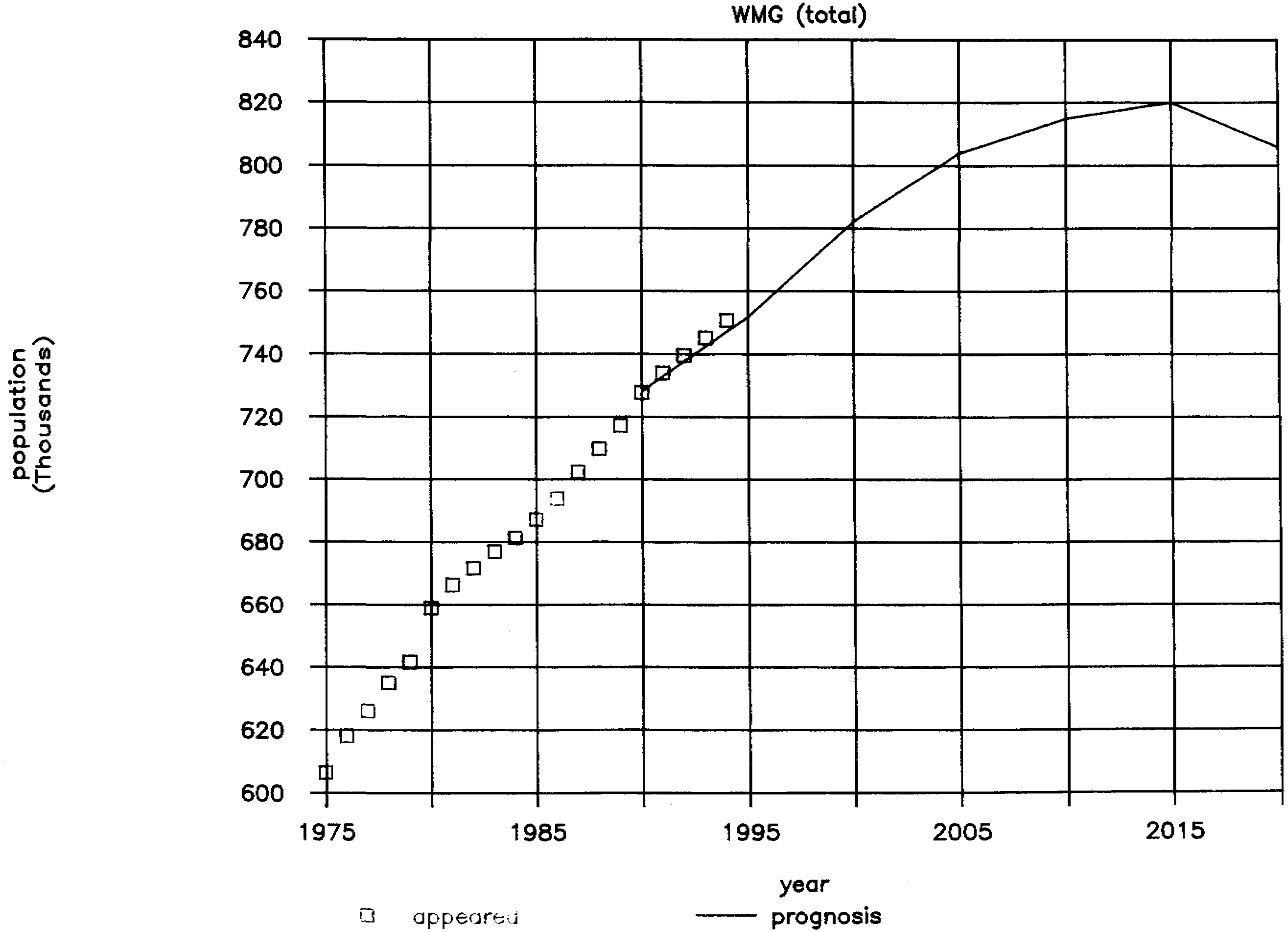
Gelderland:

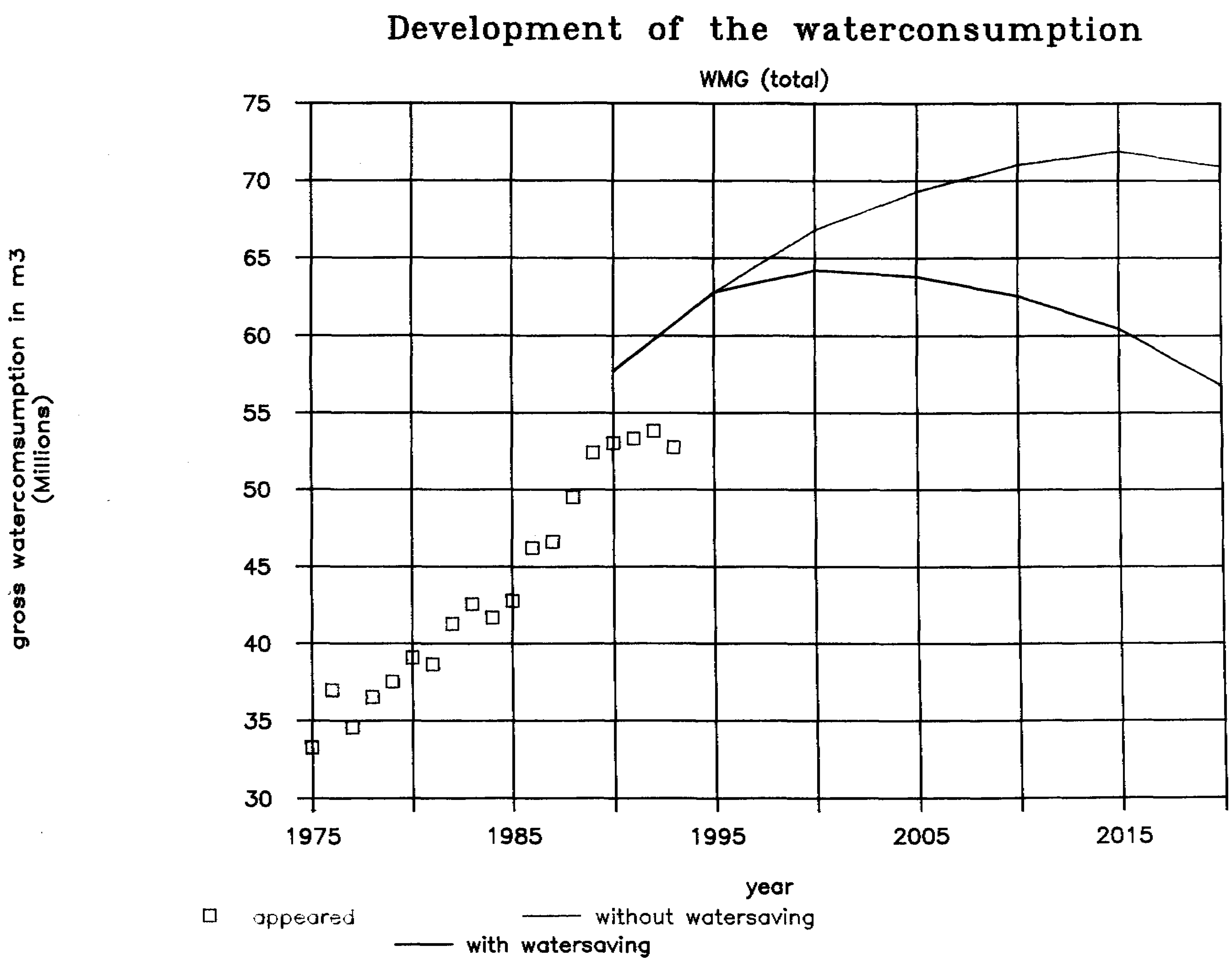
* Conclusions (1994):
  - substitution of industrial groundwater by surface water will become very expensive
  - waterconservation is paying for all parties
  - groundwater quota accepted
  - restoration wet nature by small scale watermanagement measures
  - least cost integrated solutions



Groundwater Sources for Water Supply
alternatives Gelderland
ct/m3 resp. m3/y*10^5 ---->
450
400
350
300
250
200
150
100
50
0
Ind.-C1
Ind.-C2
Ind.-C3
Reloc.
Water saving
Foliage
cap. in 10^5 m3/y

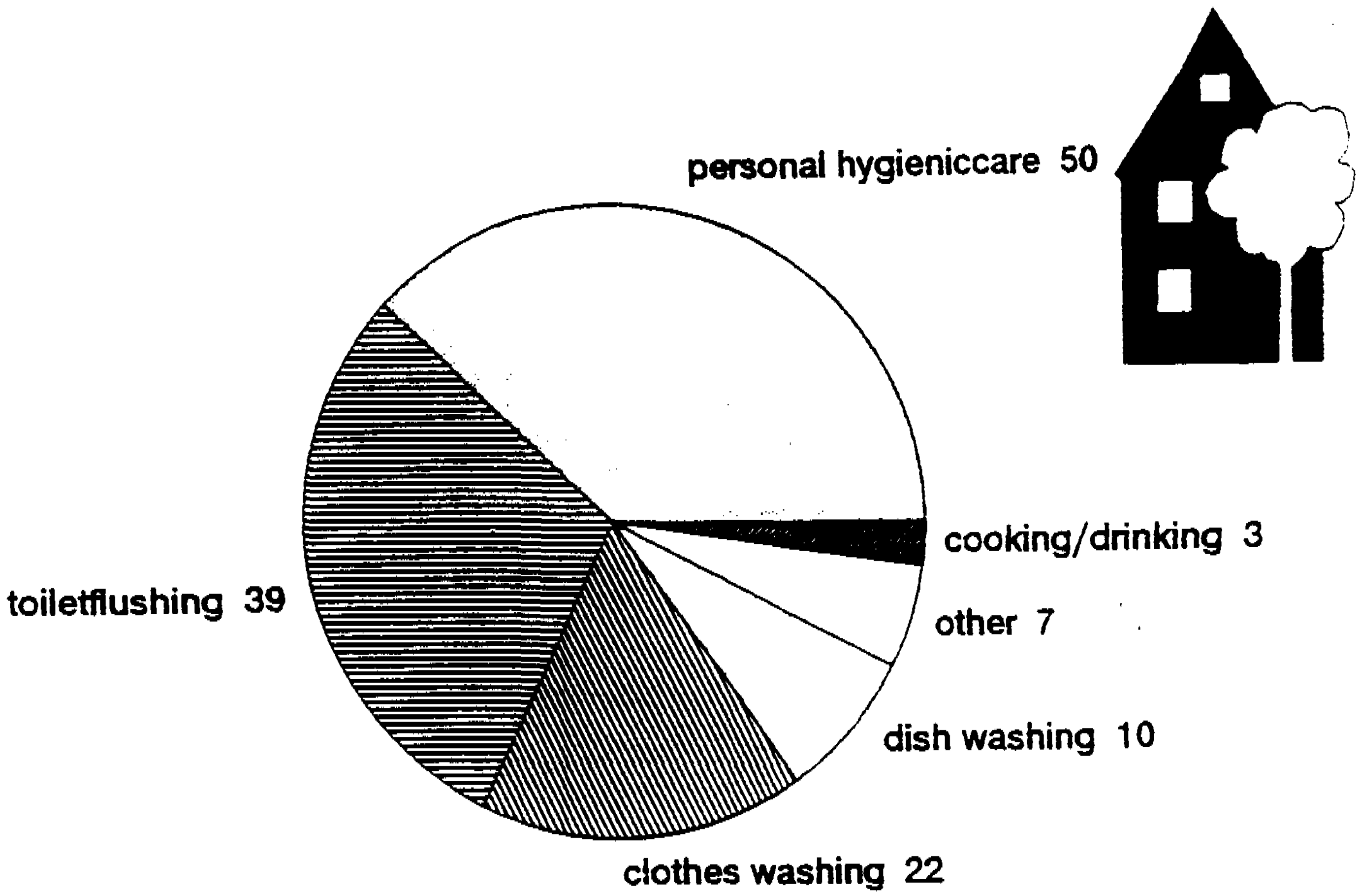
Development of the population





Development of the waterconsumption
WMG (total)
gross watercomsumption in m3 (Millions)
75
70
65
60
55
50
45
40
35
30
1975
1985
1995
2005
2015
year
appeared
without watersaving
with watersaving

Partition average domestic water use per capita in l/c.d. (1990 NL)



FINANCIAL MANAGEMENT AND CONSUMER ADMINISTRATION

Drs. A.G. Timmermans

Head Finance Division
N.V. Waterleiding Maatschappij Gelderland (WMG)
(Water Supply Company)

October 5, 1994

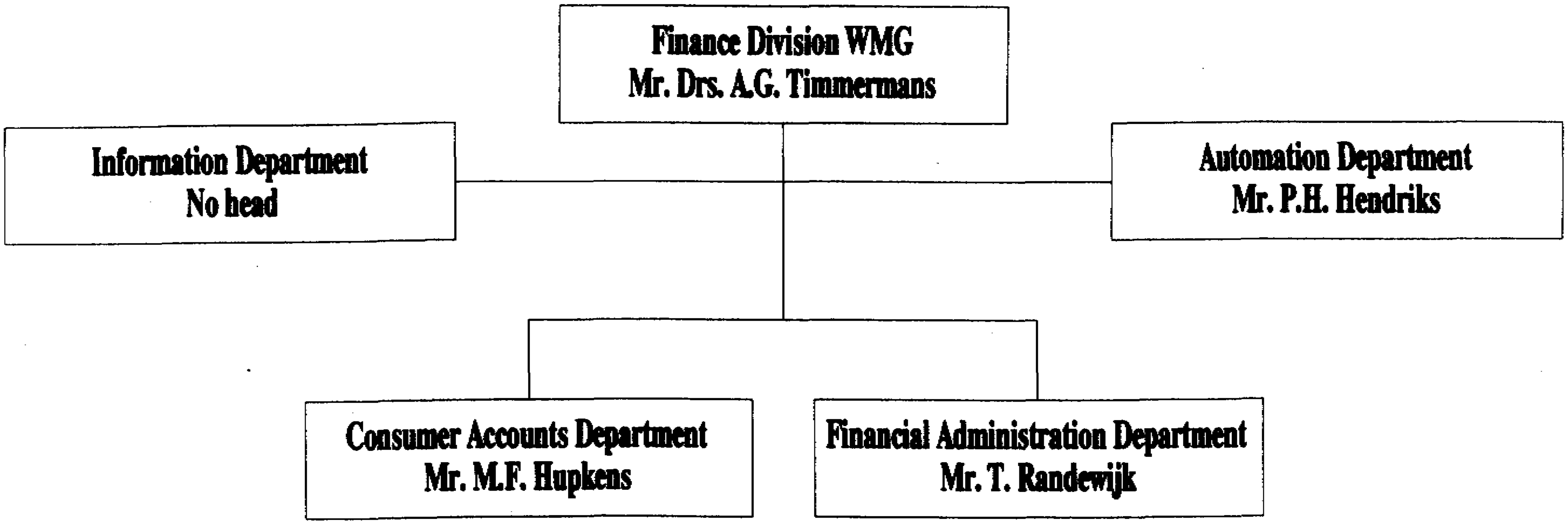
DATA WMG AT DECEMBER 31, 1993

. total balance	:	*f* 360	millions
. connections	:	272	x 1.000
. inhabitants	:	750	x 1.000
. length main pipes	:	6.600	km
. reserves	:	*f* 118	millions
. loans	:	*f* 177	millions

DATA WMG OVER 1993

• production drinking water	:		58	mill. m^3
• net export	:		5	mill. m^3
• unaccounted for control	:		5	mill. m^3
• turn over	:	*f*	97	millions
• net profit	:	*f*	-0,1	millions
• depreciation assets	:	*f*	22,3	millions
• investments	:	*f*	19	millions

Organisation Finance Division WMG



MANAGEMENT

- control and organisation of a company
- concerns about interdependent aspects
- can be distinguished between:
  - personnel management
  - production management
  - marketing management
  - financial management
    - * function of an organisation
    - * obtain and manage financial means
    - * in uncertain circumstances
  - etc.

CLASSIFICATION FINANCIAL MANAGEMENT

	long term	short term
planning	*	*
realisation	*	*
control	*	*

Long Term Financial Planning

- estimates the financial position
- for a period of 5 to 10 years
- for different strategies to choose the optimal one
- within a strategy
  - a policy for investment, employees, wages, tariffs, etc.
  - assumptions for inflation, rates of interest, etc.
- a personal computer might be helpful

SHORT TERM FINANCIAL PLANNING

- cash flow planning for 12 monthly periods (1 year)
- revolving calculation (update each month)
- goal:
  - to calculate the credit arrangements, that must be made
  - to evaluate the seasonal influences
- a personal computer might be helpful

LONG TERM FINANCIAL REALISATION

- treasury task
  - organisation of cash management
  - responsibility for the money, bills, loans

- controllers task
  - advising the management
    - * through clear documents
    - * based on financial and economic analysis
  - organisation of the administration
  - management financial information system

SHORT TERM FINANCIAL REALISATION

- weekly or daily operations of:
  - debtors
    - sending invoices
    - reminders
    - cash collection
  - creditors
    - paying bills
  - inventories
    - demand for articles
    - inventory levels
    - order quantity
  - cash management
    - current account
    - short term loans

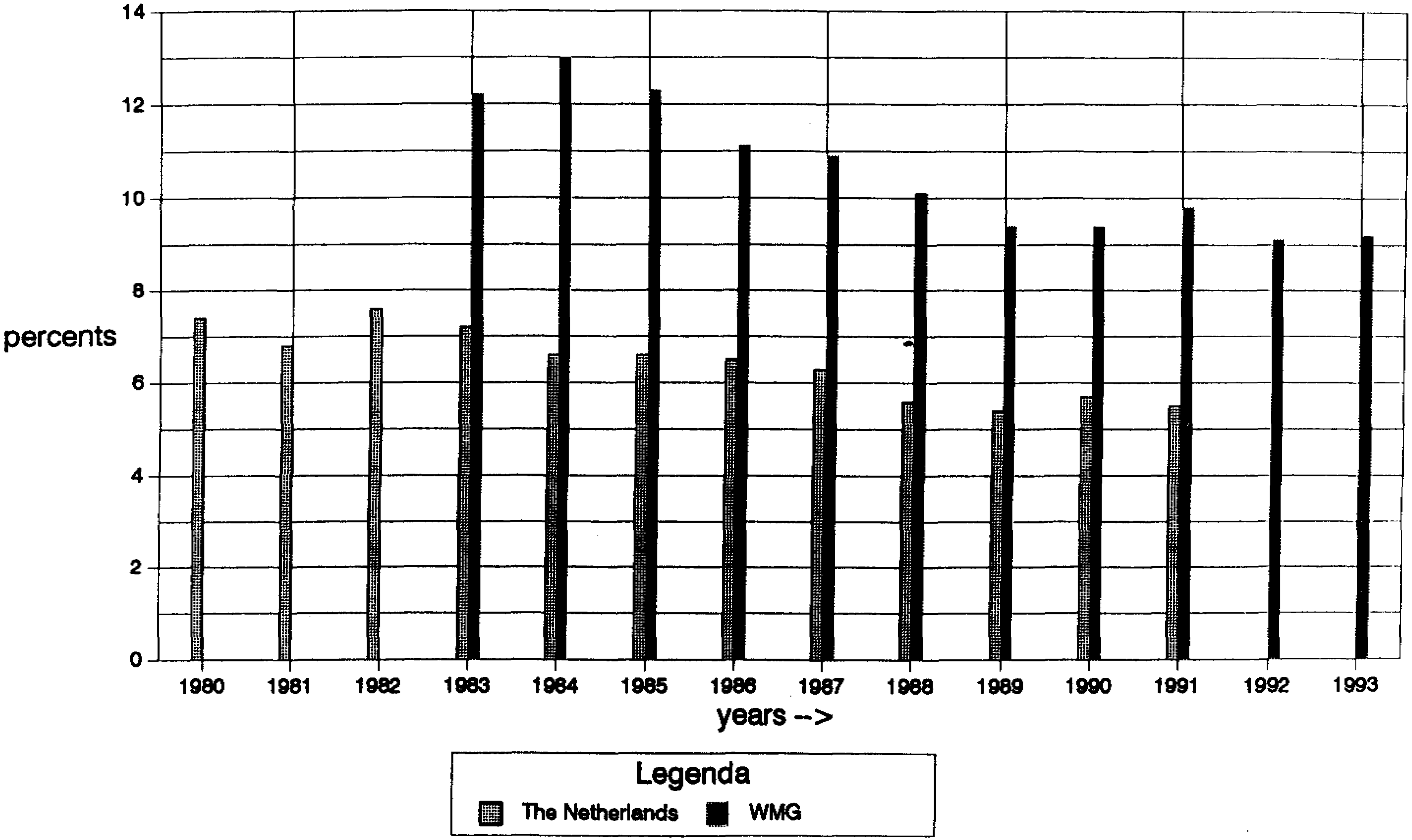
Long term financial control

- calculate and collect important ratios
  - average rate of interest
  - cost per connection
  - percentage unaccounted for control
  - meters pipe per connection
  - etc.

- useful to analyze series of ratios
  - the same ratio at different moments
  - the same ratio of comparable companies at the same moment

- ratio analyses: information to reprove companies policy

Unaccounted for control



SHORT TERM FINANCIAL CONTROL

- monthly verification of budgets with realisations
- monthly reports about debtors, creditors and inventories to compare evolvement with sanctioned program

USER ADMINISTRATION

In the past:

- individual or communal pump
- active approach for new users
- fixed amount charched for water consumption

USER ADMINISTRATION

Meterreading

- 4 districts
- once a year meterreading = 272.000 meters
- each district 68.000 meters
- handheld terminals

USER ADMINISTRATION

Invoicing

- 4 invoices a year
- 3 bills = advance invoice
- fourth invoice is yearly final
  + standing charge
  + M^3 (based on meterreading) * price per M^3
  - 4 times advanced charge last year
  + first advange charge this year

- in one year: 272.000 * 4 = 1.088.000 invoices

USER ADMINISTRATION

Collecting money

- 60% pays automatically
- 40% pays by manual transferring
    - 80% pays within 4 weeks
    - 15% after reminder
    - 5% via cash-chit

User Administration

New connections

- 3.000/4.000 new connections a year
- first connection: building connection

Moving

- 20.000 movings a year
- one-call-system

Wholesale/retail sale

- about 100 consumers require more than 5 M^3/hour
- meterreading once every quarter
- billing every month

USER ADMINISTRATION

The automated system

- consumer administration system

- all relevant data

- money collection system

  - registration of debts and payments

  - information on reminders, cash-chits, balance of payment

- Both provide management reports

- Base: a key consisting of municipalitynumber, street and housenumber

User Administration

Problems

- conflicts about billing

- no-paying

- no matching payments

TARIFF POLICY

Four purposes:

- cover actual costs
- charge reasonable andn fair prices
- convince customer of fairness
- prices should discourage spilling

TARIFF POLICY

Tariff retail users

- fixed charge: DFl 65,--

- M^3-price:

    - ordenary retai users: Dfl 1,46

    - campings: Dfl 2,02

Wholesale tariffs

Max cap per hour in M^3	max cap per quarter in M^3	fixed charge per quarter in DFl
5	3.000	4.020
6	3.600	4.824
7	4.200	5.628
8	4.800	6.432
9	5.400	7.236
10	6.000	8.040
15	9.000	12.060
20	12.000	16.080
25	15.000	20.100
30	18.000	24.120
40	24.000	32.160
50	30.000	40.200
60	36.000	48.240
70	42.000	56.280
80	48.000	64.320
90	54.000	72.360

Note: when a consumer uses more than allowed, he has to pay additonal Dfl 1,08 per M^3

TARIFF POLICY

modal employee earns Dfl 2.500,-- per month

waterconsumption is ± 16 M^3 a month = Dfl 30,-- per month

1. Introduction

2. Investment Policy
   (Goals)

3. Investment Plans (example)

4. Short–term planning and Budgetting

5. Operating budget and tarrifs

Section: Financial–Business Economics section

Activities

1. Annual Report
2. Preparing/making annual Budgetreport
3. Statistics
4. Insurance
5. Costpricing–accounting
6. Advisory
7. Cash and corporate Financing

From Investment Policy to Investment plans

Goals :

- Production of drinking water
- Distribution of drinking water
- Quality of drinking water
- Fair price

supply side (technical departments)

==> **Investment proposals/plans :**

demand side (marketing department)

↓

decisions/approval: ↓

long term investmentplan : > 5 years

medium term investmentplan : 1 – 5 years

short term investmentplan : within 1 year

INVESTMENT SHORT, MEDIUM AND LONG TERM PLAN
(example)

Description of investment-project	TOTAL BUDGET	Short term 1994	Medium/Long term x DFL 1.000.000 1995	1996	1997	1998	1999	over 1999
production								
new pumpstation Eemdijk	15	5	10					
other pumpstations	84,5	10	13	12,5	10	10	9	20
other production possibilities	84	5	7	10	12	15	15	20
Distribution								
pipe lines	132,5	17	18	17	17,8	19	18,7	25
Buildings and installations								
housing renovation	14	3,5	1,5	1	1	1	1	5
equipment and fittings	21,5	2	2	2	2,5	2,5	2,5	8
Other investments								
cars	5,4	0,8	0,6	0,5	0,5	0,5	0,5	2
land	6,6	1,3	0,5	1	1,2	0,8	0,8	1
information system	20,7	2,4	2	2,5	2,8	3	3	5
TOTAL INVESTMENTS		**47**	**54,6**	**46,5**	**47,8**	**51,8**	**50,5**	**86**

Short–term planning and Budgetting

short term investments ---> Investment Budget ---> annual costs

department activities ---> Department Budgets ---> annual costs

\+

Company Operational costs

Company operational Budget costs:

- depreciation costs
- interest costs
- salaries
- other operational costs

Waterprice calculation for 1995
(example)

Accounted profit/loss for 1995	price DFL 1,00	proposed New price DFL 1,11
	DFL	DFL
Companies income / waterturnover (estimate to sell 82.000.000 m3 water) at todays–price of DFl 1,= / m3.	**82.000.000**	**91.000.000**
Other companies turnover	**10.000.000**	**10.000.000**
Companies operating costs		
depreciation costs	**22.000.000**	**22.000.000**
interest costs	**16.000.000**	**16.000.000**
salaries	**38.000.000**	**38.000.000**
other operating costs	**25.000.000**	**25.000.000**
DEFICIT/LOSS	**–9.000.000**	**0**

Waterprice has to increase with : 11,0%

Waterprice proposal becomes DFL 1,11 for 1995

DISTRIBUTION, N.V.WMG.

1. Organisation and tasks.

The main task of the distribution department is "design, construction and management of the whole pipe network in such a way that the delivery of good drinking water is guaranteed under sufficient pressure and in sufficient quantity."

This means that

- the pipe network has to be designed and managed in a way that it is resistant against all known in- and external loads and that we have to reckon with all kinds of calamity's.
- the pipe network has to be designed with sufficient diameters to be able to deliver drinkingwater in sufficient quantity's on a maximum day and under a guaranteed pressure of at least 200 kPa at the end of the net.
- The pipe network has to be designed in a way that there is no interaction between the pipe material and the drinking water.

To fulfil this task the distribution department deals with planning, construction and maintenance of the pipe network, with so called inspection tasks (acquisition, controlling of customers installations, information and advice) and a lot of administrative work.
Furthermore the WMG distribution department takes care of the meterreading and the forced collection.

The WMG distribution department is divided into 5 divisions: 4 decentral districts and a "staffgroup" at the main office.

The "Staffgroup" of 14 workers deals with support of the head of the distribution department in managing the department and support of the districts and consist of specialists and a registrative drawingroom.

A District is divided in 4 subdivisions: Planning, Construction and Maintenance, Inspection and Administration.
The districts take care of in average 67.000 house-connections and 1650 km of mains.
The construction of the network is done by own workers and by contractors, maintenance is, most of the time, done by own workers.
Per district there are in average 45 workers.

2. The infrastructure.

The length of the Dutch network of watermains is approximately 94.000 kilometres and is still growing.

40% of the mains are made from asbestoscement, 40% is PVC an PE, 15% is cast iron and steel and 5% are made from other materials.

The use of asbestoscement is not longer allowed in Holland, so nowadays most of the new pipes are made from PVC.

The WMG-net has a length of about 6700 kilometres. 53% is made from PVC and PE, 34% is made from asbestoscement and 13% is made from cast iron and steel (1%).

The WMG is a typical PVC-minded company because PVC is a reliable material, it is easy to use, all diameters are available (up to 630 mm) and there is a big scale of appendages.
Furthermore PVC is light and therefor light to handle and it saves the back of our workers.
Only in polluted soils the use of PVC is sometimes not possible because some pollutants will permeate through the PVC into the water. In that case we try to avoid laying pipes, but sometimes we have to, and then we use steel, cast iron or special pipes, made from PVC, surrounded with an aluminium layer to prevent permeation and a PE layer to protect the aluminium.

An phenomenon we have to deal with is the incrustration of old cast iron pipes. It gives us sometimes a lot of trouble and a lot of complaints.
Most of the times we try to replace these pipes, but other times it is more economic to clean them with steel scrapers and after that we spray a thin cement layer to the inside wall of the pipe. In that case we have to make manholes every 100 to 150 meter to bring in special devices.
The delivery of drinking water to our consumers during these works is realised by a temporary aboveground pipe system for 3 to 4 days.

More and more the Dutch public utilities use "no-dig" or trenchless technologies to make road-, canal-, river- and dikecrossings.
One of the greatest advantages of these systems are that crossings can be made without disturbing the function of the road or river. Moreover it avoids damage of the road, riverbottom, riverbanks, dikes, etc. and costs for repair and maintenance later.
One of the greatest crossings ever made with the technique of horizontal directional drilling was made for some years, when we made a steel crossing with the river Waal near Zaltbommel, diameter 400 mm, a length of 1300 meter, a cement coating inside and a PE coating outside.
After making the borehole, the whole insitu prefabricated pipe was pulled in in about 22 hours. The depth of the pipe is about 30 meters below the river bottom.

The coming years the distribution department will be very busy with creating a complete information system with automated mapping and facility management.
Digital maps will come available and we have to digitise all kind off information about our system to be able to improve the quality of our work and most of all to do our work more economic.

The technical life of watermains is long but limited. We expect that, at a certain moment, we have to be busy with replacement of more than 75 kilometres of mains per year.
A good system with all kind of information about the net and the quality of the net is then essential to plan these replacements very carefully and a long time before.

3. Maintenance.

There are two extremes of maintenance programs:

- "Breakdown maintenance" or "if it works it doesn't need maintenance" or "maintenance after failure"

- "Maintenance or replacement before failure."

Both of these extremes are very expensive, certainly in a West European country as The Netherlands.

Let me try to explain why.

- Labour is very expensive in Holland, so repairs will cost a lot of money because of the great labourfactor in the costs of repairs.

- Every failure in our net will give more or less trouble for and with our customers, who are used to an almost 100% service.

- Replacement before failure means that we don't use the whole lifetime of a construction or a material so we make an inefficient use of our investments.

In our company we do something in between. We accept a certain amount of breakdowns, but we try to find an optimum in costs between repairing afterwards and replacing or maintaining before failure.

In theory it works as follows":

At a certain moment during the lifetime of a main breakdowns will occur. We calculate the average costs of a breakdown and we can calculate how many breakdowns per year will cost us as much money as the investment per year for replacing the whole main. At the moment that that amount of breakdowns will occur, it is time to replace the main.

In practice it is more difficult.

First, it is difficult to calculate the average costs of a breakdown, because the range of costs is very wide. For instance a repair in the open field is much cheaper than the repair in a paved street.
Second, we like to plan our work in advance, so we have to make predictions of the breakdownbehavior of a main.

Third, very often we won't wait until there are so many breakdowns that the costs of repairing the breakdowns will be equal to the costs of replacement, since there are other costs involved.
In that way we have to think at what we call social costs.
For instance costs that other people have due to a breakdown, like people who cannot reach their houses or shops, a factory that cannot work because they need water for their manufacturing processes, or people that have to drive several kilometres more than normal, etc.

At this moment we plan our replacements most of the time due to the technical acumen and experience of our co-operators and not based upon a theoretical model.

Beside of replacements we do a lot of structural maintenance to keep the net running in a proper way.
For instance, we have a yearly planned scheme for maintenance of hydrants and valves.
Furthermore we have scheme's for flushing dead ends of the net and for flushing transportation pipes.

We do a lot of measuring to see what the effects of flushing are and to optimize this kind of maintenance.

At last we do a lot of maintenance due to what we call the "peep-system".
If somebody calls us with a complaint we try to repair the trouble as soon as we can.
Specially these complaints give us a lot of information of the condition of our net and we planned a computerised system to lay down these information in a data base so that we can get a lot of management information from this system.
At this moment we do this by hand or on something like a card system.

The most important information about losses through leakage is obtained from the water consumption during the night.
During the night, the waterconsumption is almost zero. In every pumpingstation the consumption is registered continuously, so through comparing the figures of every night we can see if there is any abnormality which can indicate leakage.
If we establish such an abnormality we have to search where it occurs.

First we try to locate the leakage by comparing the continuous pressure registrations we have all over the net. A fall of the normal pressure indicates the location.
Also complaint of customers on pressure fall can indicate such a place.

Furthermore we try to find the place through visual inspection which is sometimes very difficult because our mains are laying very deep because of the danger of damage by freezing in wintertime and because of the very dense net of ditches and canals with a drainage function.

If we cannot find the exact location we have to search by isolating sectors of our net by closing valves.

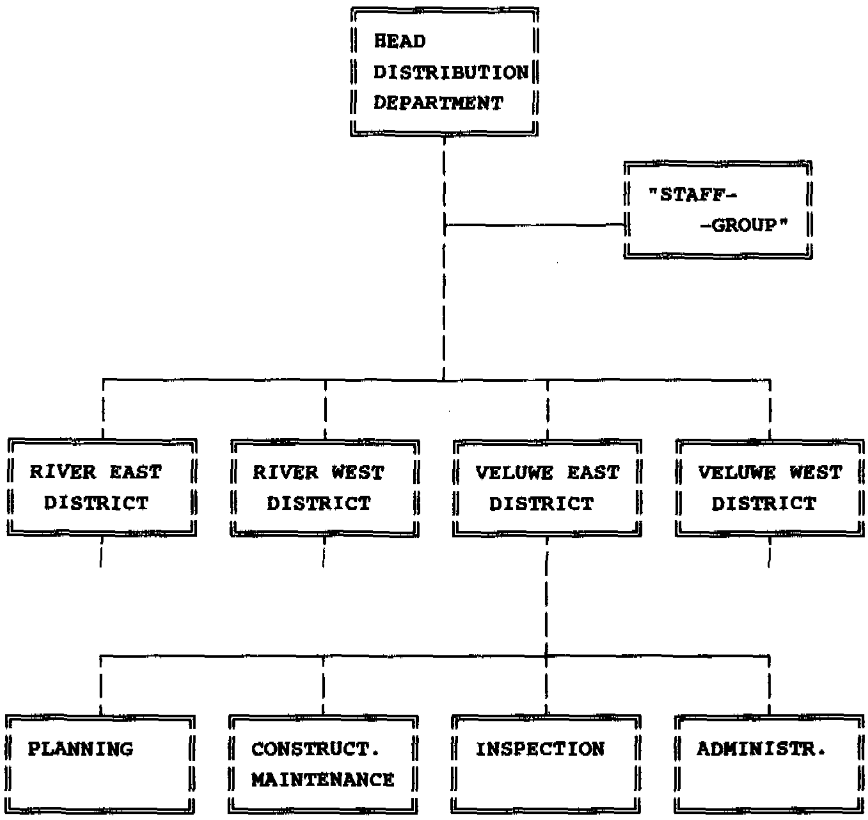
The last helps we have are the use of special instruments and leakdetection methods using radar, noise, special gasses, etc.

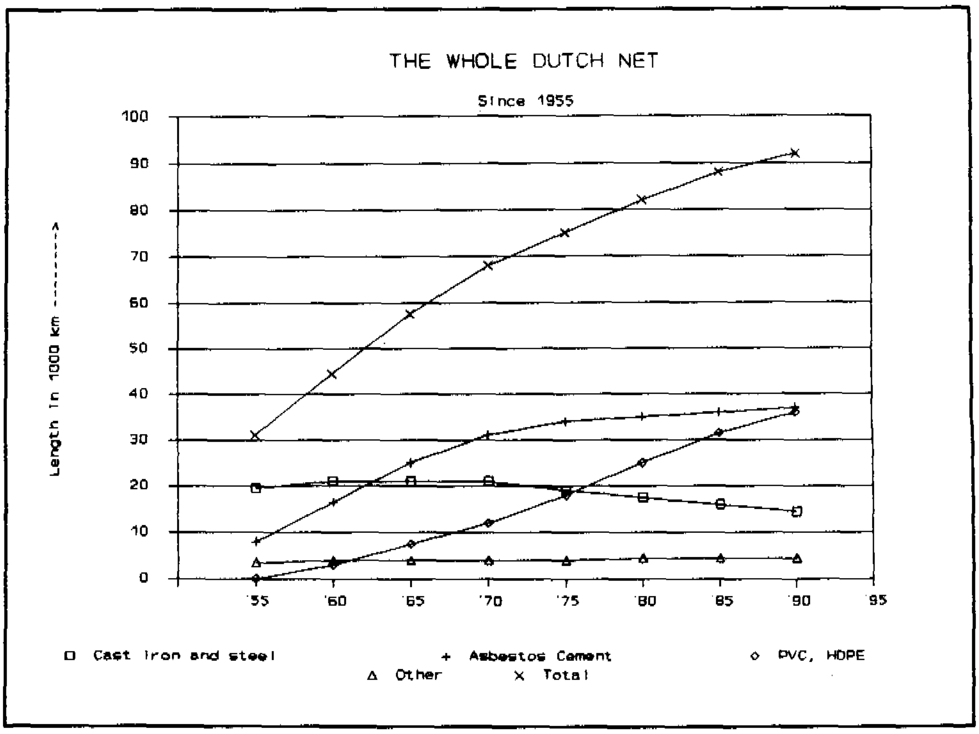
As I already told a lot of leakages will be mentioned by our customers. Our country is very densely populated so visible leakages will be detected very soon an d we will be informed. Furthermore the people is very used to have water 24 hours a day with a constant pressure and they will report or complain every abnormality.
Therefor they can reach us by telephone 24 hours a day, 7 days in a week.
During the night and in the weekends they will be automatically switched to an employee on duty.

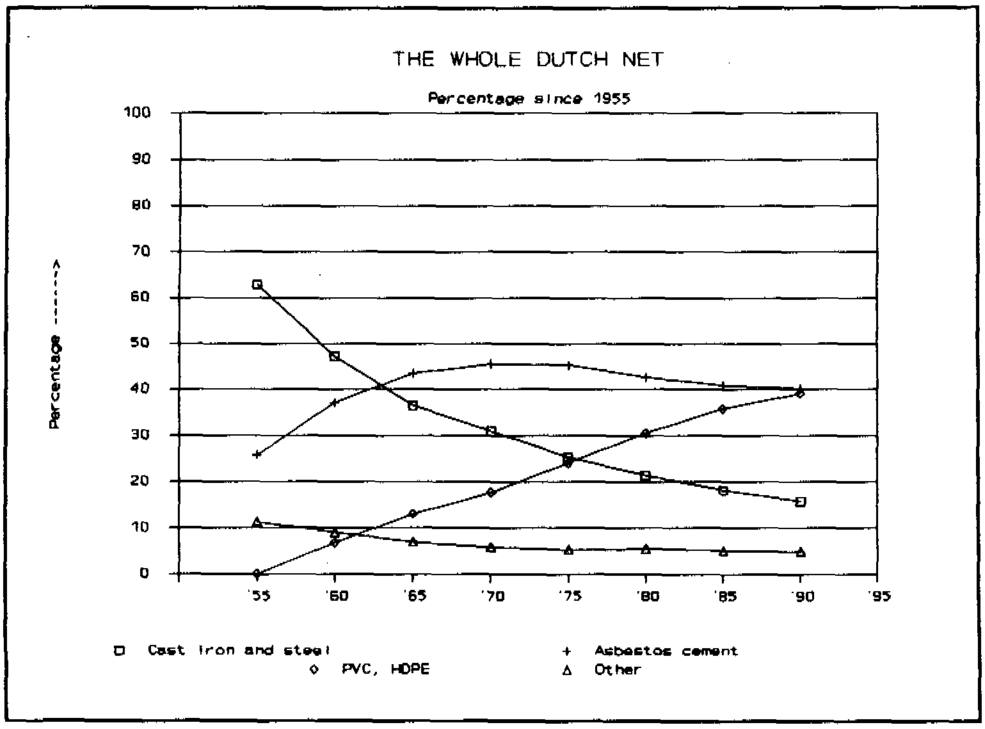
Finally some aspects on the waterquality in relation to the health of our consumers.

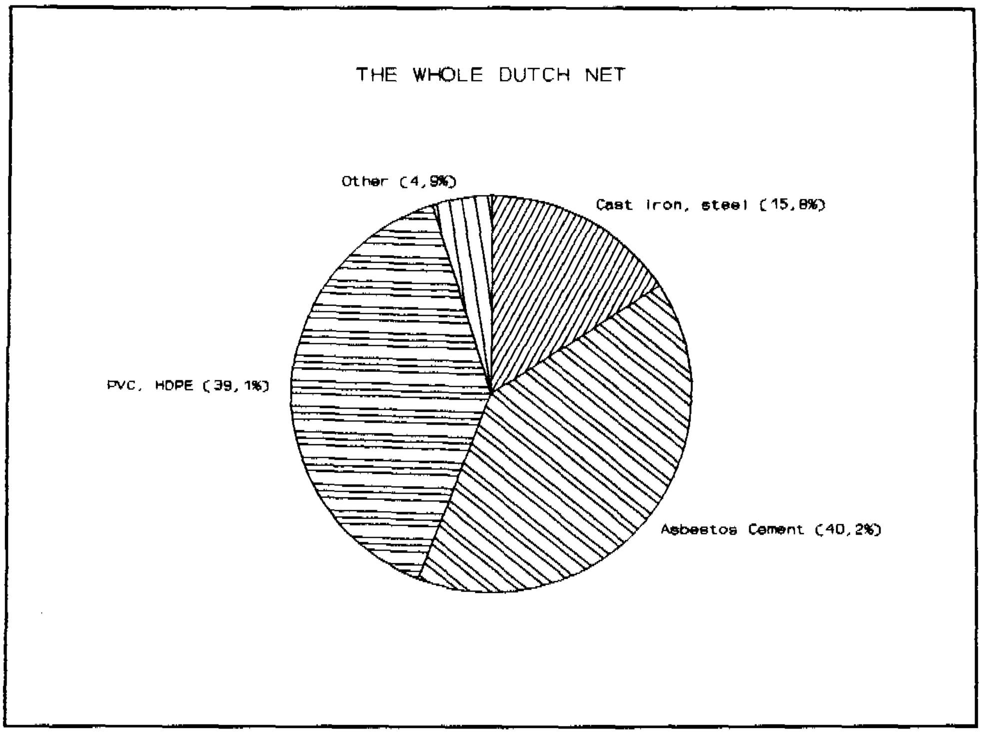
In Holland it so normal that people can drink the water directly from the tap that nobody even thinks about that.
So we have to think for them and it is our duty that the drinkingwater has always a good and hygienic quality.
We try to arrange that without the use of continuous disinfection with chlorine or else.
If we work on the net we always isolate that part of the net by closing valves.
After the work is done we flush the pipes, if neccescary with the use of chlorine, and than we take some samples for the laboratory. Than we have to wait for the approval of the laboratory.
After this approval we open de valves again otherwise we have to clean the pipe again.

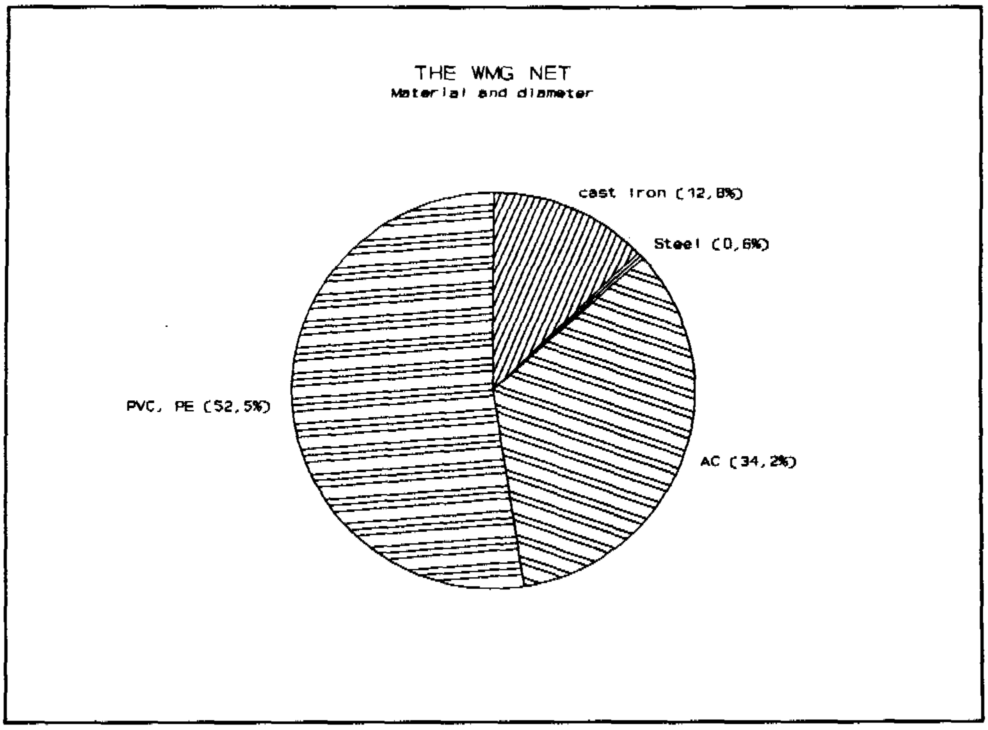
DISTRIBUTION DEPARTMENT
GLOBAL ORGANISATION SCHEME

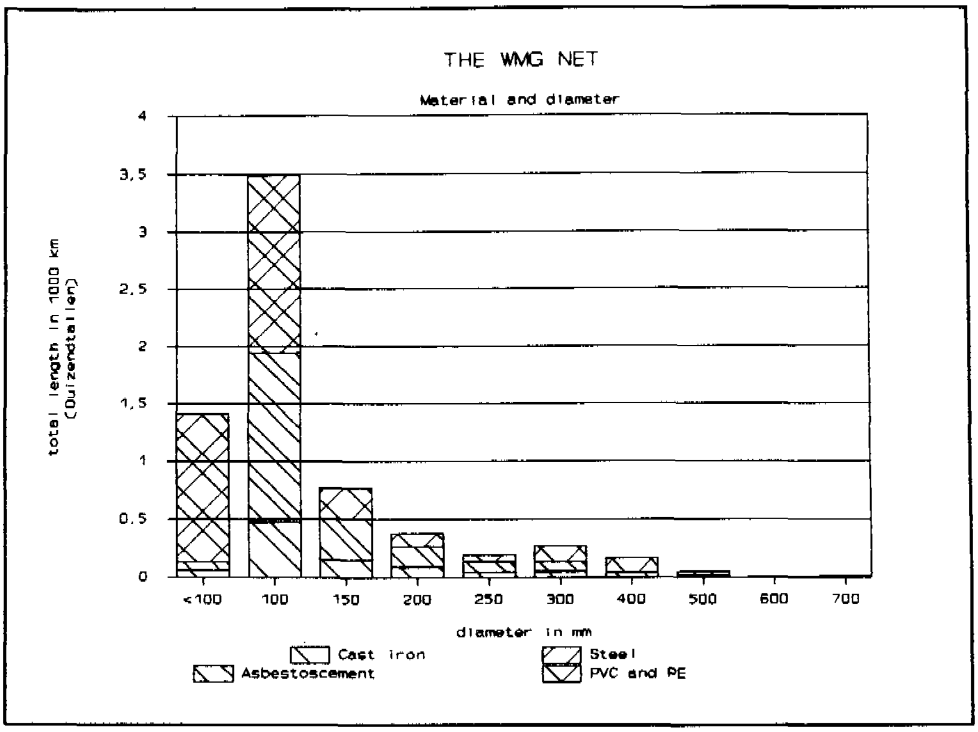


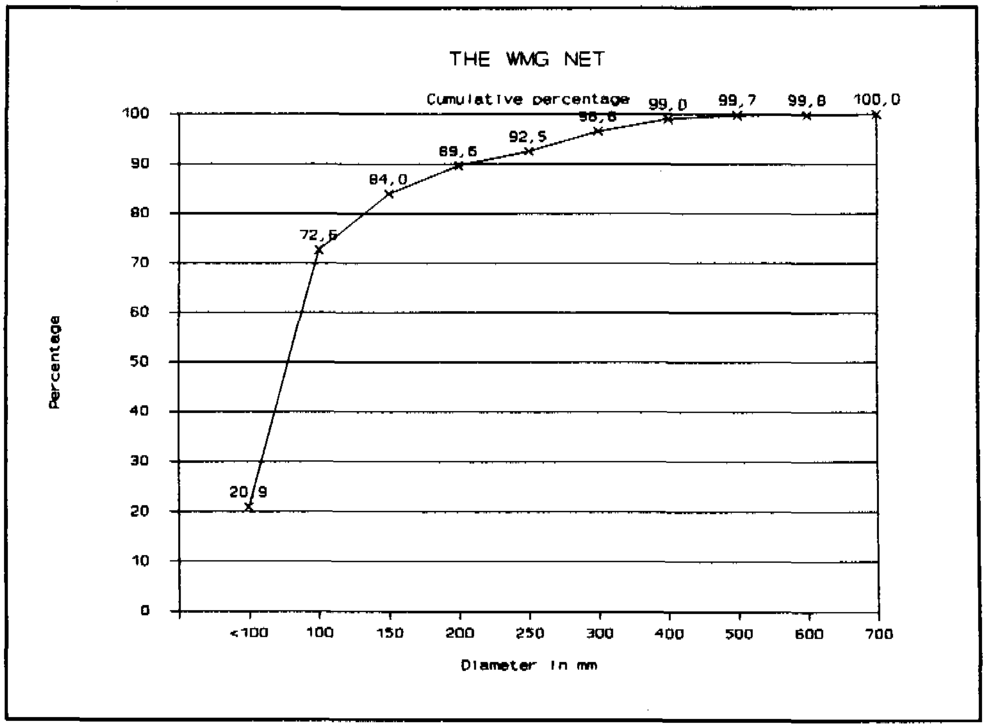

THE WHOLE DUTCH NET
Since 1955
Length in 1000 km ------->
100
90
80
70
60
50
40
30
20
10
0
'55
'60
'65
'70
'75
'80
'85
'90
'95
□ Cast iron and steel
+ Asbestos Cement
◇ PVC, HDPE
Δ Other
× Total

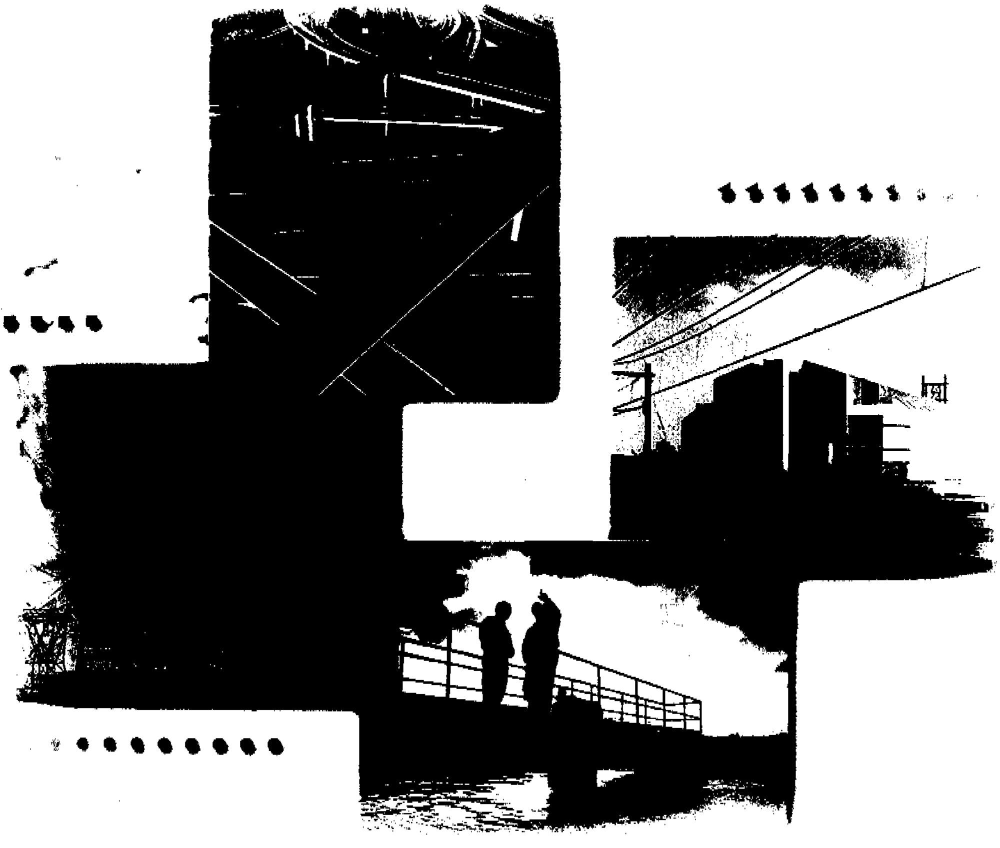

THE WHOLE DUTCH NET
Percentage since 1955
Percentage ------->
100
90
80
70
60
50
40
30
20
10
0
'55
'60
'65
'70
'75
'80
'85
'90
'95
□ Cast iron and steel
+ Asbestos cement
◇ PVC, HDPE
Δ Other


THE WHOLE DUTCH NET
Other (4,9%)
Cast iron, steel (15,8%)
PVC, HDPE (39,1%)
Asbestos Cement (40,2%)


THE WMG NET
Material and diameter
cast iron (12,8%)
Steel (0,6%)
PVC, PE (52,5%)
AC (34,2%)


THE WMG NET
Material and diameter
total length in 1000 km
(Duizendtallen)
4
3,5
3
2,5
2
1,5
1
0.5
0
<100
100
150
200
250
300
400
500
600
700
diameter in mm
Cast iron
Asbestoscement
Steel
PVC and PE


THE WMG NET
Cumulative percentage
Percentage
100
90
80
70
60
50
40
30
20
10
0
20,9
72,5
84,0
89,6
92,5
96,6
99,0
99,7
99,8
100,0
<100
100
150
200
250
300
400
500
600
700
Diameter in mm

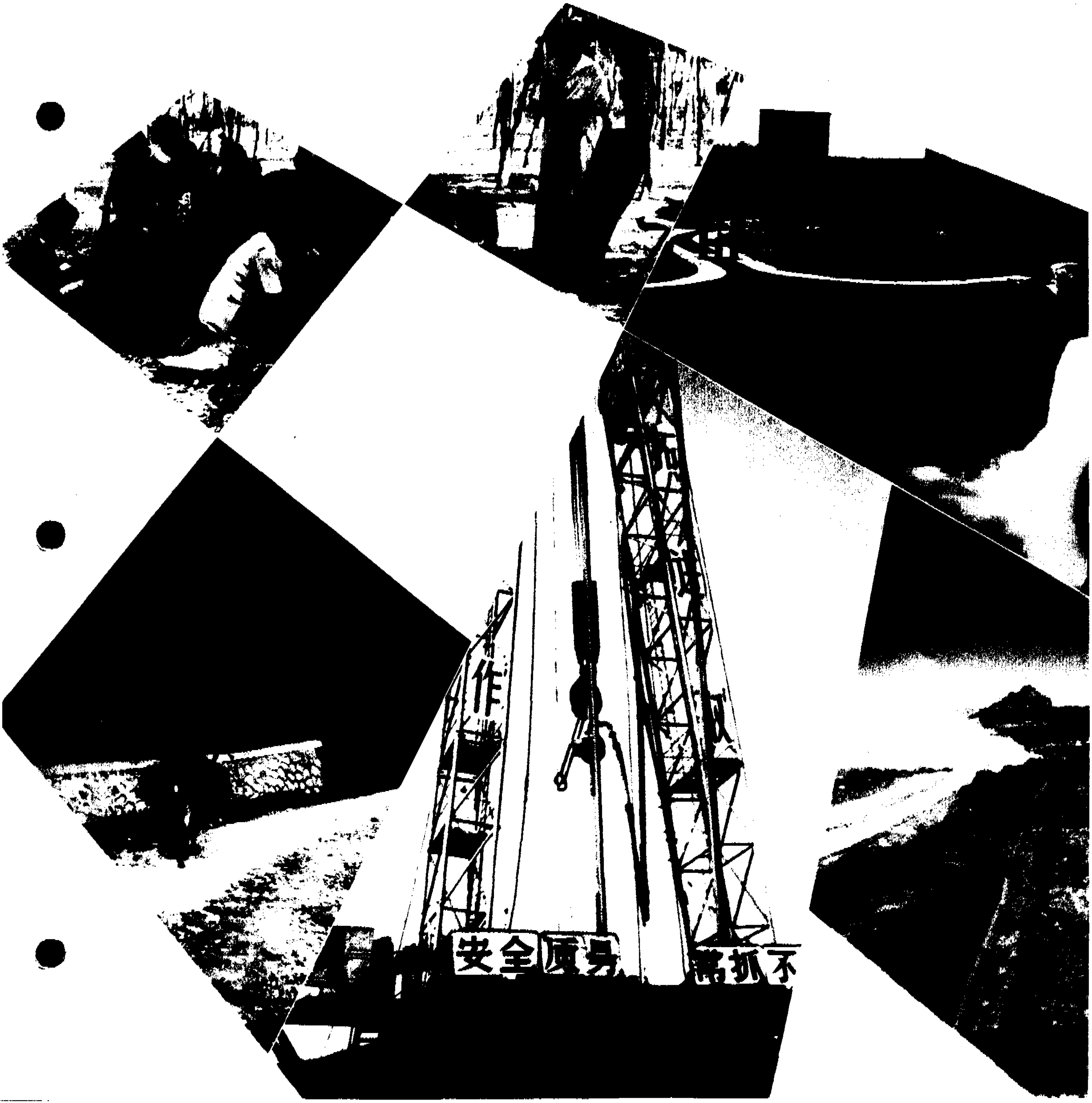


ANNUAL REPORT 1993

DHV HOLDING

CONSULTANTS

Major Worldwide Operations 1993



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Telefax +31 - 33682601
Telex 79348 dhv

Environmental Management
Environmental auditing
Environmental impact assessment
Legislation/legal assistance
Environmental risk analysis

Water Supply
Sustainable water supply systems
Hand pump and wells programmes
Desalination
Water treatment and softening
Unaccounted for water reduction
Water distribution management
Community management

Sanitation and Sewerage
Low cost systems
Sewer and drainage systems
Retention basins
Hydraulic network simulations
Real-time control
Design and operation
Minimizing industrial wastewater flows

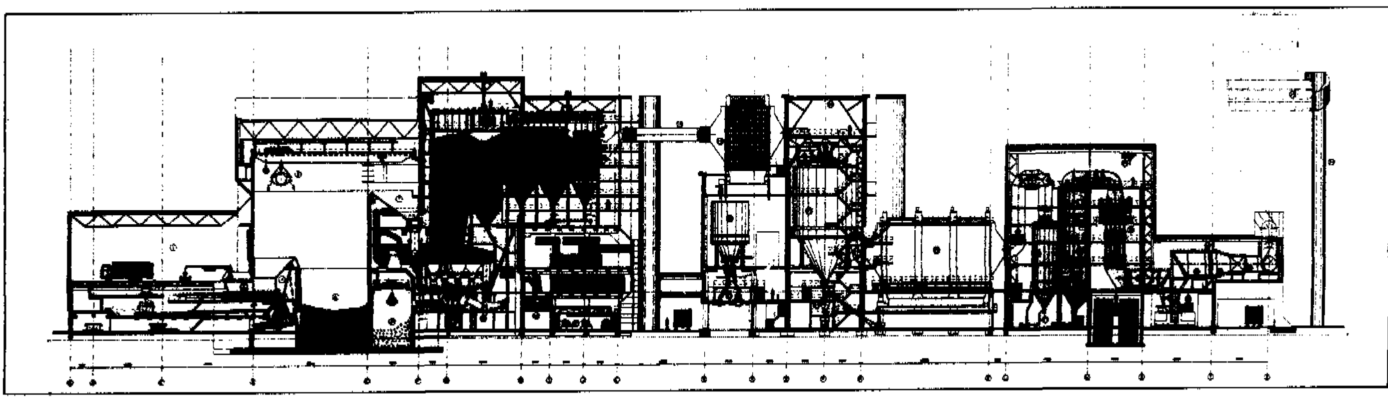
Wastewater Treatment
Aerobic and anaerobic systems
UASB system
Carrousel and Carrousel-2000
Phosphate and nitrogen removal
Recovery of heavy metals
Crystalactor
Sludge stabilization and treatment

Solid Waste
Municipal and industrial waste
Collection, transfer and storage
Minimization, separation, recycling
Dumping, controlled tipping
Composting
Incineration
Physical/chemical treatment

Air Pollution Control
Emission measurements and monitoring
Air treatment systems
Dispersion models and forecasts
Biological filtration

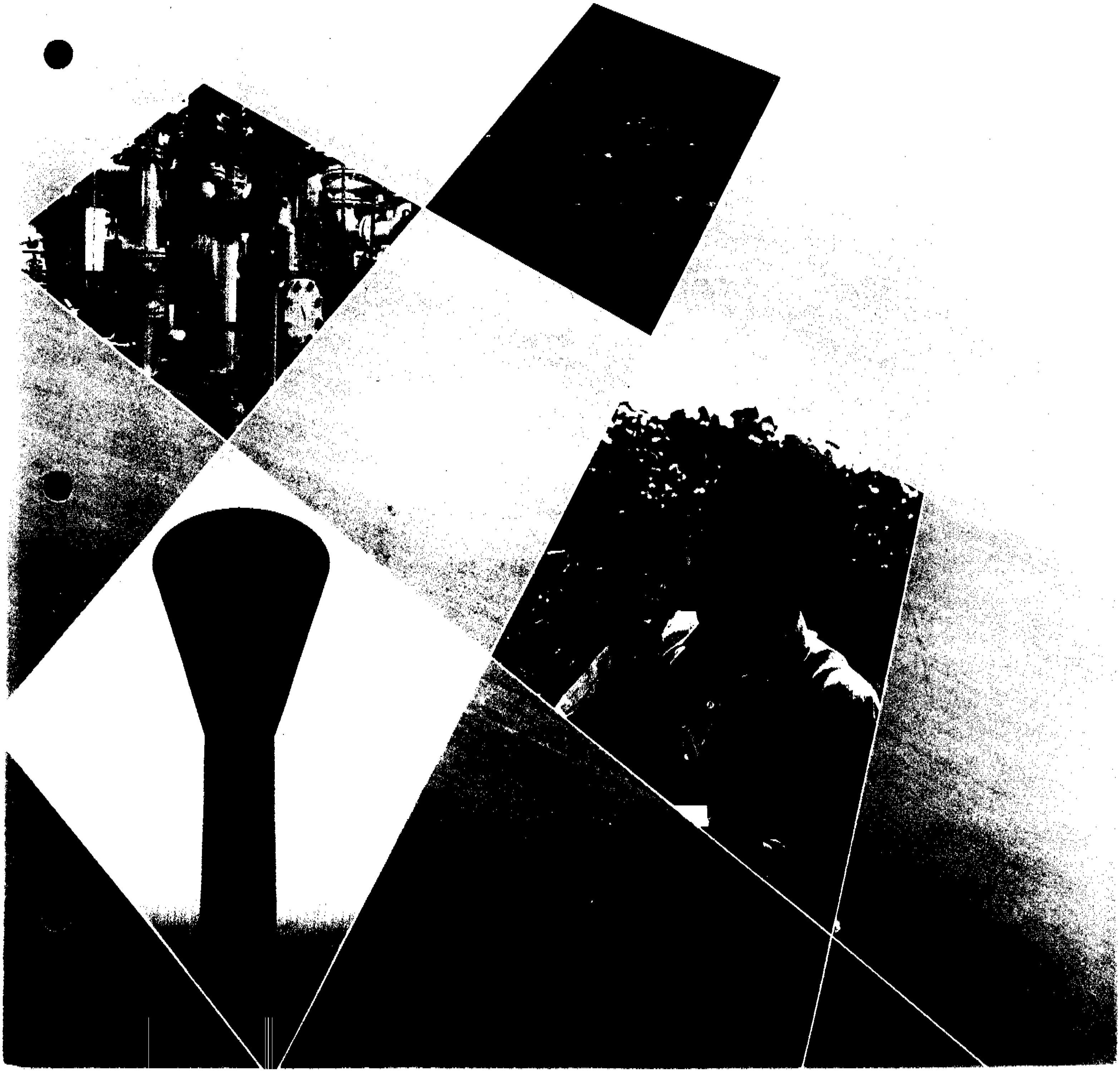
Soil and Groundwater Pollution Control
Pollution assessment
Soill pollution clean-up
Treatment of polluted groundwater
In-situ soil and groundwater cleaning

Noise Pollution Control
Noise measurement
Prevention of noise pollution
Traffic noise modelling
Noise abatement methods and technologies

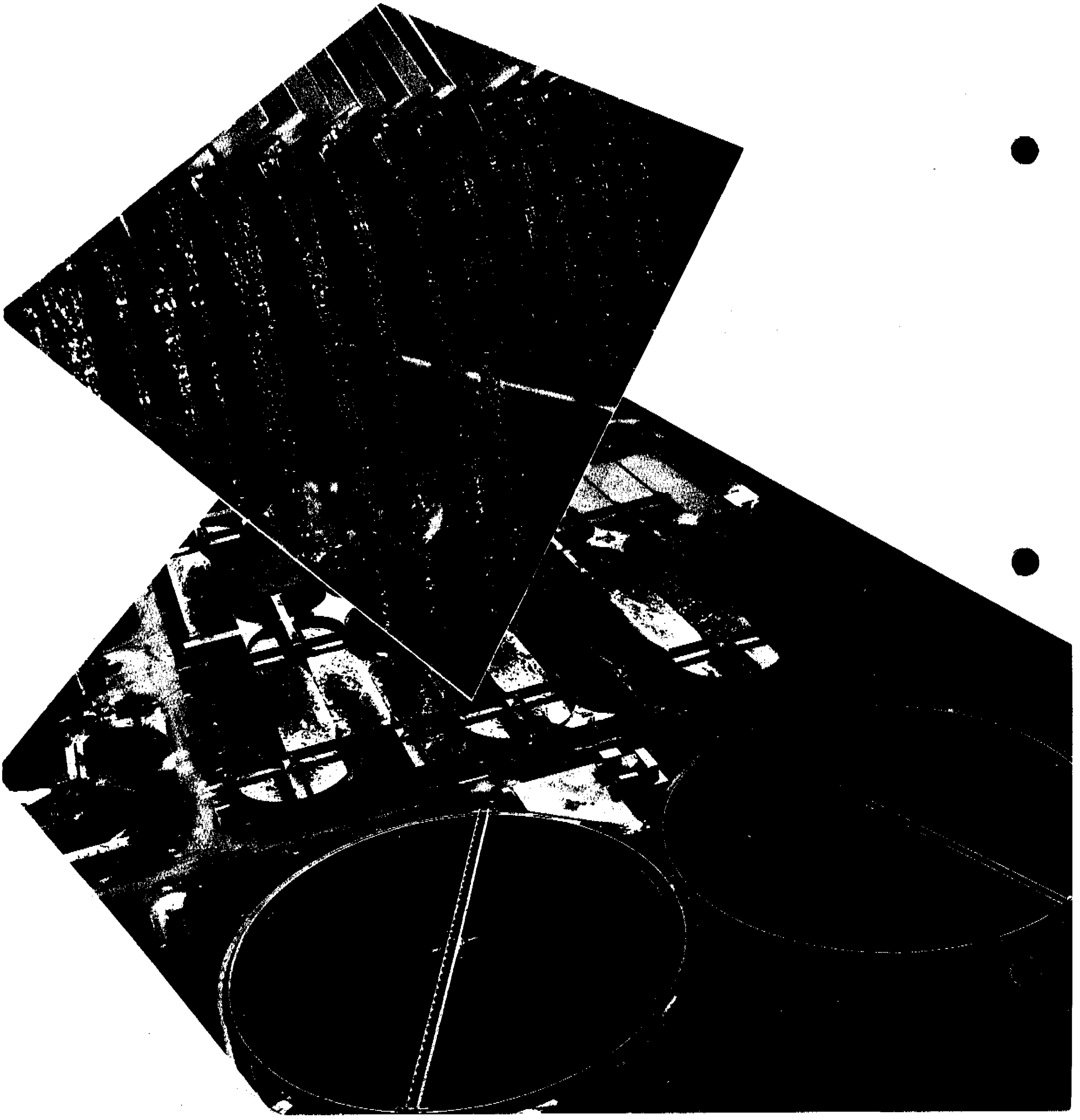


DHV CONSULTANTS

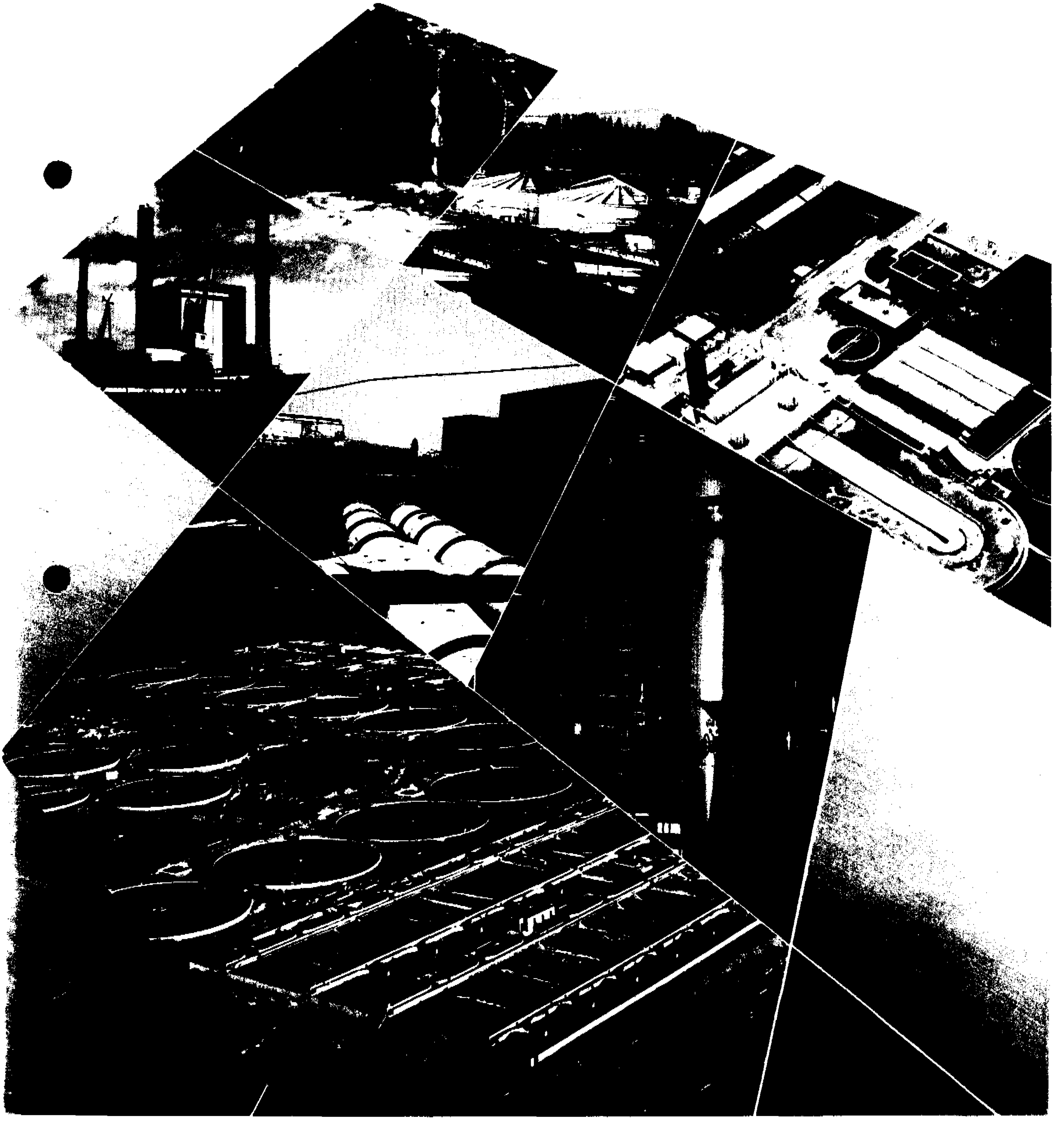
Water and Environment



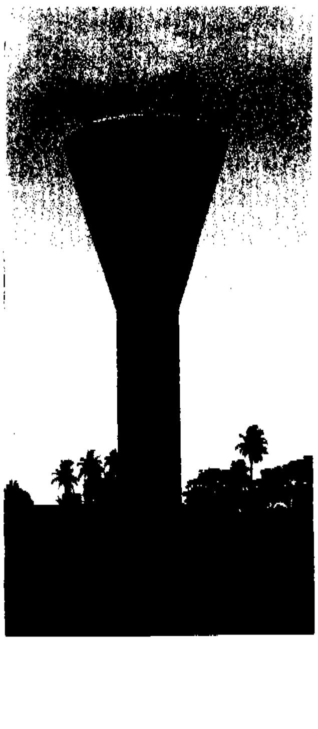
From plan to reality

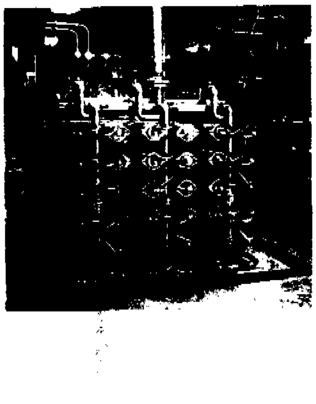


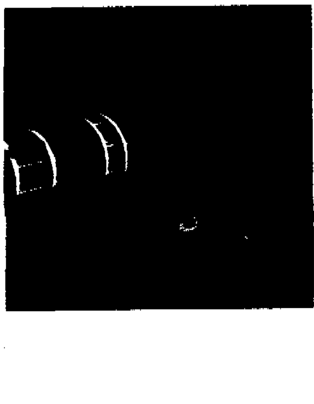
References Industry



Water supply







DHV

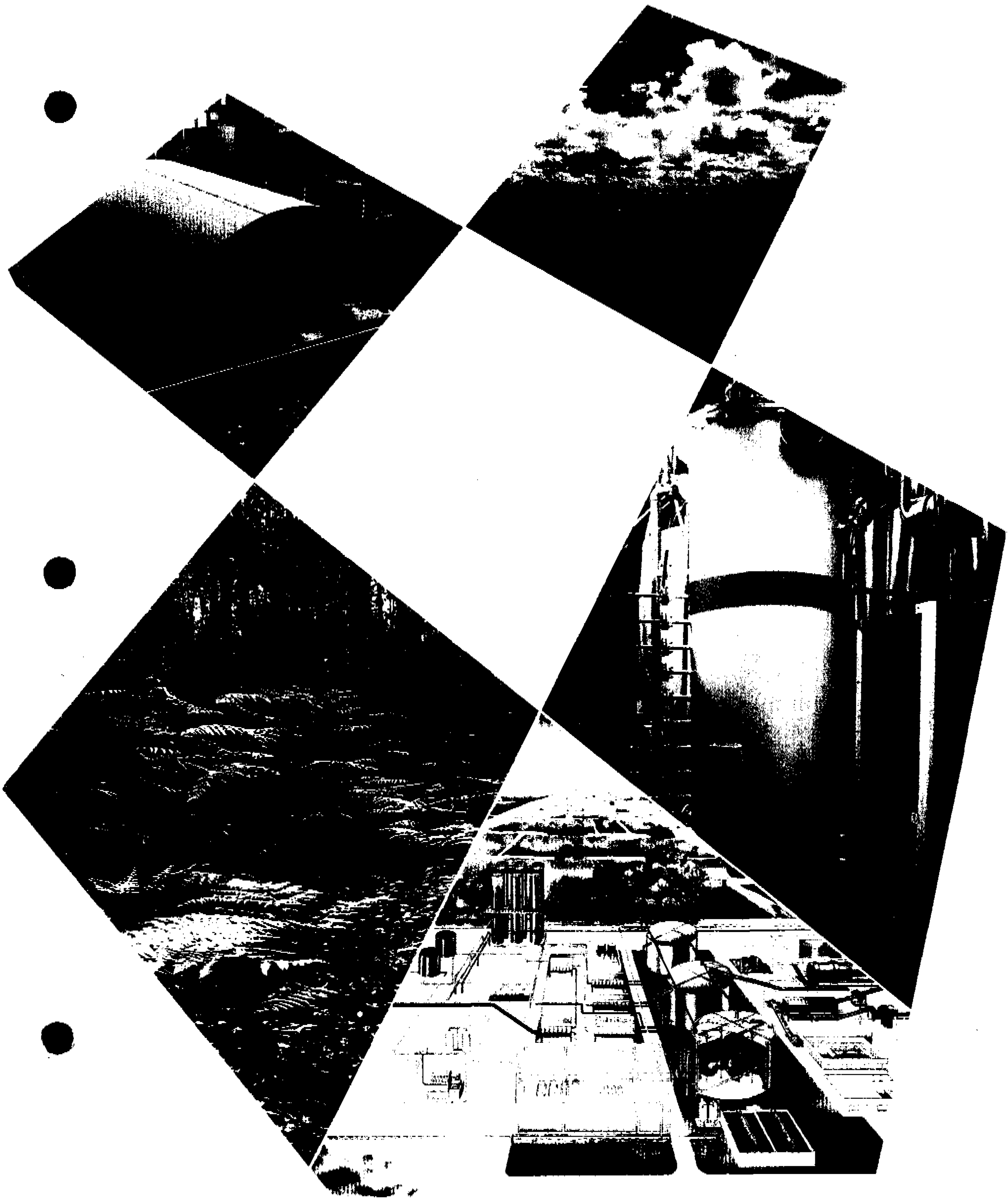
DHV Consulting Engineers

DHV

ENVIRONMENT AND INFRASTRUCTURE

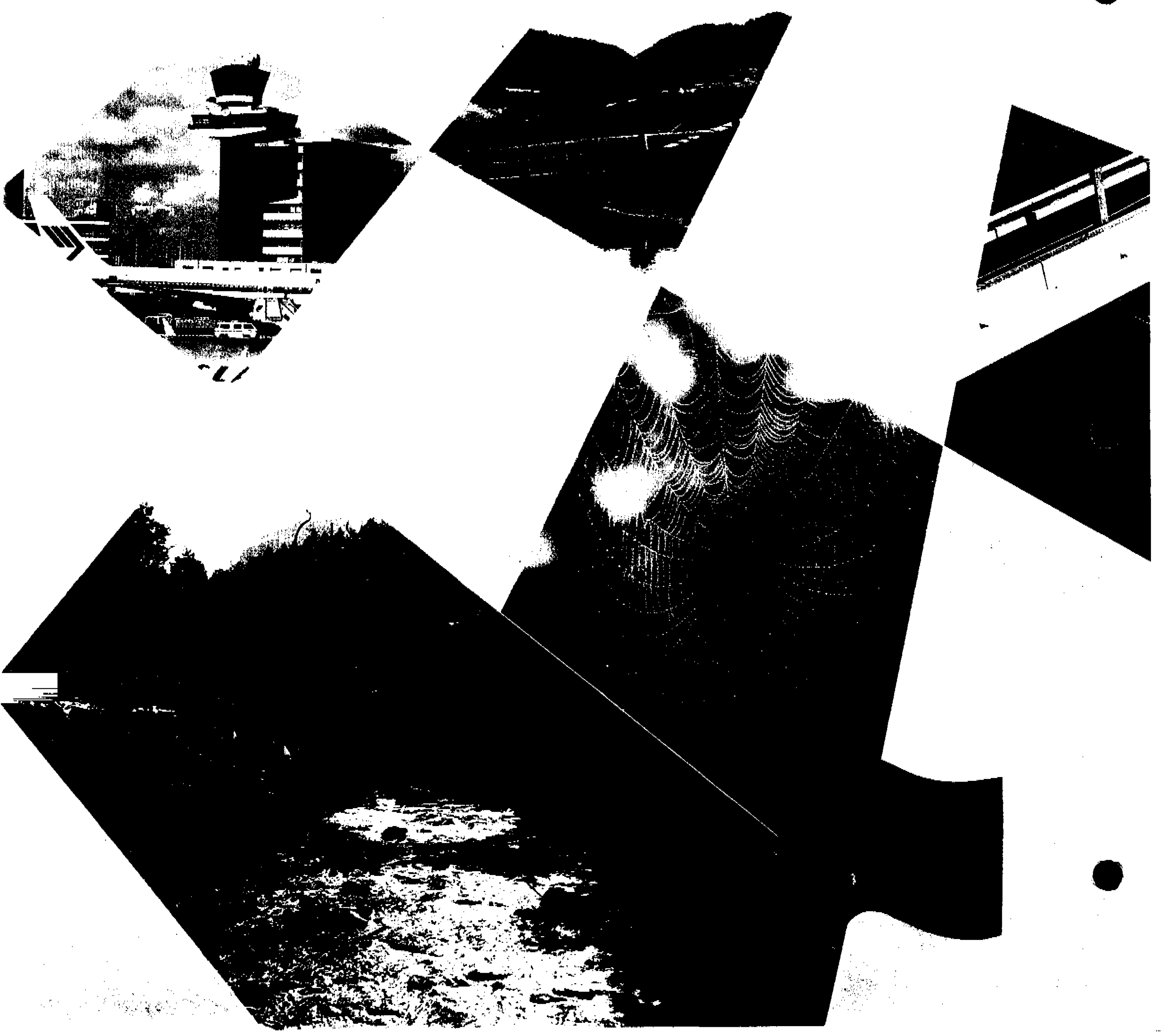
Environmental Technology

Solutions in touch with reality



ENVIRONMENT AND INFRASTRUCTURE

Environmental Management in Europe



General information on DHV's environmental and energy services

The DHV Group is a large international firm of consultants based in the Netherlands. The firm was founded in 1917 and currently has around 2500 employees. DHV has gained a worldwide reputation from many projects in a wide range of sectors and implemented in more than 60 countries.

DHV's major activities include :

- wastewater treatment and sewerage
- environmental management and technology
- waste management
- soil clean up
- air pollution control
- drinking water supply
- water resources development, irrigation and drainage
- energy saving
- hydraulic, port and road engineering
- agriculture and regional development
- urban development and transportation
- human resources and institution development

The work is supported by a number of specialized sections and laboratories: water, soil and road laboratories, information processing and operational research, economy, mechanical and electrical engineering, surveying etc.

DHV Consultants is registered with the major Financial Institutions and International Agencies, and regularly carries out projects financed by them.

Environmental management

DHV's Environmental Management consultancy services cover the interface between technology and society. It is based upon a sound expertise in fields such as organisational design, management, economy, policy development, institutional arrangements and legal procedures, combined with a strong knowledge of environmental technology. Consultancy services in environment management include:

- policy and strategy development
- environmental feasibility studies
- environmental protection systems, environmental risk analysis, environmental auditing
- environmental licensing and permitting
- environmental impact assessment
- nature conservation and landscaping

Environmental impact studies, which are required for the establishment of industrial plants and major urban extensions in an increasing number of countries, are executed by multidisciplinary teams including ecologists, engineers and biologists. As a consultant to the Netherlands Government, DHV has developed a national environmental impact assessment system.

SUMMARY OF ENVIRONMENTAL PROJECTS EXECUTED BY DHV IN CENTRAL AND EASTERN EUROPE

ARMENIA, AZERBAIJAN, BELARUS, GEORGIA, KAZAKHSTAN, KYRGYZSTAN, MOLDOVA, TAJIKISTAN, TURMENISTAN, UKRAINE, UZBEKISTAN - Preparation of an Investor's Guidebook for Environment, Health and Safety in 11 Former Sowjet Union Countries, 1994 - 1995

Client:	European Bank for Reconstruction and Development
In cooperation with:	Environmental Resources Management, Clifford Chance

The objective of the project is to provide practical guidance to investors as well as policy makers, regulators, and other decision makers in the public and private sector.
The scope of the project covers:
- administrative structure and responsibility
- environmental liability
- development planning
- environmental due diligence
- economic regulation and instruments
- environmental permitting process
- air
- water
- noise/ physical factors
- hazardous and non-hazardous waste management
- chemicals management
- emergency prevention, mitigation and response
- occupational health and safety
- public participation
- environmental requirements for key industrial sectors

BULGARIA, HUNGARY, ROMANIA, MOLDAVA, ALBANIA, SLOVENIA - Project Preparation Support for Environmental Infrastructure Projects, 1994 - date

Client :	European Bank for Reconstruction and Development (EBRD)
In cooperation with:	Coopers & Lybrand, South West Water, Aquanet

The EBRD's environmental infrastructure investment pipeline for Eastern Europe targets projects at the municipal level with strong environmental benefits. In that framework the consortium with DHV as leading partner provides support and expertise in the following fields:
- corporatisation of municipal utilities and involvement of the private sector in public sector services development and management
- municipal asset management
- financing arrangements
- financial and economic analysis
- legal analysis
- procurement support
- implementation arrangements
- environmental management

Sewerage and Urban Drainage

Product	General information on the Department of Sewerage and Urban Drainage of DHV Environment and Infrastructure
Users	Municipalities, Water Quality Managers and other institutes related to urban water management

Department of Sewerage and Urban Drainage

Since its foundation in 1917, DHV has worked in the field of urban water management. The Department of Sewerage and Urban Drainage of DHV Environment and Infrastructure in Amersfoort, the Netherlands, consists presently of 25 people. Besides the central office several (independent) regional offices exist. Clients of DHV are a.o. municipalities, water quality managers, provincial and national authorities, and industries.

In the Netherlands there are about 640 municipalities, out of which about 250 are a client of DHV. The greater part of these municipalities (except for the central region in the Netherlands) is served by the regional offices. The 'centre of expertise', however, is located at the main office in Amersfoort where software and other new products are being developed and maintained. In larger or complicated projects the main office may support the regional offices. Furthermore, specialists of the department are hired by other departments of DHV Environment and Infrastructure, DHV Water and by DHV Consultants for specialist work abroad.

Expertise

Within the group of over 40 highly educated people, the knowledge, tools and experience are available to find an appropriate solution to all kinds of problems. The consulting activities of the group cover the complete field of sewerage and urban drainage.

Examples of products

- Integrated Urban Water Management Plans
- Rational Sewer Management (ISMAS)
  - * inventory and inspection
  - * sewer quality assesment
  - * renovation and maintenance planning
  - * budget planning
- Sewer damage investigations (e.g., photo inspection) and rehabilitation plans
- Construction plans and supervision
- Hydrology and Hydraulics (e.g., CYCLONE)
- Overflow control devices (e.g., the Parallel Storage Sedimentation Sewer, design and optimization of Storage Sedimentation Tanks on the basis of turbulent flow modelling)
- Assessment of the impact of sewer overflows on the receiving water quality
- Real Time Control
- Optimization of sewage collection, transport and treatment system
- Support in software development
- Strategic studies and research
- etc.

Information

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Integrated Sewer MAnagement System - ISMAS

Product	Computer programme ISMAS
Application	Sewer Management
Users	Municipalities, Sewer Managers, Industry

Introduction

The investments in a sewerage system are considerable but necessary to achieve a desired level of public health and environmental quality. The cost of maintaining such a system over its lifetime may be even more impressive. Not spending sufficient attention and funds on routine maintenance leads to higher cost of rehabilitation or even to earlier replacement. DHV Environment and Infrastructure developed an integrated sewer management system (ISMAS), which at present assists the public works departments of over 80 municipalities in this complicated task. The ISMAS programme is a stand-alone programme on IBM-compatible personal computers and has been developed with the most up-to-date data base techniques.

ISMAS can be used during the design stage to provide all inputs required for a hydraulic analysis (the programme can easily be linked to the hydrodynamic flow model CYCLONE), during construction to monitor progress and to manage the construction process and, finally, for efficient operation and maintenance of the sewer system. The programme is not only administrative oriented, but ample use is made of graphical presentation techniques. For this purpose a direct link is made from the sewerage database with the AutoCad graphical package.

Main areas of application of ISMAS

The ISMAS programme is primarily designed for the management of existing sewer networks. By recording and processing of inspection data a maintenance and renovation schedule can be prepared. The ISMAS programme features the following functions:
- *management of the database*: to keep the system records up-to-date
- *inspection and maintenance*: to prepare and manage routine inspection and maintenance plans, to analyze the inspection data and to incorporate the results in current maintenance-, rehabilitation- and renovation schedules

- *budgeting*: to revise the short and long term budget planning
- *assessment of hydraulic performance*: to prepare the input files for the hydrodynamic flow model CYCLONE.
- *miscellaneous*: to up-date sewer maps (Auto-Cad application) and to coordinate the sewer management with other public services (e.g., road construction)

Establishing a complete database of the sewer system and keeping this set of records (administrative data and maps) up-to-date is a first concern of any sewer manager. On the basis of a regular inspection, the expected technical and economical lifetime of each pipe can be estimated.

If the condition of a sewer appears to deteriorate faster than reasonably could be expected, decisions have to be taken on if and when the sewer must be repaired or replaced. All possible solutions influence current cash-flow schedules and therefore decisions should be based on a careful technical and financial analysis.

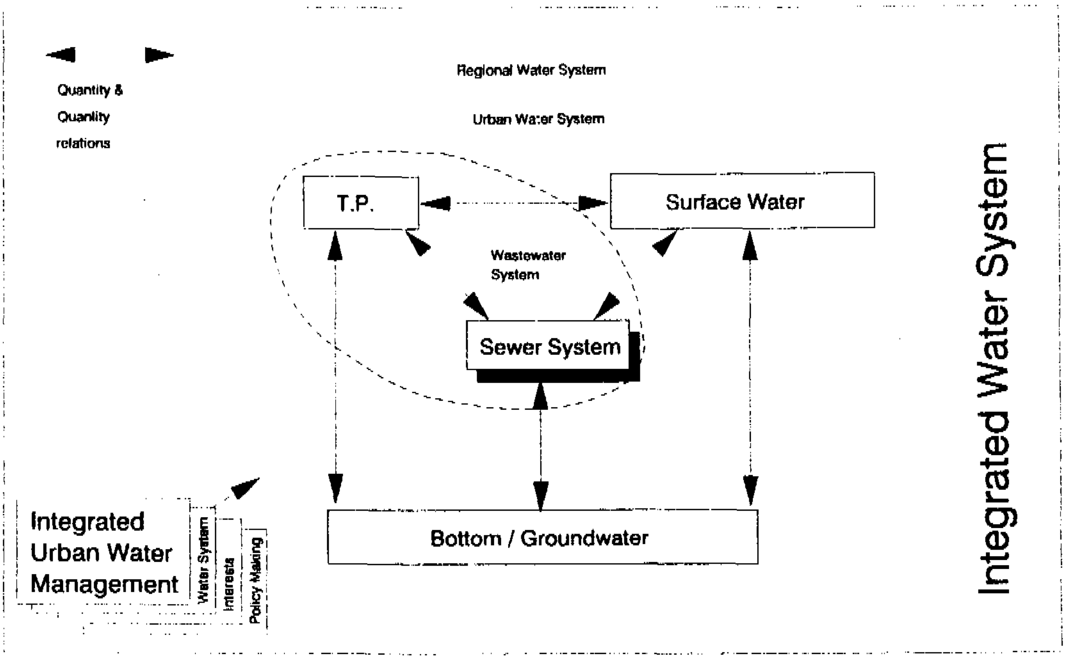
The sewer network database

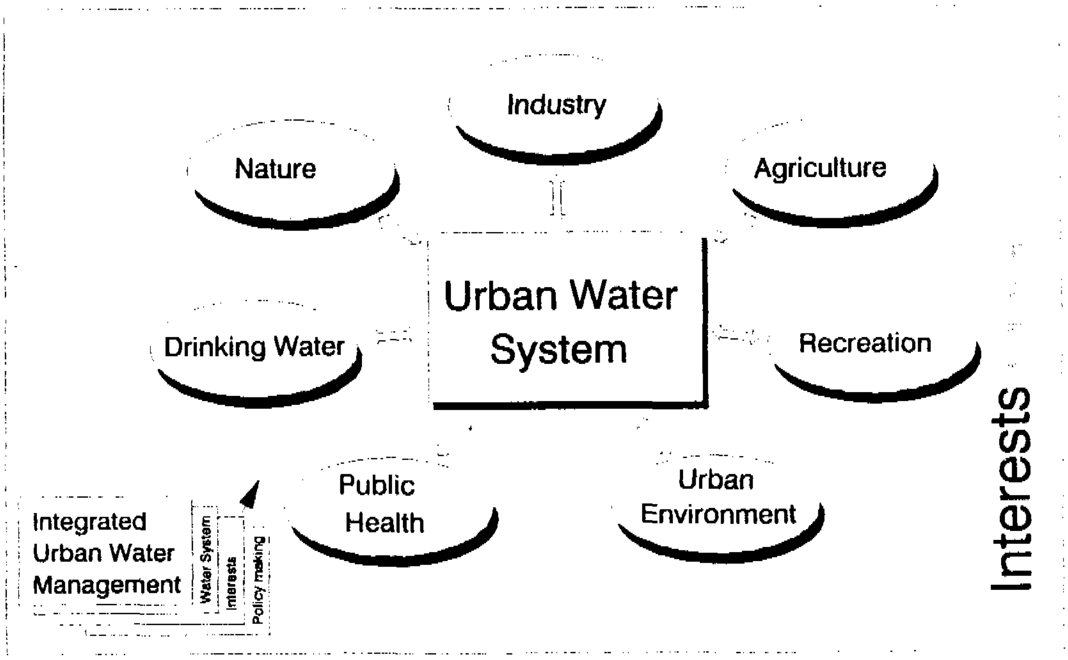
Besides basic sewer data, like levels, lengths, diameters, details on manholes and house connections, etc., the data base contains also inspection results and "complaints". Details are recorded by location (street/house number) and arranged in groups of typical complaints, to speed up remedial actions. This part of the database gives valuable information on the condition of parts of the system and, when follow-up is correctly done, improves customer relations.

Planning of inspection and maintenance

Each new pipe section is given a theoretical technical lifetime, based on general experience with sewers of similar material, diameter and use. Based on this an initial plan is prepared for routine inspection and maintenance. The plans are up-dated regularly (e.g. yearly) after inspection of (representative parts of) the network. To arrive at a new maintenance and inspection plan and ultimately at the yearly budget for maintenance and inspection activities a number of tasks is to be performed:

a. *Review condition of sewer*: (Photo) Inspections show whether sewers are silted up, (partly) blocked or have physical defects. Based on the inspection results, ISMAS can select the pipe-sections and manholes with unacceptable 'faults' and provides urgency and cost estimates of priority maintenance or repair.


Quantity &
Quality
relations
Regional Water System
Urban Water System
T.P.
Surface Water
Wastewater
System
Sewer System
Bottom / Groundwater
Integrated
Urban Water
Management
Water System
Interests
Policy Making
Integrated Water System


Industry
Nature
Agriculture
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Urban Water
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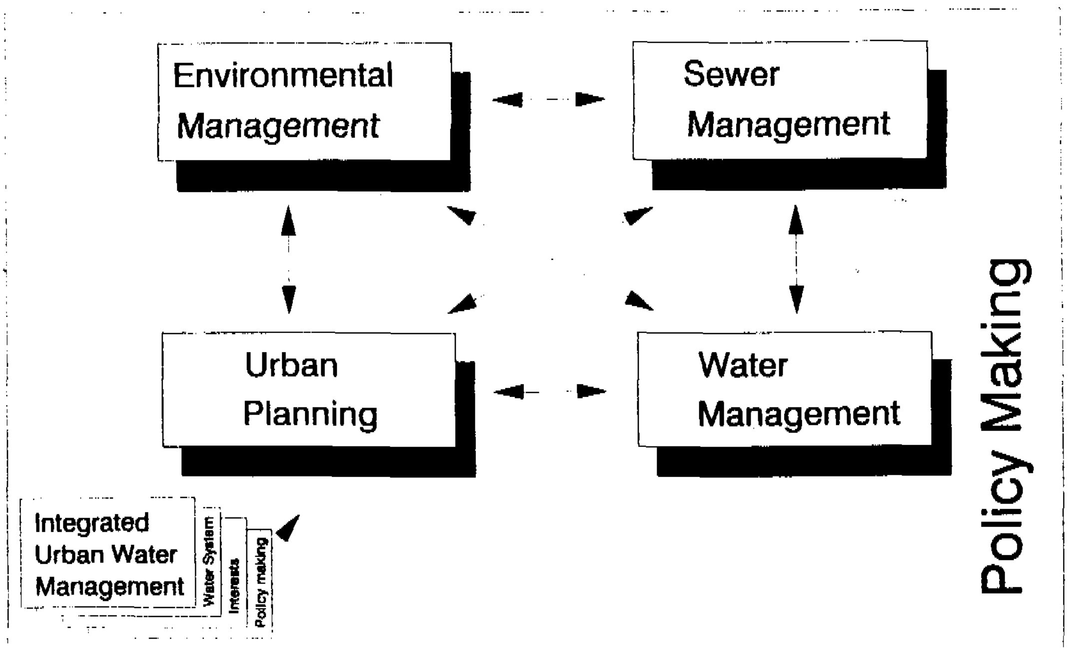
Interests
Policy making
Interests


Environmental
Management
Sewer
Management
Urban
Planning
Water
Management
Integrated
Urban Water
Management
Water System
Interests
Policy making
Policy Making

Integrated Urban Water Management

Product	Integrated Urban Water Management Plans
Users	Municipalities, Water Boards, National Authorities

Introduction

Within an urban area, different water managers can be distinguished with different responsabilities. In most cases, the municipality is reponsible for the collection and transport of waste water and the drainage of surplus rain water. These tasks result from the municipal responsibility to ensure good living and working conditions in the city.

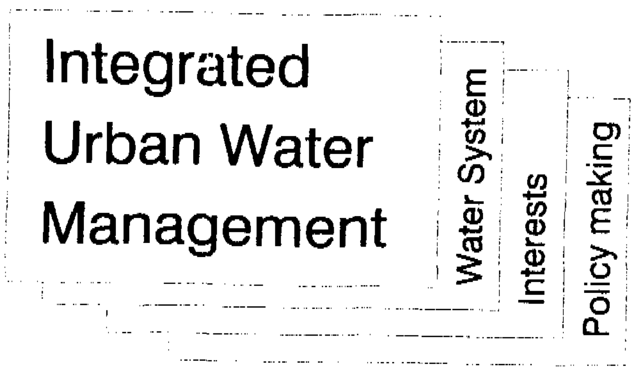
The water quality manager takes care of the treatment of the waste water and is reponsible for the quality of the receiving streams. Besides waste water treatment and other technical measures (e.g. flushing), the water quality manager may control water pollution by setting standards and regulations concerning the disposal of waste water into surface waters.

The search for efficient solutions to urban drainage problems encouraged the concept of integrated urban water management. This concept encompasses all aspects of the hydrological cycle within the urban environment, and includes the design, operation and management of foul and stormwater networks, the groundwater system as well as natural watercourses which flow through the city.

Integrated Urban Water Management Plan

The objective of an Integrated Water Management Plan is to supply insight into the interactions between all sub-systems and to determine on the basis of this information the best possible management and operation of the integral system, taking into account the effects on the environment and the costs of construction, exploitation and operation.

In analyzing the problem, 3 dimensions can be distinguished:
1) the integral water system
2) the different interests involved
3) the policy making (i.e. different authorities having different responsabilities)



The integral water system

Traditionally, urban water engineers are preoccupied with the technology of the sub-system they design: the sewer system, a retention basin, the treatment plant etc., neglecting the fact that all elements of the integral system affect each other. For example, modifying the capacity of a combined sewer system to reduce CSO may lead to more (diluted) sewage that is discharged to the treatment plant, which will affect its performance.

A fundamental part in preparing an integrated urban water management plan is the understanding of the various assets forming the water system and how they perform in various (storm) conditions. Aspects that should be considered are among others:

- surface water quantity and quality
- groundwater quantity and quality
- function and use of the various water bodies
- ecology
- type of drainage system
- relations with the environment

Different interests

Not only the 'technical' relationships between the various components of the water system determine the best solution. At the same time we have to be aware that the water system serves different interest, which might be conflicting.

Policy making

As was mentioned above, within an urban area different water managers can be distinguished with different responsabilities. Existing urban planning, sewerage and urban drainage plans, water management plans and environmental plans must be considered when developping an integrated urban water management plan.

Some recent projects executed by DHV in the field of Integrated Sewer Management

Project Description	Client	Particular Tasks A: Studies B: Design C: Construction	Period	Value of Fees (DFL)
Setup of Sewer Management System (ISMAS) incl. hydrodynamic calculations (CYCLONE), total inventory, inspection, quality evaluation, renovation-advice and financial planning for the cities of:				
- Maastricht (120,000 inhabitants)	Mun. of Maastricht	AB	1989-1990	350,000
- Enschede (150,000 inhabitants)	Mun. of Enschede	AB	1988-1989	400,000
- Utrecht (230,000 inhabitants)	Mun. of Utrecht	AB	1988-1990	100,000
- Ede (90,000 inhabitants)	Mun. of Ede	AB	1988-1990	800,000
- about 60 smaller cities	various municipalities	ABC	1985 - 1991	2,000,000
Hydraulic calculations and optimisation of the sewerage system of the city of The Hague	Municipality of The Hague	AB	1991-1992	600,000
Preparation of the Dutch National Standard Cataloque for sewer inspection and interpretation + classification of sewer-inspections results	Ministry of Environment, the Netherlands	A	1989	100,000
Guidelines for Dutch Municipalities concerning sewer management	Association of Dutch Municipalities	A	1990-1991	50,000
Guidelines for Storm Water Pollution Control	Five Water Pollution Boards	A	1990	25,000
Basic design and detailed engineering for the rehabilitation and improvement of the existing sewage and stormwater system of Schiphol	SCHIPHOL International Airport Amsterdam, The Netherlands	ABC	1986-1991	

Summaries of some recent sewerage and urban drainage projects executed by DHV in the Netherlands

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Project: **Urban Drainage Masterplan Amsterdam 1993**
Client: **The Municipality of Amsterdam**

Amsterdam features specific drainage problems as the city is intersected by a large number of canals. From an environmental point of view, only non-polluted discharges are allowed on these canals. Following the latest legislations on these matters, the masterplan is being revised with special attention to new renovation techniques and stormwater outfalls.

Project: **Urban Drainage Masterplan The Hague 1992**
Client: **The Municipality of The Hague City**

The drainage system consists of over 15 individual drainage areas. Moreover the neighbouring cities are draining through the The Hague area. The Dry Weather Flows are entirely pumped. The drainage area planning involved a structural and hydraulic assessment of the existing sewer network. Apart from this, the masterplan included an optimalisation study for maximum use of available storage capacities. A cost recovery method (imposing of taxes) has been developed based on contributions of real estate owners and users.

Project: **Feasibility Study + Detailed Design Amsterdam Airport 1986-1991**
Client: **Schiphol, International Airport Amsterdam**

The Amsterdam airport has recently almost doubled its capacity. Being an airport specific design criteria has been applied. Special attention was paid to the drainage system with regard to the removal of the de-icing chemicals from the runways and platforms.

Project: **Urban Drainage Masterplan Maastricht 1989-1990**
Client: **The Municipality of Maastricht.**

Preparation of a masterplan for rehabilitation and extension of the present sewerage and drainage system. Implementation of a Sewer Management System, including hydraulic calculations, total inventory, on site inspection, quality surveys and renovation advices. A financial scenario has been developed to cover the expenditures related to drainage for the short- and midterm by imposing taxes on the consumers.

Project: **Feasibility Study 1989-1990**
Client: **The Municipality of Utrecht.**

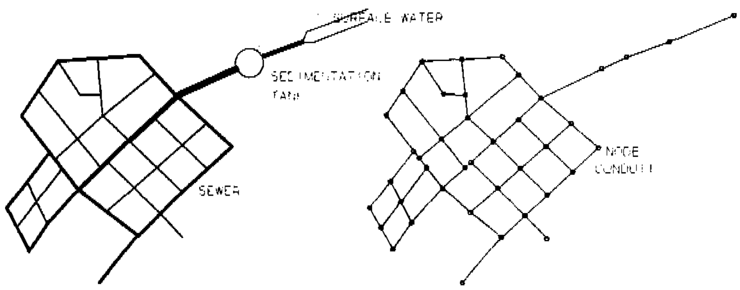
Originally the drainage system discharged at dispersed locations in the nearest canal. Alternative discharge locations and transport means were evaluated. At some places the sewers have been projected beneath the canal invertlevels, thus creating a dual canal system. During the project a computerized and graphical oriented management system has been introduced.

Hydrodynamic Flow Model CYCLONE

Procuct	Hydrodynamic flow model - CYCLONE
Application	Design of sewerage and drainage systems
Users	Municipalities, Water Boards, Industry, Consulting Engineers

Introduction

The computer programme CYCLONE is a hydrodynamic model that can be used to simulate the water flows in open and closed conduit systems. The model has been developed primarily to facilitate a detailed analysis of the hydrodynamic behaviour of sewerage and urban drainage systems. Flow routing is based on the well known De Saint Venant Equations, which are solved by using an advanced implicit numerical scheme. Networks of 5000 branches and nodes can be dealt with by CYCLONE in one run on a normal PC. Several ancillaries, such as storage basins, weirs, valves, pumping stations, etc, may be incorporated in the schematisation.



Schematisation of a sewer network

Use of the model

In general, CYCLONE can serve as a tool in designing new systems, but also to assess the effectiveness of possible measures to improve the systems performance. Some examples:

- The location and amount of street flooding, due to a certain design storm or a historical rain event, can easily be determined.
- Besides analysing of the sewerage system, the model can also be used to check the discharge capacity of the receiving stream by simulating the flood waves that result from operating overflows.

- A proper insight into the hydrodynamics of the system is extremely important when designing overflow control devices and other structures. Obviously it should be prevented that large investments are made for expensive structures which are not functioning properly.
- Steady flow models (which are based on the kinematic wave approach) fail in simulating backwater and other hydrodynamic effects which may be important factors when assessing the performance of a sewerage system. These phenomena, which certainly play an important role in steeply sloped areas with partly filled sewers, can be dealt with by CYCLONE.

Input and output

The input required to run CYCLONE can easily be set up using any editor, but if available, it can also automatically be derived from the sewer management system ISMAS. Output is supplied in digitized form which is used to create the necessary graphs and tables of the calculated flows and water levels.

A very stong feature of cyclone is that the simulation can also be presented by animation. The user can show the calculated flows, discharges, water levels, or filling degrees for the whole system or only a part of it.

Applications

CYCLONE is used by DHV for various projects, inside and outside the Netherlands. Recently, the complete sewerage systems of two relative big cities (The Hague and Bergen op Zoom) have been analysed with the model. Several municipalities have bought the programme to use it in conjunction with the sewer management system ISMAS.

Information

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Survey of sewerage and urban drainage networks

Product	Condition survey of Sewerage and Urban Drainage Networks
Users	Municipalities, Water Quality Managers and others

Condition survey strategy.

Massive investments are necessary for the initial construction of drainage and sewerage systems. Due to natural and physical wearing and the chemical influence of raw sewage on the masonry and concrete sewers, the constructional strength will however gradually deteriorate. Studies shows actual expected lifetimes for concrete sewers ranging from 40 to 70 years. Especially older systems are becoming at a stage where renovation might be desirable. A preventive renovation of sewers will be benificially as calamities will be reduced, priorities can be set, expenditures are predictable and plans for resurfacing of roads can be incorporated.

Survey techniques.

In general nowadays three methods are available for inspection of closed conduits. These methods are:
- Photographical inspection survey.
- Video-inspection survey.
- Visual inspection by entering the wider sections.

A *photographical* inspection survey of the drains consists of pictures taken from the manhole into the drain mouth. For this purpose a camera is mounted on a beam and can be operated by remote control. After opening of the manhole cover, the beam is lowered into the pit and subsequently photo's are made into all drains connected to this pit. If the size of the manhole is sufficient, and hooks or other devices allow easy access, the photo's might be taken manually. The photo allows a clear view up to 10 meters into each drain. DHV has over ten years experience with this method. This method allows for a good first judgement of the constructional and hydraulic aspects of the pipelines.

A *video* inspection survey consists of a remote controlled camera, which is mounted on a frame. This frame is made self-propelling and can be controlled from the surface through connecting wires. The complete equipment can be manouvered through the pipe. The results are very detailed views of the physical condition of the pipes over its complete length.

This method is costly and requires some preconditions. The pipe must be clean and virtually dry. In a pipe filled with sediments or larger debris, the mobile frame will stuck itself. To overcome this problem the pipes are generally cleaned prior to the inspection by a so-called high-pressure technique.

The *visual* inspection is only applied when the sizes of the drains allows for entering. For the primary system this can be useful, but strict safety rules should be respected.

Systematic Survey.

Surveying of sewerage systems will be performed for the following reasons:
- Checking maps and complete the inventarisation of the system.
- Assessment of the physical and constructional aspects of the pipes.
- Assessment of the hydraulic performance.

When the drainage and sewerage system has not been surveyed nor periodically maintained over a longer period of time, the condition of manholes and pipes will be unknown. In such a case a photographical survey is a relatively economical and quick method to gain insight in the condition of the pipes. The advantages of executing a photographical inspection survey prior to an optional video-inspection are:

- The photographical survey can start on short notice as the equipment is cheap, simple and rigid.
- The drains have not to be cleaned in advance so the photo's will also indicate the amount of sedimentation and hence the hydraulic performance.
- The inevitable problems with locating and opening of the manhole covers, the encountering of unexpected situations such as different pipe sizes and connections, can better be experienced during a photographical survey as during a video-survey. The equipment mobilised for a video-survey is expensive and waiting days for any delay should be paid for, so a good logistic planning of the survey is vital.
- Drains found to be in good to excellent order during a photographical survey can be skipped from a optional video-survey. Hence the total expenditures can be minimized.
- From the photographical survey, the drainage maps can be improved and corrected and used for a good planning of further activities such as hydraulic calculations and a video-survey.

The examining and assessing of the sewer condition from the photographs is standarized in various countries. In general these methods comply with each other. At the moment initiatives are employed for standarisation within the European Community.

b. *Analyze complaints*: After the type and urgency of rehabilitation have been indicated, ISMAS provides the pipe sections, manholes and connections for which complaints can be handled by corrective measures. The system shows which measure may be taken and estimates the costs involved.

c. *Plan for corrective maintenance (immediate repairs)*: Based on the list with urgent corrective maintenance, prepared under (b), including cost estimates, a plan is made based on priority, duration of activity, capacity and available budget.

d. *Plan for preventive maintenance (routine maintenance)*: If necessary, the initial/theoretical maintenance plan is adjusted. With the help of ISMAS the actual "remaining lifetime" of the sewer or manhole is calculated, which is the bases for all further financial calculations.

e. *Plan inspections*: The inspection plan covers visual (mirror, man), photo and video inspection. The type of inspection, way of implementation, general or in specific area, etc., are added to the database and form part of the information required to calculate the "plan year", which is the year in which major repair or replacement will be required. Aspects that influence this calculation, like year of construction, pipe material, type of foundation etc., are derived from the general database.

f. *Compile and prepare reports*: Summaries are important for an analysis of maintenance activities and for an evaluation of costs. Planned inspection and maintenance is summarised for each district and period.

Other aspects

The application "Budgeting" in ISMAS assists with the preparation of a Five-Year financial planning and the up-dating of the One-Year detailed plan. Furthermore, the programme can generate automatically the input files required for the hydrodynamic flow model CYCLONE. Several utilities are included, such as the drawing of sewer networks by AutoCad.

Parallel Storage Sedimentation Sewer

Product	Parallel Storage Sedimentation Sewer (PSSS)
Application	Improved overflow control device for combined sewer systems
Users	Municipalities, Water Quality Managers

Introduction

DHV Environment and Infrastructure has developed a new type of overflow control device, the so called Parallel Storage Sedimentation Sewer (PSSS), which can be considered as an attrative alternative for overflow control devices as applied so far. (The PSSS is protected by Dutch patent no. 9100473).

For the past few years, various overflow control devices have been developed to reduce the negative impact of combined sewer overflows (CSO) on the quality of the receiving waters, such as storage sedimentation basins, stilling ponds, storage sewers, vortex overflows, etc.. Sedimentation of solid particles and increased storage capacity are the main principles of the majority of these devices. A proper design of overflow control devices is very important as the flow conditions must be maintained so that sedimentation of solids will occur. Moreover, the risk of erosion of settled material should be minimized as this may lead to high pollution loads of the CSO. The problem is that the hydraulic boundary conditions are usually only vaguely known. Besides, in designing these devices a certain risk of erosion of settled material has to be excepted (as the actual load may exceed the design load).

Advantages

A main advantage of the PSSS is that re-suspension of settled material cannot occur, regardless the hydraulic loading. Erosion of the sediment bed is avoided by separating the storage and the transportation function in the construction. The mechanisms involved are explained below.

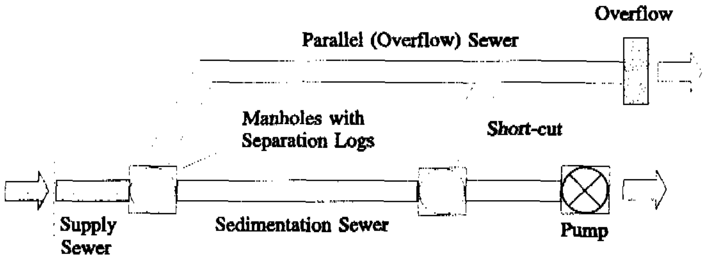
Compared to the above mentioned solutions the PSSS does not only perform better, but it is also cheaper to construct and more efficient in use of space. The PSSS is constructed with normal sewer pipes and some special manholes. Mechanical, electrical or pneumatical devices are not required.

Another advantage is that the PSSS is self-cleansing. The sediment sewer is constructed so that the settled sediment will be transported to the treatment plant during dry-weather-flow. An obvious requirement for a succesful use of the PSSS is therefore that the sewer where the PSSS is applied must have a dry-weather-flow.

In 1991, a PSSS was implemented in the sewerage system of the municipality of Ede. After one year operation the sedimentation sewer is still clean, meaning that with respect to the self-cleansing of the system the PSSS functions satisfactory. A monitoring campaign to quantify the pollution removal efficiency is planned. Recently, a project was started to construct a PSSS in the municipality of Rheden.

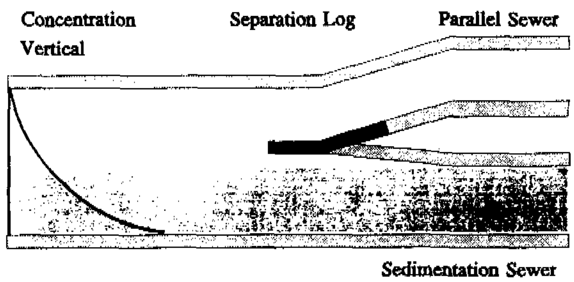
Principles of the PSSS

The working of the PSSS is based on the fact that the greatest part of the pollution is attached to the transported sediment. Hence, pollution loads of CSOs can be reduced by removal of sediments from the sewage.



Scheme of the PSSS (Top view)

In the *Supply Sewer* sediment particles will settle down, meaning that the sediment will concentrate towards the bottom of the pipe. In the first *Separation Log* the sediment-rich underflow is separated from the relatively clean upperflow. The underflow is directed to the *Sedimentation Sewer*, which is dimensioned so that further settling will occur. The settling velocity depends on the particle sizes and on the flow conditions. In the PSSS, proper flow conditions are maintained under all conditions. Regardless the hydraulic loading, the critical shear stress will not be exceeded, meaning that erosion of the sediment bed cannot occur.



The upperflow is directed to the *Parallel (Overflow) Sewer* and discharged via the overflow structure into the surface water. The *Pump* that discharges the sewage to the treatment plant has a limited capacity. The surplus is discharged through the *Short-cut* to the parallel sewer. The distribution of the discharges over the Parallel Sewer and the Sedimentation Sewer is controlled by the capacities of the *Pump* and the *Short-Cut*.

DHV INTEGRATED SEWER MANAGEMENT SYSTEM

SOME DUTCH SEWER STATISTICS

Inhabitants	15.340.169
Houses	6.118.461
Area	41.525 km^2
Houseconnections	5.905.840
Houses without connect.	212.390 (3.6%)
Inhabitants per km^2	452
Houses per km^2	180
Houseconnect. per km^2	142
Houses with. connect./km^2	5,1
Local sewer-rates / household	Dfl 45,- upto Dfl 275,-

SOME DUTCH SEWER STATISTICS

Lenght of sewer system	73.000 km
Number of outfalls	12.000
Number of treatment plants	448

Type of sewer system:

Combined sewer system	75 %
Separated sewer system	22 %
Improved separated system	3 %

Type of sewer system:

Gravity systems	86 %
Pressure system	13 %
Vacuüm system	1 %
Air/pressure system	0.1 %

Age sewer system:

40 year and older	15 %
10 - 40 years	53 %
upto 10 year	32 %

Used materials:

concrete	73 %
systhetic materials	23 %
ceramiek	3 %
other	1 %

SOME EUROPEAN SEWER STATISTICS

	primairy treatment % conn.	secondary treatment % conn.	total %conn.
The Netherlands (1990)	1	91	93
Belgium (1980)	0	23	23
Danmark (1990)	8	90	98
Germany (1990)	6	79	86
France (1990)	.	.	68
Greece (1985)	1	9	10
Italy (1990)	.	.	60
Luxembourg (1990)	3	87	90
Portugal (1990)	9	12	21
Spain (1990)	11	42	53
New Sealand (1985)	8	80	88
Nippon (1990)	0	42	42
Canada (1990)	17	53	70
United States (1985)	15	59	74

efficiëncy primary treatment 20 - 30%
efficiency secondary treatment > 80 %

DUTCH ORGANISATION OF SEWER MANAGEMENT

Municipalities are responsible for sewer management
- legal obligation for sewermanagement
- legal obligation for making last houseconnections (3.6%)
- legal obligation for reducing CSO pollution with 50%

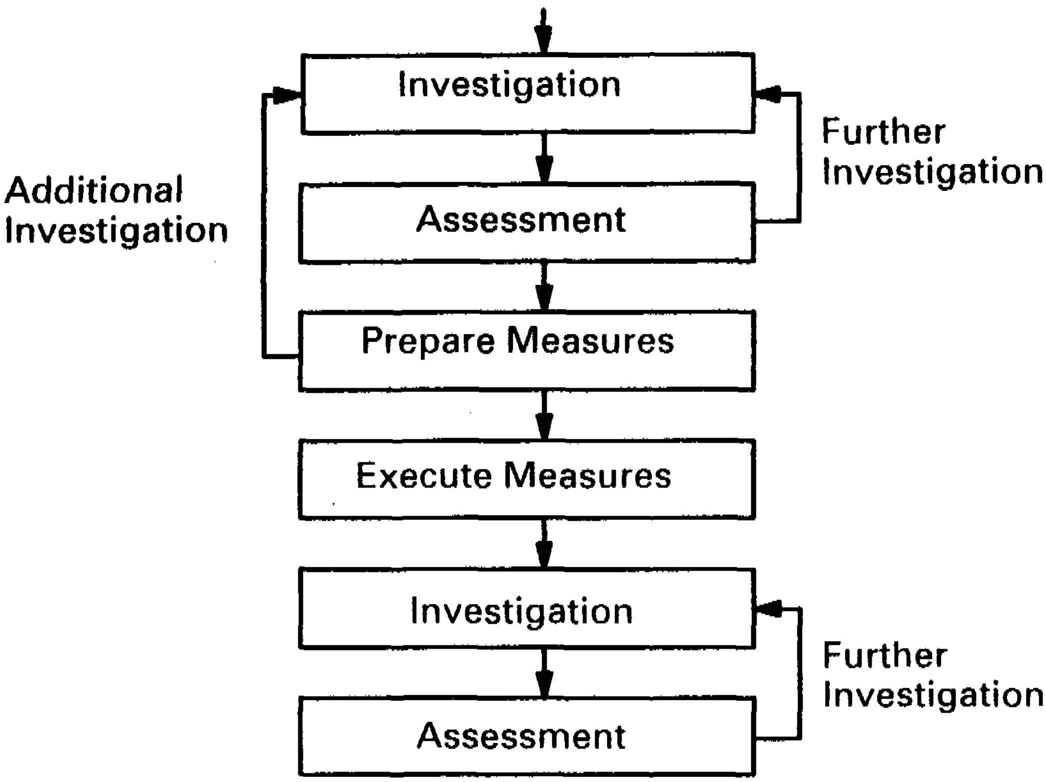
Water boards are responsible for surface water quality
- impose design rules for sewer systems
- grant licenses for CSO's
- impose fines if no license is available

Provinces are responsible for groundwater
- groundwaterpollution by sewer systems still in examination

KIND of PLANS

- Municipal Sewerplan
- Operational plan for inspection and maintenance
- Operational plan for replacement
- Operational plan for improvements
  (environmental and hydraulic capacity)
- Financial plan
  Long term budgetting
  Long term sewer rates

SEWER MANAGEMENT CYCLE



Context of basic activities: management process

SEWER MANAGEMENT

-Definition of the data to inventory (which data?)

-Inventory geometry (e.g. mapping)

-Datacontrol

-Inventory sewer quality-data (e.g. by inspection)

-Prepare measures

-Longterm plan of measerures

-tuning of the plans with:
- -roadmanagement
- -other plans

-Longterm cost estimation

-Longterm financingplan

POTENTIAL MEASURES

Overview of potential measures

Concept	Characteristic regarding condition (article)	Characteristic regarding functioning (system)
Maintenance	maintain unchanged	return to original functioning
Repairs	limited change of condition	return to original functioning
Renovation	radical change of condition (equal to new construction)	return to original functioning
Replacement	removing existing article; installing new article	return to original functioning
Improvement	not applicable	adjustment of original functioning

GOAL SOFTWARE PACKAGE ISMAS

-Process maintenance and inspection data + complaints

-Lay out of rehabilitation plans and maintenance plans

-Calculation local sewer-rates scenario's

-Help for draw up a Municipal Sewerplan

-Help by hydraulic calculations

-Help to accomplish environmental goals province

-Help for efficient data-exchange

FUNCTIONS IN ISMAS

-Management basicdata
-Managemente sewerdata
-Selections
-Graphs
-Reports
-Networkstructure
-Renovation planning
-Maintenance planning
-Inspection planning
-Unitprices
-Long term budgetting
-Cost covering system
-Building- en street-connection
-Interaction with Pavement Manegement System
-Interaction with Hydraulic software
-Interaction with visual inspections
-Interaction with graphical systems

INTEGRATION WITH ADMINISTRATION SOFTWARE

-in principal with each Oracle package
-basic registration:
- geometry
- administration
-municipal sewer rate systems
-environmental systems etc.

INTEGRATION WITH GRAFICAL SOFTWARE

-interactive grafical database management
-sewer management drawnings
-special thematical drawnings

Waste Water Treatment Plant

The Nieuwe Waterweg

* Introduction
* Organization of Hoogheemraadschap Delfland
* Requirements
* Organization of the WWTP Nieuwe Waterweg and management aspects
* Walk over the plant

HOOGHEEMRAADSCHAP VAN DELFLAND

OR-1
BESTUUR EN DIENSTEN

VERENIGDE VERGADERING

Dijkgraaf (voorzitter)
6 hoogheemraden
12 hoofdingelanden gebouwd
12 hoofdingelanden ongebouwd
12 hoofdingelanden waterkwaliteit

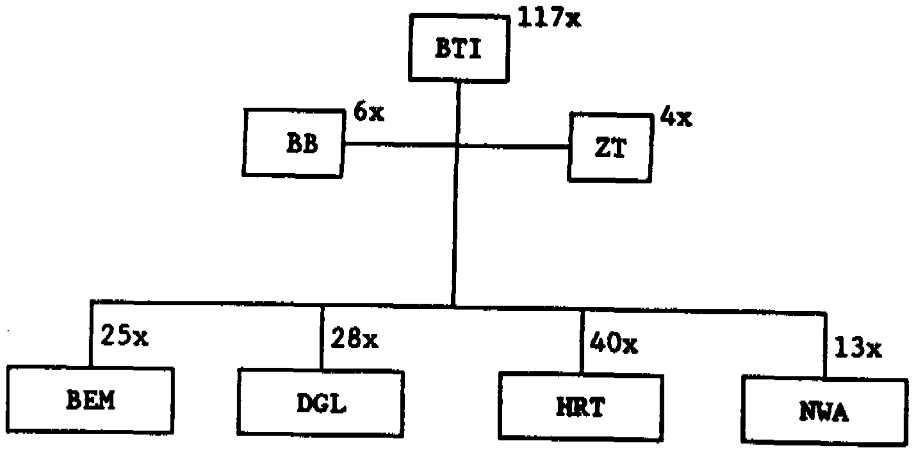
DIJKGRAAF EN HOOGHEEMRADEN

Dijkgraaf (voorzitter)
2 hoogheemraden gebouwd
2 hoogheemraden ongebouwd
2 hoogheemraden waterkwaliteit

- administratieve dienst
  - SECRETARIS-RENTMEESTER
    - Algemene zaken
    - Financiële en economische zaken
    - Oud archief en bibliotheek
    - Voorlichting
- stafdienst personeel, organisatie en automatisering
  - DIRECTEUR
    - Organisatie
    - Personeelbeheer en rechtspositie
    - Personeelvoorziening
    - Informatievoorziening
- technische dienst
  - DIRECTEUR-INGENIEUR
    - Waterkeringen en Waterhuishouding
    - Administratie
    - Beheer Technische Installaties
    - Technologie
    - district Den Haag
    - district 's Gravenzande
    - district Maassluis
    - district Pijnacker

Organization BTI

Organogram:



BTI = Management Technical Installations
BB = Project department
ZT = Treatment Proces department
BEM = Surfacewater Pumping Installations
DGL = Waste Water Treatment Plant The Groote Lucht
HRT = Waste Water Treatment Plant Houtrust
NWA = Waste Water Treatment Plant The Nieuwe Waterweg

Requirements

* Historical only BOD-removal

* 1972 Law Pollution Surface water

- BOD < 20 mg/l
- SS < 30 mg/l
- N-kj < 10 mg/l
  (when water temperature > 10 °C)

* 1-1-95 Phosphate removal

- WWTP-capacity < 100.000 2 mg/l
- WWTP-capacity > 100.000 1 mg/l

* 1-1-98 Total-Nitrogen removal

- WWTP-capacity < 20.000 15 mg/l
- WWTP-capacity > 20.000 20 mg/l

SEWAGE TREATMENT PLANT "NIEUWE WATERWEG"

Constructed in 1979
Capacity 80.000 p.e. (54 g BOD per p.e. per day)
dry weather flow: 1050 m3/h
storm weather flow: 3000 m3/h

Process description:

Water treatment

Comminutor

Grit chamber, surface load 30 m3/m2.h

Presedimentation tank, diameter 42.5 m
depth (at side) 2 m
design surface load : 2 m3/m2.h

2 Aeration tanks, plug flow; each 2850 m3
Aeration capacity: fine bubble aeration, 2 x 3325 m3 air/h
The amount of activated sludge is according the design 3.5 g/l dry solids in the aeration tanks. The design sludge loading is 0.14 kg BOD/kg dry solids.day

2 Final sedimentation tanks; diameter 42.5 m
depth (at side) 2 m

Sludge treatment

Prethickener
Digestor, retention time 20 days at 33 °C
Post-thickener
Sludge dewatering: Belt pressure filter.

Remarks

The sewage arrives at the plant by means of a pressure sewer and has high concentrations of H_2S, which causes odour problems and corrosion. Therefore iron(III)chloride is dosed so FeS precipitates.

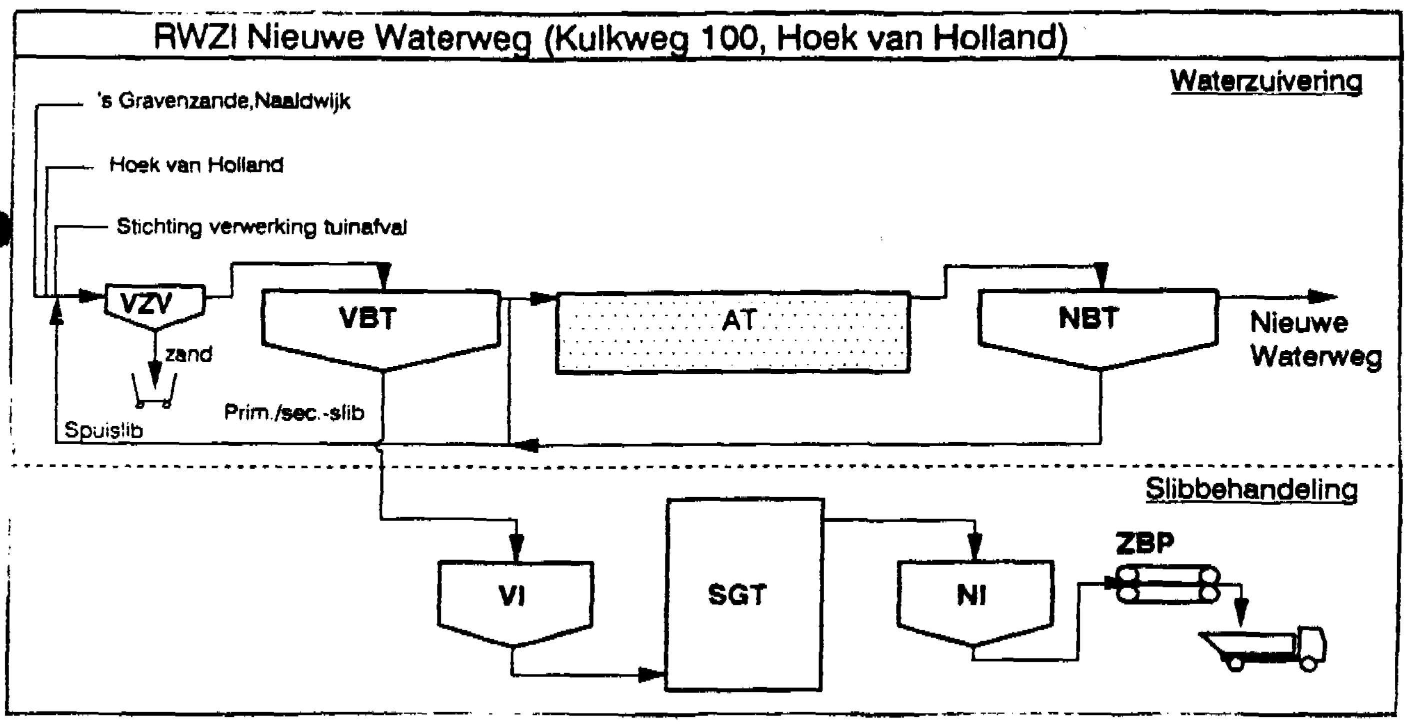
During the summer period (May-October) nitrification takes place. In the winter season the temperature is too low to maintain the population of nitrifying bacteria (at this sludge load). Within a few years the plant will be modified to allow nitrification and denitrification during the year, to reduce the discharge of nutrients into the North sea.

The excess sludge is digested and dewatered at the site. After dewatering it is currently transported to a large quantity sludge dump site. By 1995 a sludge incineration plant will be constructed where the sludge from all STP's in the province will be incinerated.

Performance (1989)		Influent	Effluent
COD	mg/l	642	66
BOD	mg/l	256	5
SS	mg/l	238	10
Kj-N	mg/l	51	18
NO3-N	mg/l	-	10
PO4-P	mg/l	8.6	3
SVI	ml/g	100	

Lay-out

VZV grit chamber
VBT presedimentation tank
AT aeration tank
NBT secondary sedimentation tank
VI prethickener
SGT digestor
NI postthickener
ZBP filter belt press



Baanhoek Production Location

A clear view

Baanhoek production location

Baanhoek production location is one of the five plants forming part of the Europoort Water Authority which is responsible for the treatment of water. We should like to tell you something about this process in this brochure.

Baanhoek production location actually consists of two plants: a surface-water plant and a ground-water plant. The end product of both is drinking water which is supplied via the distribution network to our customers on the Island of Dordrecht. Its annual production is some 10 million m_3. The other two production location plants, Berenplaat and Kralingen, take care of the remaining treatment in the distribution area of Europoort Water Authority. The fifth production location at 's Gravendeel is a stand-by for emergencies.
Drinking-water has to comply with numerous government requirements. It has to be colourless, have a good taste and smell and be free of pollutants or pathogenic organisms. In addition, the "Waterleidingwet" (the Act relating to drinking-water treatment) states the maximum concentration allowed in treated drinking-water for 57 pollutants. Since the surface-water and ground-water do not meet this standard, treatment is necessary. At the Baanhoek production location this takes place as follows.

Surface-water treatment plant

The Surface water treatment plant uses water which is stored and decarbonated by the "Waterwinningbedrijf Brabantse Biesbosch" in large reservoirs. This Biesbosch water is pumped to Baanhoek by a transport line, 800 mm in diameter, 9 km in length. If no further supplies of raw water are possible, this can be taken over by the storage reservoir De Grote Rug. The raw water is discharged into the buffer reservoir and then pumped by the Low Lift Pumping-station to the treatment plant.

Some data:

Capacity storage reservoir:	6,000 m^3
Capacity Storage reservoir "De Grote Rug":	2.200,000 m^3
Low Lift Pumping-station:	4 pumps, 500 - 1080 m^3/h each

Dosage system and filters

First of all ferric chloride sulphate (FeC_5O43) is added and mixed in a waterfall-mixer. This causes small flocs to be formed which stick to each other and thereby become larger. A coagulation aid is used to strengthen the flocs. During this coagulation process, the humic acids and suspended matter of the Biesbosch water are caught in the flocs. Up-flow filters and down-flow filters then intercept the flocs. By regularly backwashing the filters with water and air, the flocs are removed and then drained off to the sludge basin. The sludge is then thickened and taken away.

Dosage system:	2 channels
Ferric sulphate dosage:	average 8 mg Fe/l
Dosage coagulation aid:	average 1.8 mg/l Wispro
Coagulation time:	min.2.5 minutes
Up-flow filters:	8 filters
Surface area:	36 m^2, each
Filtration rate:	max. 10 m/h
Built-up filterbed:	gravel: 0.7m 2-5 mm; 0.25 m 4-8 mm; 0.35 m 8-12 mm; 0.35 m 10-20 mm
Back-wash rate:	water 50 m/h, air 60 m/h
Down-flow filters:	6 filters
Surface area:	36 m^2
Filtration rate:	max. 12 m/h
Built-up filterbed:	1.3 m gravel, 1.2-2.4 mm
Back-wash rate:	water 50 m/h, air 60 m/h
Back-wash pumps:	2 pumps, 2500 m^3/h each

Ozonisation

The water is then treated with ozone. This kills off viruses and bacteria, causes micro-pollutants to decompose and improves the taste. Oxygen present in the air is used to make ozone. The ozone is formed by filtering and drying this, and then exposing it to high voltage electric discharge in ozone generators. The ozone produced is added to the water over a porous element, situated on the bottom of the ozone-contact cellar at a depth of 5 m. The fine bubbles formed then rise to the surface and release the ozone into the water. The residual ozone gas above the water-surface is destroyed.

Ozone dosage:	average 1.5 mg/l, max. 3 mg/l
Contact-time:	min. 5 minutes
Number of ozone-generators:	3
Power consumption:	0.04 kWh/m^3

Activated carbon filters

The water receives its final treatment in activated carbon filters. these remove the remaining micro-pollutants and improve the taste and smell. These pressurised steel filters are fed with water from the Middle Lift Pumping station. Since activated carbon deteriorates, it has to be renewed every two years. The filters are back-washed every week to remove the intercepted matter.

Middle Lift Pumping station:	4 pumps, 300 - 1080 m^3/each
Activated carbon filters:	5
Type of carbon:	Norit PK 1-3 mm
Filter volume:	100 m^3per filter
Contact time:	min. 8.4 minutes

Ground-water treatment plant

The ground-water is extracted by pumps from the Maassluis formation at a depth of 100 to 140 m in the water-catchment areas Polder de Bieschbosch, near Kop van 't Land and Wantij/Jeugddorp. The quality of this ground-water is good, containing a small amount of iron, manganese, ammonium and methane, but a substantial amount of lime (i.e. hard water). The water is transported from the catchment areas in a 7 km long pipeline to Baanhoekweg. The water then undergoes the next stage of treatment.

Aeration

To add oxygen and to remove methane and CO_2, the water first flows over so-called pall-ring beds. These are steel tanks filled with plastic rings through which the ground-water and outside air flow together. During this process the above-mentioned gases are exchanged. In order to prevent contamination, the beds are back-washed weekly with water and air.

Aerators:	3 vessels, 250 m^3/h each
Dimensions:	bed height 3.7 m, diameter 1.6 m
Surface rate:	max. 150 m/h
Back-wash rate:	water 100 m/h, air 250 m/h

Pre-filtration

During aeration, iron and manganese in the ground-water form the oxidation products $Fe(OH)_3$ and Mn_3O_4 and are intercepted by the pre-filters, filled with gravel. These filters have to be back-washed with water and air every three days. The back-wash water with sludge is drained off into the sludge basin. The filtered water flows into the intermediate cellars.

Pre-filters:	4 filters
Surface-area:	18.5 m^2, each
Built-up bed:	2 m gravel, 1.5-2.5 mm
Filtration rate:	max. 10 m/h
Back-washrate:	water 50 m/h, air 50 m/h
Intermediate cellars:	2 cellars of 40 m_3

Decarbonation reactors and polishing filters

In the last stage of treatment, the hardness of the water is reduced to approximately 1.5 mmol/l (8.4 °D). For this purpose slaked lime ($Ca(OH)_2$ is added to the water in the decarbonation reactors, with the result that calcium-carbonate precipitates onto the graft-sand. Since the water and lime-milk flow upwards in these tall steel tanks, the sand fluidizes and the enlarged lime-grains gravitate. The lime-grains are periodically tapped off and new graft-sand is added to the reactors.

Since not all of the lime-grains will gravitate (carry-over approximately 5%), polishing filters are placed behind to catch it. Iron sulphate is added here to optimize the filtration process.

Decarbonation reactors:	3 reactors, each 170-285 m_3 /h
Reactor bottom:	conical with tangential inlet
Dimensions:	height 10 m, diameter max. 1.9 m
Flow rate:	min. 60 m/h, max. upward speed 10 m/h
Lime-milk dosage:	65 mg/l $Ca(OH)_2$; solution 1-4%
Polishing filters:	4 filters, each 190 m_3/h
Ferric dosage:	0.5 mg/l $Fe^{3}+$
Surface area:	20 m^2
Built-up bed:	1 m anthracite 1.6-2.5 mm, 0.8 m gravel 0.6-0.8 mm
Filtration rate:	max. 9.5 m/h
Back-washrate:	Water 55 m/h, air 60 m/h

Other facilities

The treated water from both plants is mixed. Since water consumption is higher in the daytime than at night, a drinking-water storage reservoir is provided. In order to prevent contamination by bacteria and higher organisms from growing during transport to our customers, a small amount of sodium-chlorite (0.7 mg/l) is added. Caustic soda (5.4 mg/l) is also added to raise the pH to 8-8.3.

The High Lift Pumping station pressurizes the water up to 32 m + N.A.P., which is sufficient to supply water throughout the entire service area. To prevent waterhammer during start-up and shut-down of the high lift pumps, a waterhammer tower has been constructed to protect the distribution network.

Drinking-water storage reservoir:	2 compartments, 7.500 m^3 net each
High Lift Pumping station:	4 pumps, 300-1000 m^3/h each and 1 pump of 1000 m^3/h
Waterhammer tower:	Height 33 m, capacity 75 m^3

Baanhoek in brief

Surface-water plant	
Went into operation:	1968
Capacity:	2160 m^3/h
Investment:	ƒ 40,000,000.-
Ground-water plant	
Went into operation:	1990
Capacity:	570 m^3/h
Investment:	ƒ 16,700,000.-
Site area:	4.5 ha, excluding storage reservoirs
Personnel:	26

Water on the move

Water is a natural product. The Europoort Water Authority ensures that clear, clean and reliable water is supplied. It endeavours to handle energy, chemicals and waste disposal in an environment-friendly way. It cooperates with the VEWIN-environmental plan, carries out research into new treatment methods and equipment and lobbies for the water of the river Meuse to be cleaned up.

In other words, Europoort Water Authority is constantly on the move.

Production location Baanhoek
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WATERBEDRIJF
EUROPOORT

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Figure

Oppervlaktewaterzuivering =	Surface-water treatment
Spaarbekken Brabantse Biesbosch =	Storage reservoir "Brabantse Biesbosch"
Bufferbekken Dordrecht =	Buffer reservoir "Dordrecht"
Lage Druk Pompstation =	Low Lift Pumping station
Doseerruimte =	Dosage channel
Opwaartse filters =	Up-flow filters
Neerwaartse filters =	Down-flow filters
Ozonisatie =	Ozonisation
Bufferkelder =	Buffer cellar
Bijmengen van behandeld grondwater =	Adding and mixing treated ground-water
Korrelkoolfilters =	Activated carbon filters
Reinwaterreservoir =	Drinking-water storage reservoir
Waterslagtoren =	Waterhammer tower
Grondwaterzuivering =	Ground-water treatment
Beluchting =	Aeration
Voorfiltratie =	Pre-filtration
Tussenberging =	Buffer or "intermediate" cellar
Ontharding =	De-carbonation
Nafiltration =	Polishing filters
Reinwaterberging =	Drinking-water storage

Kralingen
Production location

A clear view

Kralingen production location

Kralingen production location is one of the five plants of the Europoort Water Authority which is responsible for the treatment of water. We should like to tell you something about this process in this brochure.

The raw water to be treated is taken from the river Meuse by the Waterwinningbedrijf Brabantse Biesbosch and stored and decarbonated in large storage reservoirs. The end product is drinking-water, supplied via the distribution network to our customers in Rotterdam-Noord, Delft and Capelle a/d IJssel. Its annual production is 40-45 million m^3.
The three other production locations Berenplaat and Baanhoek (surface-water treatment and ground-water treatment) treat the water for the remaining service are of Europoort Water Authority. A fifth production location, 's Gravendeel, is a stand-by for emergencies.
Drinking-water has to comply with numerous government requirements. It has to be colourless, have a good taste and smell and be free of pollutants or pathogenic organisms. In addition, the "Waterleidingwet" (the Act relating to drinking-water treatment) states the maximum allowed concentration in treated drinking-water for 57 pollutants.
The Biesbosch water does not meet this standard and needs further treatment.
At the Kralingen production location the process is as follows.

Storage reservoirs

The Biesbosch water is pumped to Kralingen via a transport line, 1400 mm in diameter, 34 km in length. An interconnection line, 1400 mm in diameter, to Berenplaat can provide back-up supplies of raw water in emergencies.
In the case of an emergency, intake of raw water out of the Nieuwe Maas is possible.
The raw water is discharged into the storage reservoir, acting as a buffer. The Low Lift Pumping station pumps the water from the storage reservoir to the treatment building.

Capacity storage reservoir:	max. 90,500 m^3
Low Lift Pumping station:	4 pumps, 1.5 m^3/each

Coagulation and lamella separators

In the treatment building, first of all ferric sulphate $Fe_2(SO_4)_3$ is added and mixed with a static-mixer. This leads to the formation of small flocs. Slow mixing ensures that the flocs stick together and grow. If necessary a coagulation aid is used. During this coagulation process, the humic acids and suspended matter from the Biesbosch water are caught in the flocs. Since the flocs formed are heavier than the water, they then sink onto the lamella separators.
The settled flocs are then thickened into sludge, pumped to the drying fields and taken away.

Ferric sulphate dosage:	average 5.5 mg Fe^{3+}/l
Number of units:	6
Volume:	560 m^3 each
Number of compartments:	4 per unit
Coagulation time:	min. 20 minutes
Settling rate of floc:	average 1.2 m/h
Number of lamellas:	576 per unit, 1.2 x 3 m each, sheet thickness 0.7 mm

Ozonisation

After coagulation and removal of the flocs, the water undergoes ozonisation. This kills off viruses and bacteria, allows micro-pollutants to decompose and improves the taste. The ozone is produced by using oxygen present in the air. By drying this and then exposing it to high voltage electric discharge in ozone generators, ozone is formed. The ozone produced is added to the water with the aid of rotating ejectors, thereby forming small bubbles. The residual ozone above the water-surface is destroyed either catalytically or thermically.

Ozone dosage:	2-3.5 mg/l
Contact time:	min. 5 minutes
Number of ozone generators:	12
Power consumption:	0.06 kWh/m^3
Number of ejector/contact-chambers:	6

Double-media filters

In order to remove the residual turbidity, the water is filtered over double-media filters. This filterbed is built up of a layer of sand, 0.7 m thick, and a layer of anthracite, 0.8 m thick, supported by a layer of gravel. Since these filters constantly become dirty, they have to be back-washed daily with water and air.

Number of filters:	12
Filter area:	9 x 4 m each
Built-up filterbed:	support layer 0.7 m, sand layer 0.7 m (0.8-1.25 mm), anthracite layer 0.8 m (1.6-2.5mm)
Filtration rate:	max. 20 m/h
Back-wash rate:	air max. 60 m/h, water max. 45 m/h
Back-wash pumps:	3 pumps, 0.6 m^3/each
Back-wash water consumption:	approx. 4%

Activated carbon filters

The finishing touch is given by filtration over activated carbon. These remove the remaining micro-pollutants and improve the taste and smell. The pressurised filters, made of steel, are fed by the Middle Lift Pumping station. Since the activated carbon deteriorates in quality, it has to be regularly regenerated by the supplier. In addition, the filters have to be back-washed every 2 to 3 weeks to remove the matter caught in them.

Middle Lift Pumping station:	4 pumps, 1 m^3/each
Number of activated carbon filters:	12
Type of activated carbon:	Norit ROW 0.85
Regeneration frequency:	1.5 years
Volume of filterbed:	90 m^3 each
Contact time:	7.5 minutes

Drinking-water storage reservoirs and High Lift Pumping station

Since water consumption is higher in the daytime than at night, two large drinking-water storage reservoirs are provided. The reservoirs are constructed in steel, 10 mm thick, and are particularly striking due to their teardrop shape. In order to prevent contamination by bacteria and higher organisms from growing during transport to our customers, a small amount of chlorine (0.3 mg/l) is added.

The High Lift Pumping station pressurizes the water up to 28 m + N.A.P., sufficient to supply water throughout the entire service area.

Drinking-water storage reservoirs:	2 reservoirs, net 30.000 m^3 each
High Lift Pumping station:	8 pumps, 0.83 m^3/each

Other facilities

Chemicals are used in the treatment process. Ferric sulphate and Wispro-floc for flocculation, sulphuric acid during conversion of the purchased ferro sulphate into ferric sulphate, caustic soda to bring the pH back to the required level and chlorine for post-decontamination. The chemicals are stored in silos and tanks situated in the treatment building.

The treatment process also needs energy. First of all the pumps, such as the Low Lift Pumps, the Middle Lift Pumps and the High Lift Pumps. Energy is also needed for ozone generation and process control. In order to continue to supply water in the case of an electrical power breakdown, an emergency generator is provided.

Process monitoring and control is carried out by personnel in the central control room, situated in a tower on the treatment building. The control room is manned 24 hours a day to control and adjust the process and to receive and accept chemicals.

The plant is maintained by its own technical department with its own workshops and parts-store.

Kralingen in brief

Went into operation:	1977
Site area:	28 ha
Net capacity:	7200 m^3/h
Investment:	ƒ 198,000,000.-
Personnel:	65

Water on the move

Water is a natural product. The Europoort Water Authority ensures that clear, clean and reliable water is supplied. It endeavours to use energy, chemicals and waste disposal in a environment-friendly way. It cooperates with the VEWIN-environmental plan, carries out research into new treatment methods and equipment and lobbies for the water of the river Meuse to be cleaned up.

In other words, Europoort Water Authority is constantly on the move.

Production location Kralingen
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WATERBEDRIJF
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Figure

Spaarbekken Brabantse Biesbosch =	Storage reservoir "Brabantse Biesbosch"
Ontvangbekken =	Storage reservoir
L.D.P. =	Low Lift Pumping station
Ferri-dosering =	Ferric dosage
Vlokvormers =	Coagulation
Lamellen seperatoren =	Lamella separators
Slib =	Sludge
Ozonisatie =	Ozonisation
Dubbelaagsfilters =	Double-media filters
M.D.P. =	Middle Lift Pumping station
Koolfilters =	Activated carbon filters
Spoelwater pompen =	Backwash pumps
Chloor = Chlorine	
Reinwaterreservoir =	Drinking-water storage reservoir
H.D.P. =	High Lift Pumping station
Primaire doseringen =	Primary dosage
Eventueel coagulatiehulpmiddel =	coagulation aid if required
Slibindikker met roerder =	sludge thickener with mixer
Bufferkelder =	buffer cellar
Eventueel secundaire doseringen =	Secondary dosage if required

Figure

Noodinlaat Oude Maas =	Emergency inlet Old Meuse
Spaarbekken =	*Storage reservoir*
Biesboschleiding =	Biesbosch pipeline
LD pompstation + micro-zeven =	Low Lift Pumping station + micro-strainers
Chloorbleekloog =	Sodium hypochlorite
Doseringsgebouw =	Dosage building
IJzeromzet installatie =	Iron conversion installation
Vlokhulpmiddel, (poederkool), kalk =	Coagulation aid, (activated carbon powder), lime
Slib =	Sludge
Vlokkendekenfilters =	Floc blanket filters
Beluchting + nadesinfection =	Aeration + post-decontamination
Koolfilters =	Activated carbon filters
Filtergebouw =	Filter building
Bufferkelder =	Buffer cellar
M.D.P. =	Middle Lift Pumping station
Reinwaterreservoir =	Drinking-water storage reservoir
H.D.P. =	High Lift Pumping station

Practical test process chart =
new treatment process and local distribution network
channel after micro-filtration
ferric sulphate
coagulation aid
floc blanket unit
rapid filtration through sand
buffer tank
ozonisation chamber
intermediate buffer ozone generation
caustic soda
15 minutes contact time
activated carbon filter 1
(biology)
intermediate buffer
15 minutes contact time
activated carbon filter 2
(absorption)
intermediate buffer
UV decontamination
middle lift pumping station
reservoir for the distribution network
high lift pumping station
overflow
buffer tank washing water
to the local drinking water network of Berenplaat
water extraction channel

Berenplaat
Production location

A clear view

Berenplaat production location

Berenplaat production location is one of the five treatment plants of the Europoort Water Authority which is responsible for the treatment of water. We should like to tell you something about this process in this brochure.

The raw water to be treated is taken from the river Meuse by the "Waterwinningbedrijf Brabantse Biesbosch" and then stored and decarbonated in large storage reservoirs. The end product is drinking water, supplied to our customers in Rotterdam-South, West-IJsselmonde, the western harbour area, Voorne-Putten and the Hoeksche Waard. The inhabitants of Rotterdam-West, Schiedam, Vlaardingen, Maassluis and part of the Westland area also drink water from the Berenplaat plant. Approximately 100 million m^3 is produced annually.
The three other production locations Kralingen and Baanhoek (surface-water plant and ground-water plant) undertake the remaining drinking water production in the service area of Europoort Waterworks. A fifth treatment plant in 's-Gravendeel is a stand-by for emergencies.
Drinking-water has to comply with numerous government requirements. It has to be colourless and have a good taste and smell and be free of pollutants or pathogenic organisms. In addition the "Waterleidingwet" (the Act relating to drinking-water treatment) states the *maximum allowed concentration* in treated drinking-water for 57 pollutants. Since the Biesbosch water does not yet meet this standard, further treatment is necessary.
The Berenplaat production location process is described below.

Storage reservoir and Water extraction channel

The Biesbosch water is pumped to the Berenplaat plant via a 30 km long, 1800 mm diameter pipeline. The raw water is received in the Water extraction channel which acts as a temporary storage location. In emergencies, the emergency storage reservoir, situated near the Berenplaat plant, and the raw water interconnection line to the Kralingen production location can take over supplies.

Some data:

Intake of pumping station:	5 pumps, capacity 12,500 m^3/h each
Capacity of storage reservoir:	max. 7,300,000 m^3
Capacity of Water extraction channel:	max. 200,000 m^3

Dosage building

The Low-Lift Pumping station pumps water from the water extraction channel into the dosage building. The water is first filtered through micro-strainers. These are large rotating drums, provided with a fine screen, removing all particles larger than 35 µm. The water is then decontaminated with sodium-hypochlorite. Since a retention time of about 30 minutes is needed for decontamination, a retention cellar has been built with a labyrinth of channels. Finally a number of chemicals are added to the water by means of mechanical mixers. These chemicals are: ferric sulphate $(Fe_2(SO)_3$, if necessary a coagulation aid and activated carbon powder, and lime for pH-correction.

Low Lift Pumping station:	2 x 6 pumps (total capacity 22,000 m^3/h)
Micro-strainers:	16 strainers, mesh 35 µm
Sodium-hypochlorite dosage:	approx. 1 mg/l Cl_2
Ferric sulphate dosage:	approx. 7 mg/l Fe^{3+}
Coagulation aid dosage (during winter only):	approx. 1.0 mg/l (Wispro), average
Activated carbon powder dosage (if necessary):	approx. 7.5 mg/l
Lime dosage:	approx. 6 mg/l CaO

Filter building

The ferric sulphate forms iron flocs in the water. Slow stirring makes the flocs stick together and grow. This process can be speeded up by adding a coagulation aid if necessary. During this flocculation process the humic-acids and suspended matter in the Biesbosch water will be enclosed in the flocs. Since the weight of the flocs formed is higher

than the weight of the water, they can later be removed. This takes place in the floc blanket gravity filters. The flocs formed are then discharged.
In order to remove the remaining turbidity, the smell and taste and also the micro-pollutants, the water is filtered over activated carbon. The filterbed is built up of a layer of granular activated carbon, height 1.0 m, supported by a layer of gravel. Since these filters gradually become dirty, they have to be backwashed every couple of days. The activated carbon slowly deteriorates in action and has to be regularly regenerated by the supplier. Finally the water is aerated over cascades, buffered in a cellar and then pumped to the drinking-water storage reservoirs by the Middle Lift Pumping station. In order to prevent contamination by bacteria and higher organisms from growing during transport to our customers, a small amount of sodium-hypochlorite (0,5 mg/l) is added in the upper weir of the cascades.

Floc blanket filters:	80 filters, surface area 5.7 x 8.3 m, each
Surface load:	max. 4.8 m/h
Activated carbon filters:	24 filters, surface area 4.2 x 19.1 m, each
Specification activated carbon:	Chemviron carbon TL8611, effective grain size 0.8-1.0 mm
Regeneration frequency:	approx. every 1.25 year
Filtration rate:	max. 9.4 m/h
Contact time:	min. 7 minutes
Expansion during backwashing:	16-20%
Aeration cascades:	4 aerators, consisting of 5 weirs in series, each
Buffer cellars:	average 2 x 2,500 m^3
Middle Lift Pumping station:	2 x 4 pumps (total capacity 20.500 m^3/h)

Drinking water storage reservoirs and High Lift Pumping station

The High Lift Pumping station pressurizes the water up to a maximum of 44 m+ N.A.P., sufficient to supply water throughout the service area. Water consumption is higher during the daytime than at night. To keep the flow almost constant in the treatment process, three large drinking water storage reservoirs (two old and one new one) are situated between the Middle Lift Pumping station and the High Lift Pumping station.

Drinking-water storage reservoirs:	3 reservoirs, net capacity 35,000 m^3, each
High Lift Pumping station:	8 diesel-driven pumps (total capacity 26,500 m^3/h)

Other facilities

Several chemicals are used in the treatment process, such as ferric sulphate and Wispro-floc for flocculation, sulphuric acid during conversion of the purchased ferro sulphate into ferric sulphate, lime to bring the pH back to the required level and sodium-hypochlorite for disinfection. The chemicals are stored in silos and tanks situated inside or close to the dosage building.
The treatment process also needs energy. First of all the pumps, such as the Low Lift Pumps, the Middle Lift Pumps and the High Lift Pumps. In addition energy is needed for heat and process control. In order to cope with an electrical power breakdown, an emergency power generator is provided.
The monitoring and control process is carried out by personnel in the central control room, situated in the High Lift Pumping station, and is manned 24 hours a day to control and adjust the process and to receive and accept chemicals.
The plant is maintained by its own technical department.

Water on the move

Water is a natural product. The Europoort Water Authority ensures that clear, clean and reliable water is supplied. It endeavours to use energy, chemicals and waste disposal in an environment-friendly way. It cooperates with the VEWIN-environmental plan, carries out research into new treatment methods and equipment and lobbies for the water of the river Meuse to be cleaned up.
In other words, the Europoort Water Authority is constantly on the move.

New treatment technique at Berenplaat

Europoort Water Authority has an eye to the future. Since 1 July 1991 trials have been carried out at Berenplaat production location with a new treatment technique, aimed at raising the quality of the water to an even higher level. If all goes according to plan, this perfect water will flow out of the taps in 1999. The consumer is becoming more and more critical. He only wants the best. This also applies to drinking water. Increasingly high specifications will be laid down in this respect in the future. Europoort Water Authority believes this to be justified, but is nevertheless all too aware that it cannot yet count on any permanent improvement of the raw material: the water from the river Meuse. The main culprit is the continual pollution of the environment.

Ozone

Using present treatment techniques, it would not be possible to make drinking water of an even better quality out of the steadily deteriorating river water.

This is precisely why Europoort Water Authority began its search for more refined treatment techniques. Its attention fell on the use of ozone, activated carbon and ultraviolet light for the treatment of water. If necessary hydrogen peroxide can also be used. This is principally a new development which is being closely followed by other water authorities.

Different applications

The treatment techniques described above have of course already been tested before, usually individually but occasionally as a total process. This generally concerns other applications, such as environmental treatment of polluted ground-water. This involves one or more pollutants with which considerable experience has already been acquired. This technique is also occasionally used for the production of drinking water, especially in France and the United States, but it is still at an experimental stage there just as it ishere. This experience gained abroad is also being incorporated in the current experimental system.

These new experimental system is needed to find out how variations in water from the Meuse can be solved using this technique and whether the new treatment is compatible with the existing one.

Feasibility test

The use of a new treatment technique therefore necessitates thorough research.

Europoort Water Authority therefore set up a trial system at Berenplaat where extensive experiments were carried out until the autumn of 1993. These tests included research into extreme situations.

The trial system consists of a pre-treatment installation, an adapted part of the existing plant and two experimental plants. The experiments resulted in a positive answer to the question as to whether this new treatment technique is feasible. In addition, employees at Berenplaat have gained a great deal of experience with the new process and the equipment involved. At the beginning of 1994, the experiment was promoted to the status of a small drinking water plant. The drinking water produced is pumped into the local network of Berenplaat, to offices, workshops and business premises (see chart). The behaviour of this new drinking water in the distribution network is therefore being established within the legally prescribed control framework. This stage of the project is also progressing successfully.

Sodium chlorite disappears

At the Berenplaat plant, sodium chlorite is still being used to decontaminate the drinking water. This is no longer used in the experimental system. The water receives further treatment by ozonisation.

The following step consists of filtration with activated carbon. Then comes a post-decontamination with the aid of ultra-violet light. In one of the experimental plants, after the carbon infiltration the water passes through a micro-strainer to remove any higher organisms.

Building on paper

Extensive changes in the process such as these require a great deal of preparatory work. The first stage of this preparation, the preliminary design, is now complete. The main lines of the process, including a comparison with alternatives, are on paper, together with an overview of the estimated cost. In mid-1994 a start will be made (?was made) on the detailed design. During this phase, which will last about one year, all details will be determined for the definitive system following careful selection. When working out the building plans on paper, constant use is made is made of research carried out, plus additional research if necessary, using the experimental system.

Clear improvements

Europoort Water Authority drew up a long list of specifications for the research and the design phases. These will all have to be shown to be feasible before a decision is taken to give the new treatment technique the green light. One of the objectives is for the drinking water to be biologically stable. This means that it must be impossible for bacteria to grow in the distribution network. In addition the water must contain no more than a minimum amount of organic micro-pollutants and higher organisms. This not only improves the clarity of the water, it also prevents the formation of by-products in the water.Furthermore, the water must be completely free of taste and smell. In other words, it largely concerns improvements in quality which will be clearly noticeable by the consumer. What the consumer will not be so clearly aware of is the considerable improvement in supply reliability. This means that the supply of reliable water can continue regardless of any problems occurring.

Berenplaat in brief:

Went into operation:	1966
Site area:	163 ha
Net capacity:	18,000 m^3/h
Investment (1966):	ƒ 150,000,000.-
Personnel:	80

Production Location Berenplaat
Berenplaat 10
3209 LJ Hekelingen
Telephone: +31 (10) 293 60 00

WATERBEDRIJF
EUROPOORT

P.O. Box 59999, 3008 RA Rotterdam, Telephone +31 (10) 293 50 00

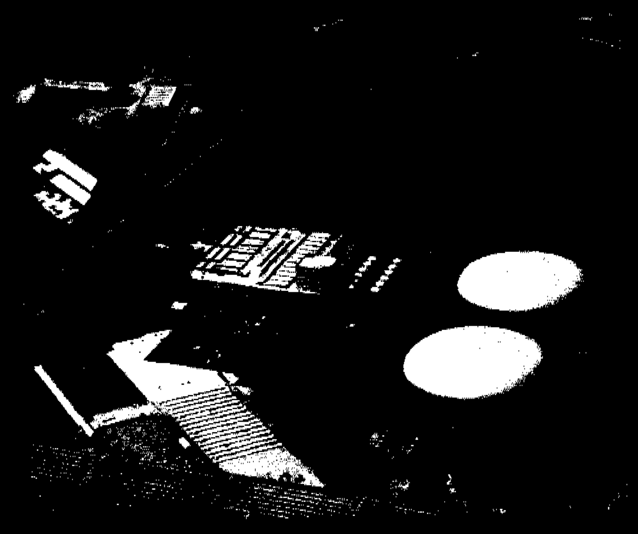
Produktielocatie Baanhoek

helder bekeken

Produktielocatie Berenplaat

helder bekeken

Produktiebedrijf Kralingen



helder bekeken

N.V. Watermaatschappij Zuid-Holland Oost

General management of water supply in South Holland by WZHO

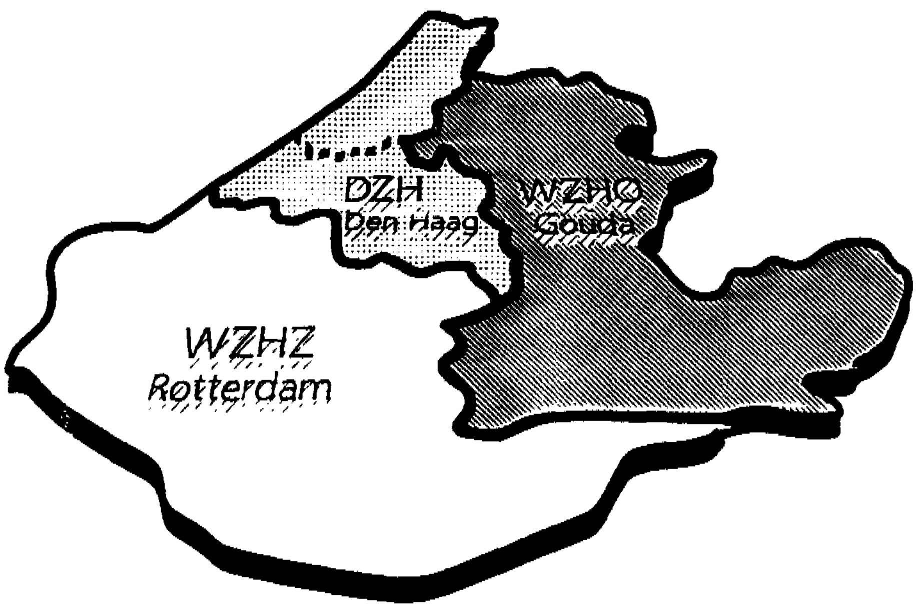
?/? 2,25/

Mrs. I.J.L. Couwenberg-Veraart
Head of the legal and PR-department, secretary to the Board of Directors, involved in the strategy and policy making of the company

Organisation of the water supply companies

Situation of the province of South Holland in the Netherlands

Organisation of the water supply companies



Organisation of the water supply companies

Governement

Central government
Law setting national standards for drinking water quality

Local government (province)
Execution of law by making plans for organisation in our province

Organisation of the water supply companies

<u>Autonomy</u>
40 watercompanies in the Netherlands, of which three in the province of South Holland

Division of South Holland over three watercompanies, based on different sources: surface, dune, ground water

Organisation of the water supply companies

Autonomy watercompanies

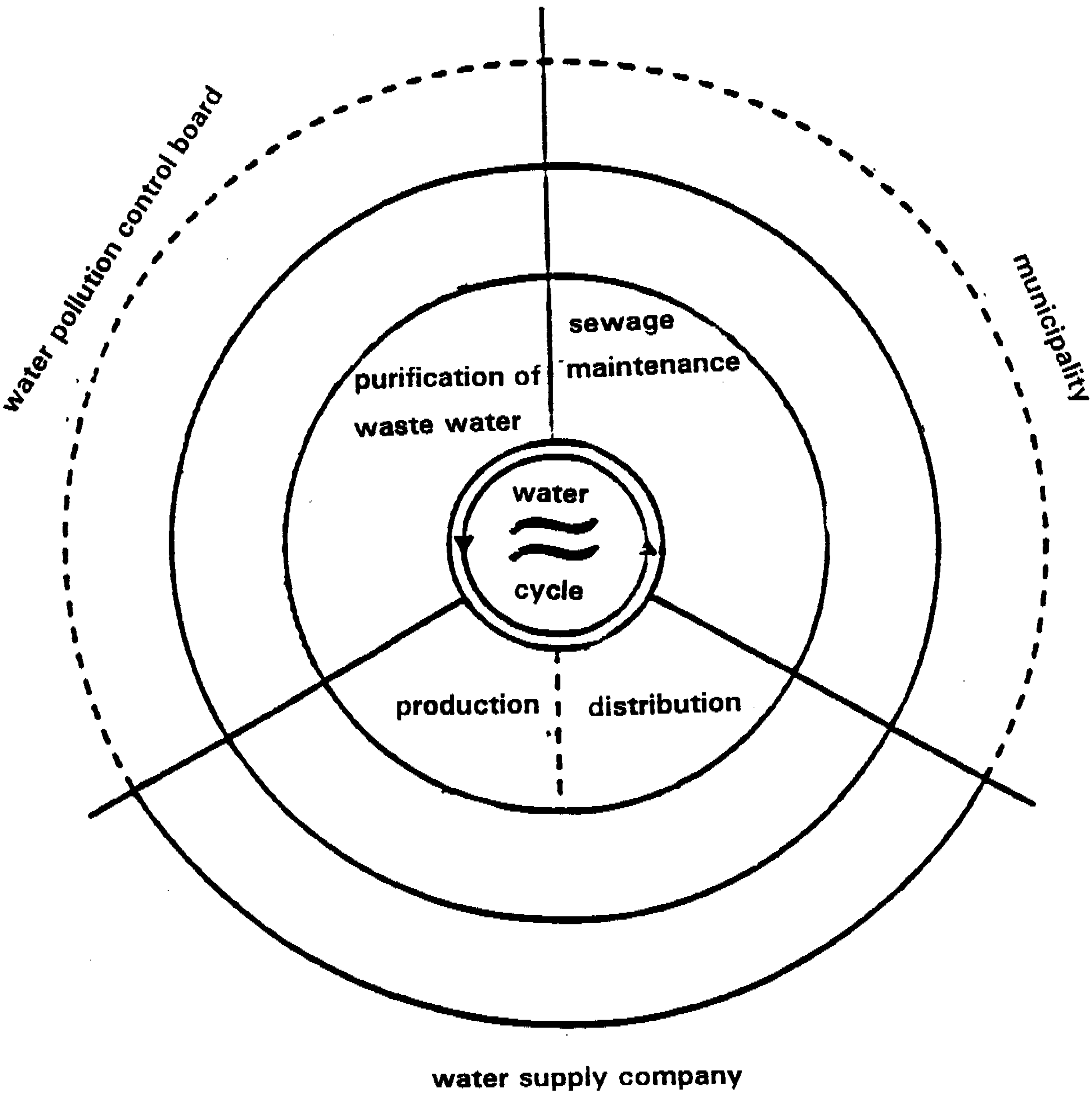
- exclusive permission for distribution of drinking water

- plan for organisation in own district

South Holland	3 million
WZHO	650.000 people
	260.000 connections

- drinking water only task, no waste water

water cycle


water pollution control board
municipality
sewage
maintenance
purification of
waste water
water
cycle
production
distribution
water supply company

Organisation of the water supply companies

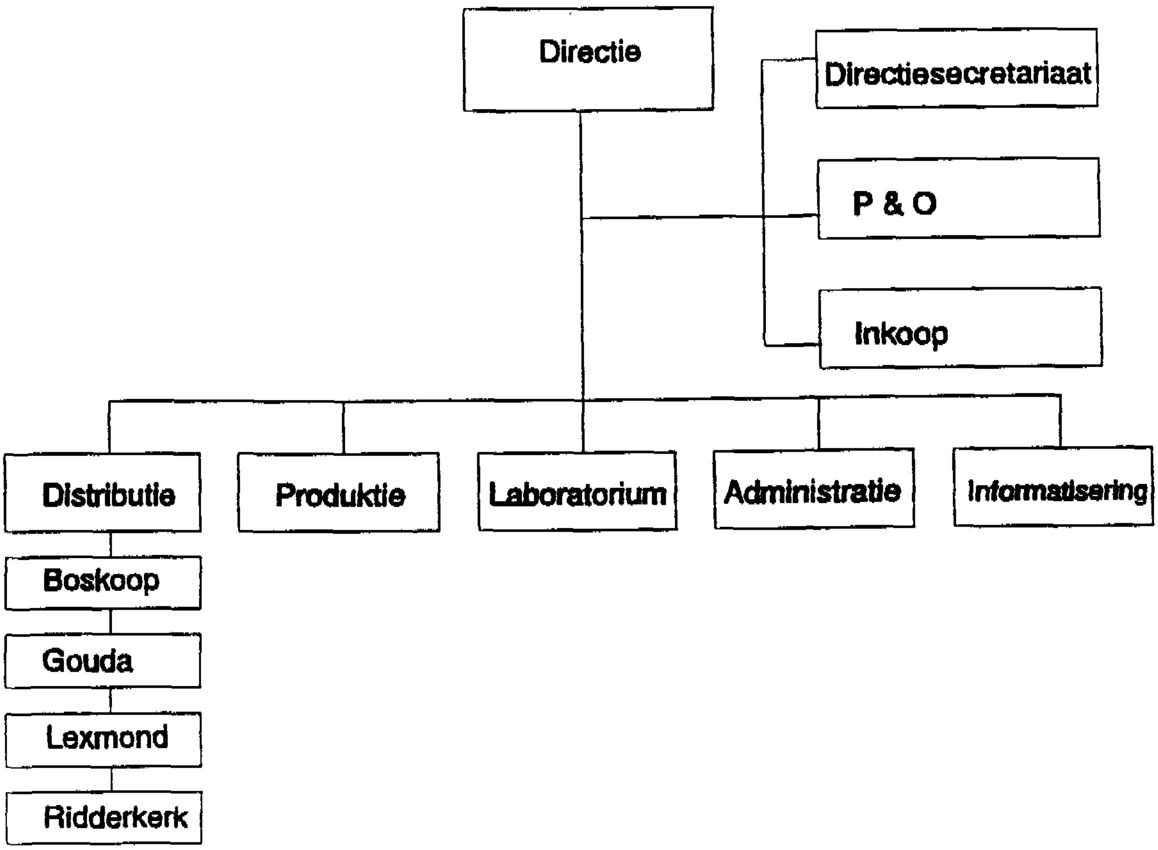
Autonomy watercompanies

- Legal authority

  - WZHO is a private company with limited liability
  - Shares are kept by 35 shareholders (municipalities)

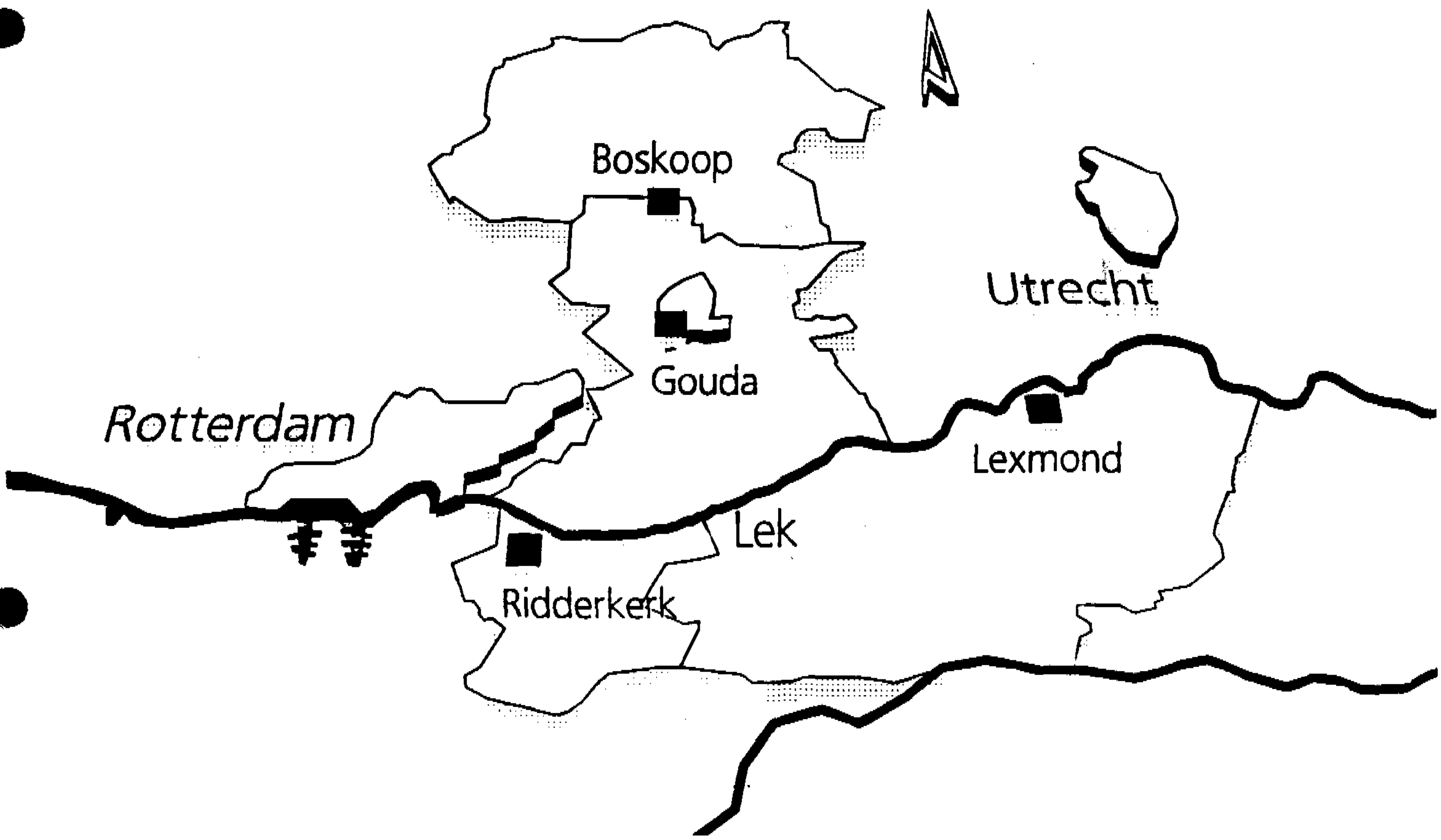
General assembly of shareholders WZHO (35)	Shareholders appoint board of directors, approve of proposal for tariff-setting
Board of directors (13)	Board of directors supervise performance of the company and can hire and fire managing directors
Managing directors (2)	managing directors represent company by law and are authorised to perform all necessary actions; they define the strategy and the policy of the company
Management Team (7)	management team is responsible for the execution of the company policy and translation of policy into actions

Organisation of the water supply companies



Organisation of the water supply companies

Provision area



Organisation of the water supply companies

Figures 1993

• employees	342
• connections	260.000
• population of provision area	650.000
• total use	50 million m3
• consumption per household	145 m3
• total length pipelines	3.400 km

Organisation of the water supply companies

Autonomy : sustainability

- Coverage houseconnections: 100%

- Goal: tariffs acceptable to society, therefore only modest profits

- Investments covered by loans

- Recover costs from tariffs

WZHO

Organisation of the water supply companies

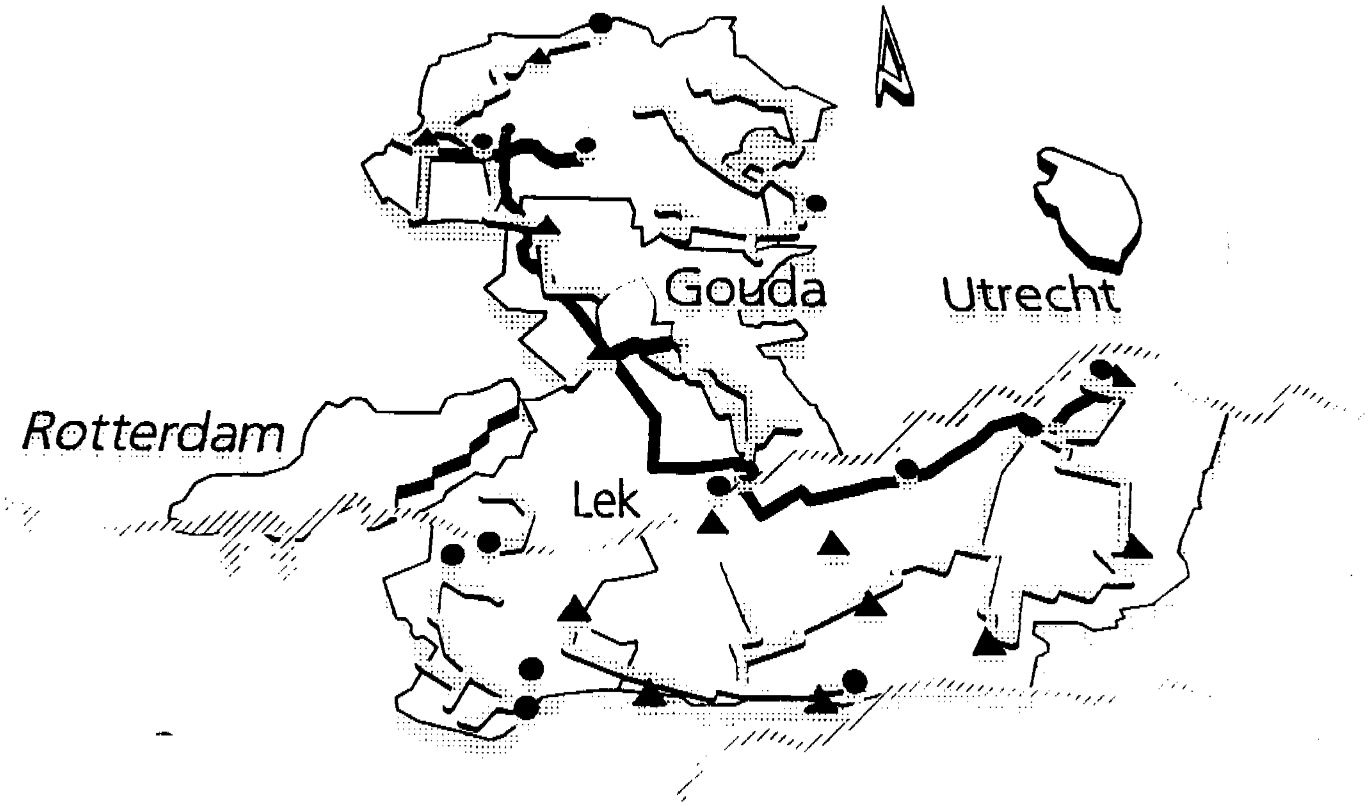
Policy WHZO: Main goals

Goal 1 to produce enough drinking water by:

- obtaining concessions from the province
- realising infrastructure
- building watertreatment plants and pumping stations

Organisation of the water supply companies

Infrastructure and Watertreatment plants



VZHMO

Organisation of the water supply companies

Goal 2 to keep the tariffs at an acceptable level by:

- staging investments in time
- increasing our own capital to lower the costs of loans
- lowering the costs of our organisation

Public relations and public awareness

Goal 3 maintaining good public relations

- public concern for quality of the environment
  - pollution
  - increasing costs for production drinking water

- water supply sector low profile, limited territory in the Netherlands, strong demands from
  - industry
  - agricultural sector
  - building sector

Public relations and public awareness

- different interests, therefore increasing importance of maintaining good public relations with:

  - shareholders
  - farmers
  - domestic consumers
  - local and cental government

- different approaches to different interest groups

  - economising on waterconsumption: industry, farmers as well as domestic users

WZHO

Public relations and public awareness

Goal 4 organisation development

- improving efficiency and effectivity
- reducing costs

PLANNING

FORECASTING DEMAND

* **domestic demand**
  - number of inhabitants
  - daily water consumption

* **agricultural water use**
  - number of pigs, cows etc
  - water consumption for pigs, cows etc

* **industrial water use**
  - extrapolation

Utility planning

* New production facilities
  - increase of demand
  - reallocation of production facility
    - pollution
    - desiccation
  - new purification scheme (pollution)

* Additional distribution
  - new production facility
  - reallocation of production facilities

Aspects of distribution planning

* Advanced models for network calculations

* Reliability: 75% of maximum capacity can be delivered

* Industrial areas (pollution)

Distribution planning

* Long term (15 years)
  - possible scenario's for infrastructure

* Mid term (5 years)
  - alignment
  - diameter
  - costs
  - alternatives
  - obtaining permissions

* Short term
  - smaller works

Technical Planning of distribution systems

* Optimal alignment
  - permissions obtained

* Design
  - diameter
  - valves
  - connections
  - selection material
    (pvc, steel, ductile iron)

* Preparation
  - granting permissions
  - drawings
  - tendering

Maintenance program distribution

- check valves, fire hydrants
- replace water meters
- check cathodic protection
- repair defect parts
- quality control
- flushing program
- replacing mains (increasing leakage)

Organisation distribution

* Head office -> mains

- plan preparation
- registration
- support staff
- supervisors
- flushing teams

* Branche offices (70.000 connetions)
- head
- administration staff
- plumbers
- store
- supervisors

FORECASTING DEMAND

↓

required production facilities

↓

ground water

↓ ↘ license

lowering of the
ground water level

↓

desiccation of nature resources

↙ ↘

reduction
of water
consumption

use of
surface
water

WOB

PROTECTION OF GROUND WATER

- excessive use of manure
- pesticides
- storage of oil
- waste disposal

Protection zone

- bacteriological: 60 days zone
- chemical: 25 years zone

travel time of water > 25 year
(wells deeper than 100 m):
only protection against decp drillings

Soil protection act

- regulations: restrictions for manure, pesticides
- financial compensation (higher costs for the farmers)

WOB

MONITORING GROUND WATER

- system of observation wells (vulnerable locations of ground water abstraction)

- sampling

- data bank management system

- detecting trends in ground water quality

- geohydrological and geohydrochemical knowledge of the ground water system

- modelling ground water quality (prediction)

WOB

SURFACE WATER PROTECTION

river Rhine

- international agreements (Rhine Action Plan)
- some cases settled in court
- very polluted (industrial activities)

river Meuse

- negotiations with Belgium (Meuse Action Plan)

TREATMENT
Ground water

removing of iron and manganese:

→ aeration and rapid sand filtration

deep ground water:

→ removing of methane by degassification tower

pesticides:

→ granular activated carbon filtration

acid rain/deacidification (shallow water wells):

→ filtration over crushed limestone

WOB

J/C

MAINTENANCE

* Maintenance plan
  → systematic program

* Skilled personnel

* Tools

* Record keeping

FINANCIAL & COMMERCIAL MANAGEMENT

1. DUTCH SITUATION
2. INVESTMENTS, PLANS AND TARIFF POLICY
3. BALANCE POSITION AND COSTING
4. MANAGEMENT - INFORMATION
5. SALES PROCEDURES
6. INFORMATION TECHNOLOGY
7. SUMMARY/KEY FACTORS

WOB

The Dutch situation

A. Acting parties/laws

- Ministry/Waterworks Association/Provincial gvt/Companies

- Drinking Water Supply Act (1957/1975)
- Groundwater Act/Soil protection Act/Water management Act

B. Water supply

- total 1200 mln m3/groundwater (2/3)/domestic use (60%)

C. Companies

- large scale companies for production and distribution
- to an integrated water control

- legal status/ltd (plc)

D. Reorganisation of the sector, to 15-20 companies

- integration production/distribution
- minimum 100.000 connections (300.000 on average)
- more than 1 production unit
- own laboratory facility/control

- further European drive for more concentration?

E. Tariff scales

- domestic consumption
- industrial supply

- new connections

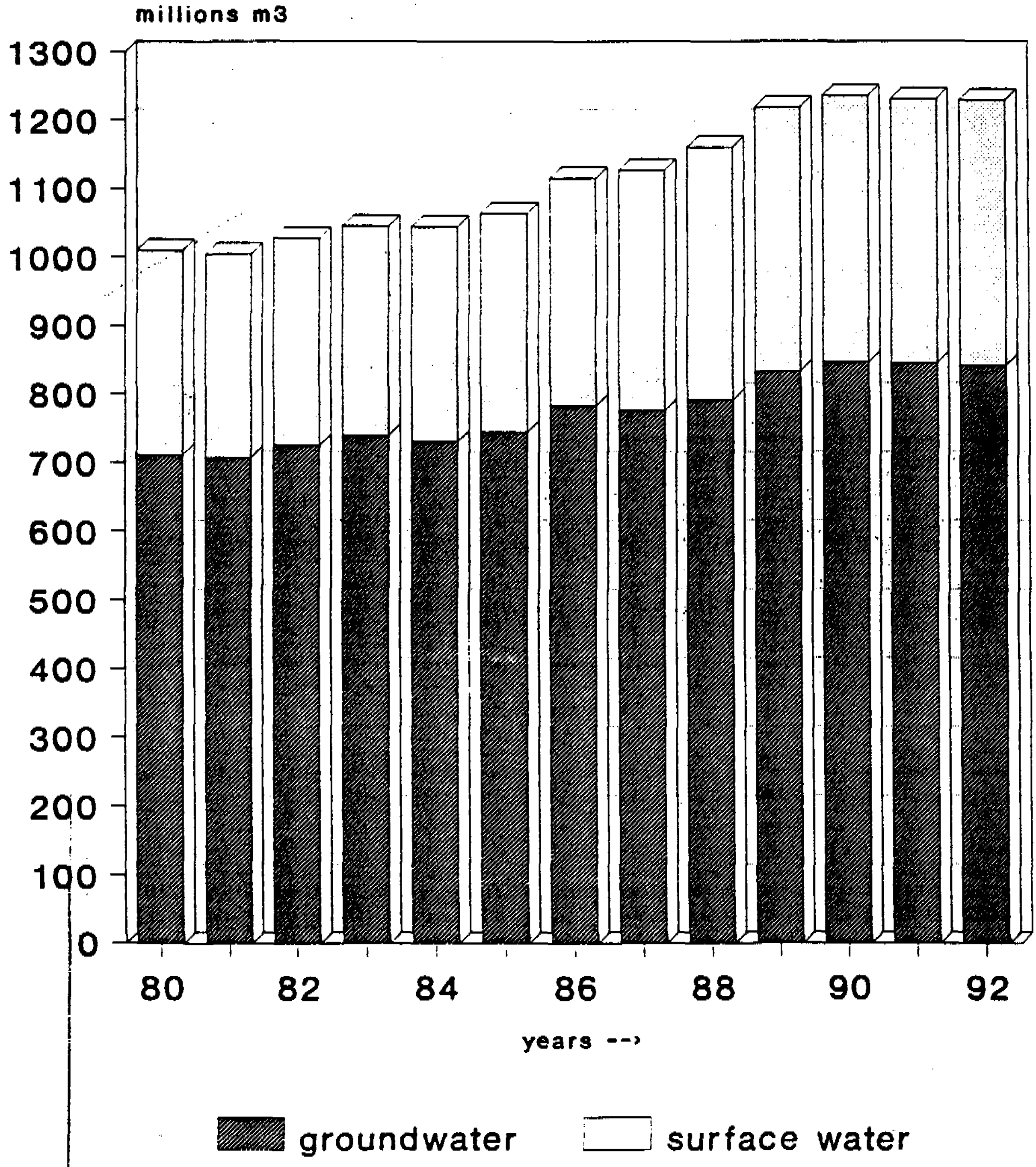
WOB

Number of watercompanies per province (1.1.1994)

Province	1985	1994	plan
Groningen	2	2	1
Friesland	1	1	1
Drenthe	3	1	1
Overijssel	7	3	1
Gelderland	9	5	1
Utrecht	5	2	1
Noord-Holland	9	4	1
Zuid-Holland	29	4	3
Zeeland	1	1	1
Noord-Brabant	15	5	1
Limburg	9	2	1
Flevoland	1	1	1
	91	31	14

WOB

Production of drinking water
in the Netherlands



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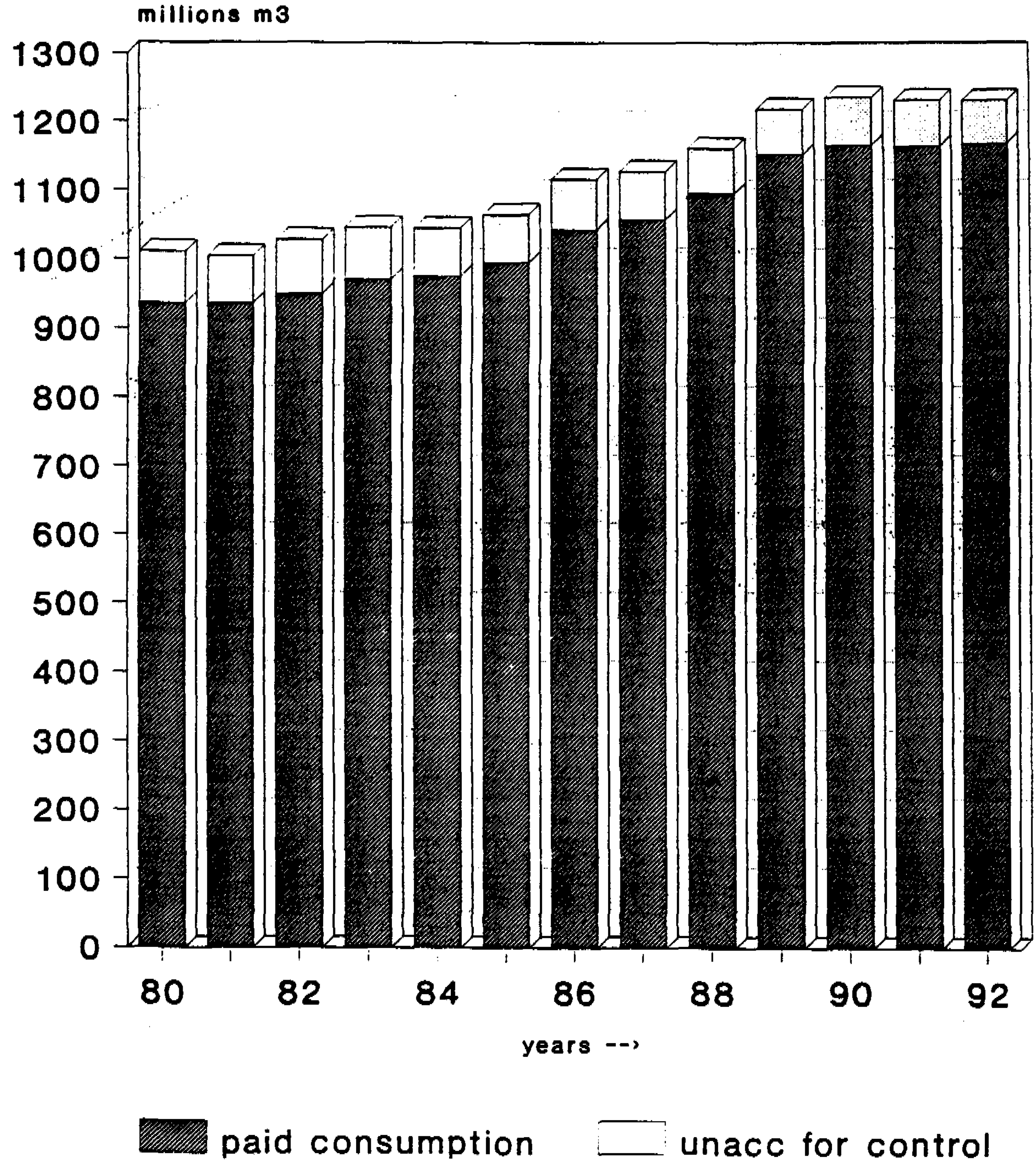
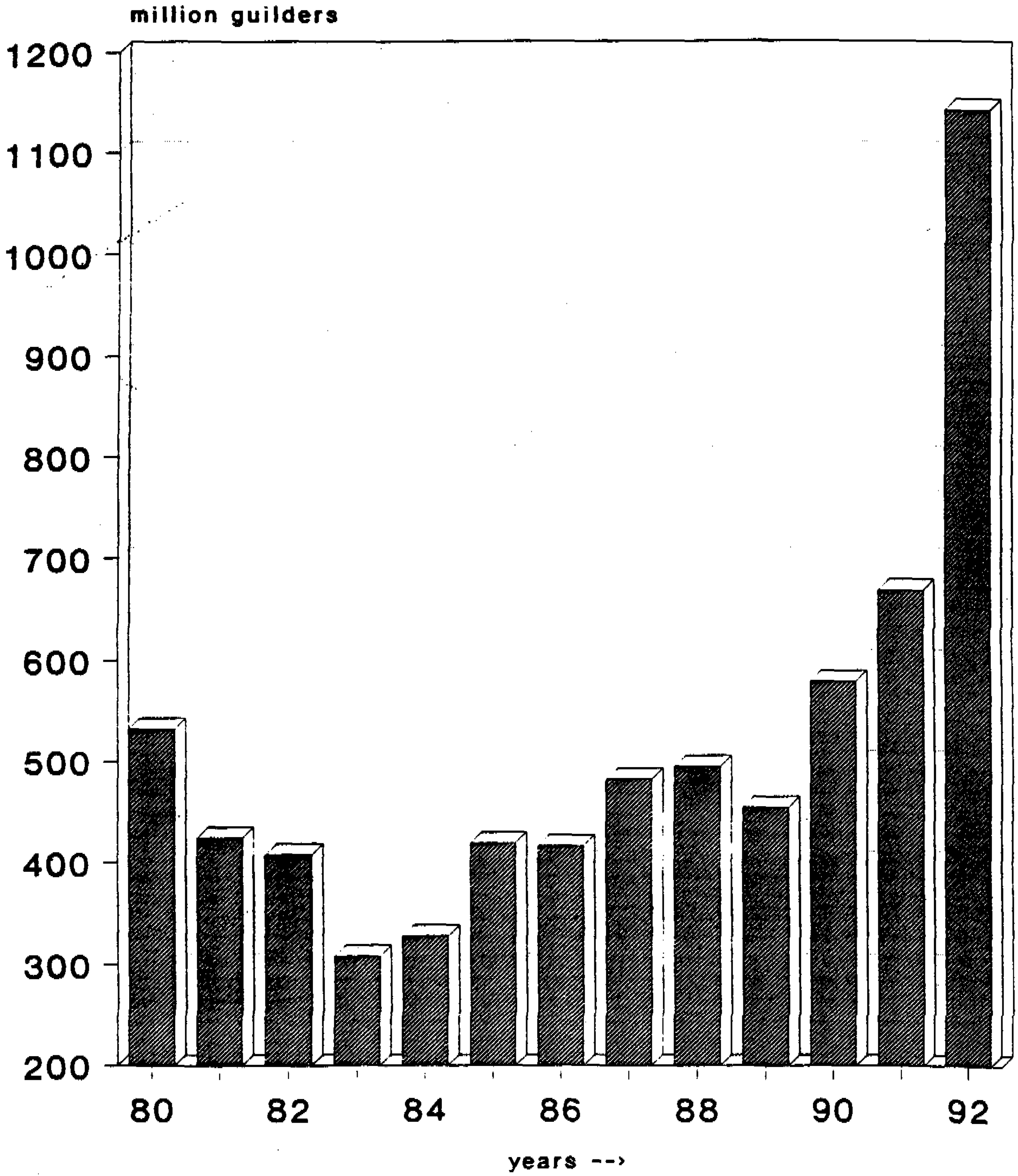
Consumption of drinking water
in the Netherlands

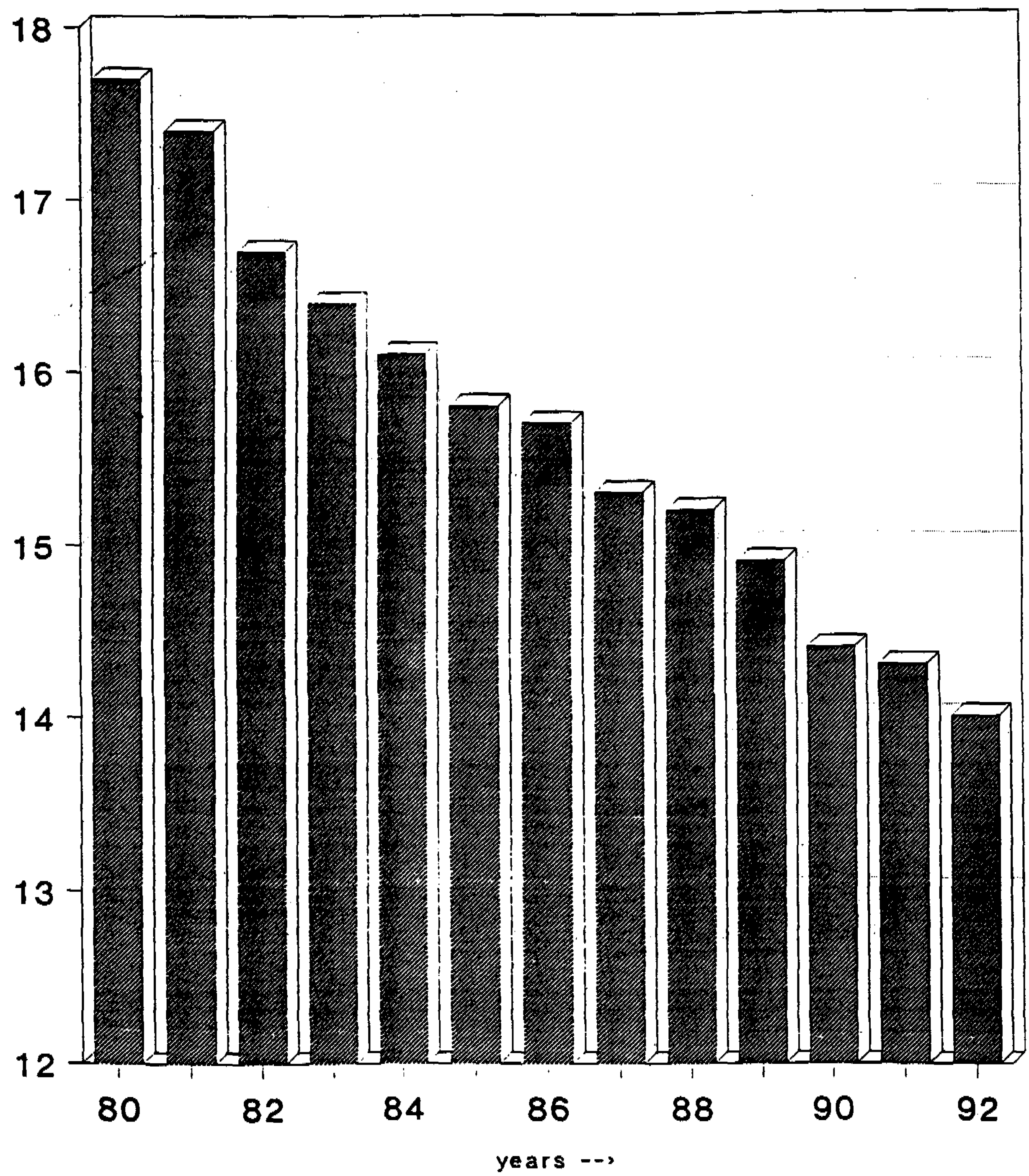


WOB

Investments fixed assets water supply
companies in the Netherlands

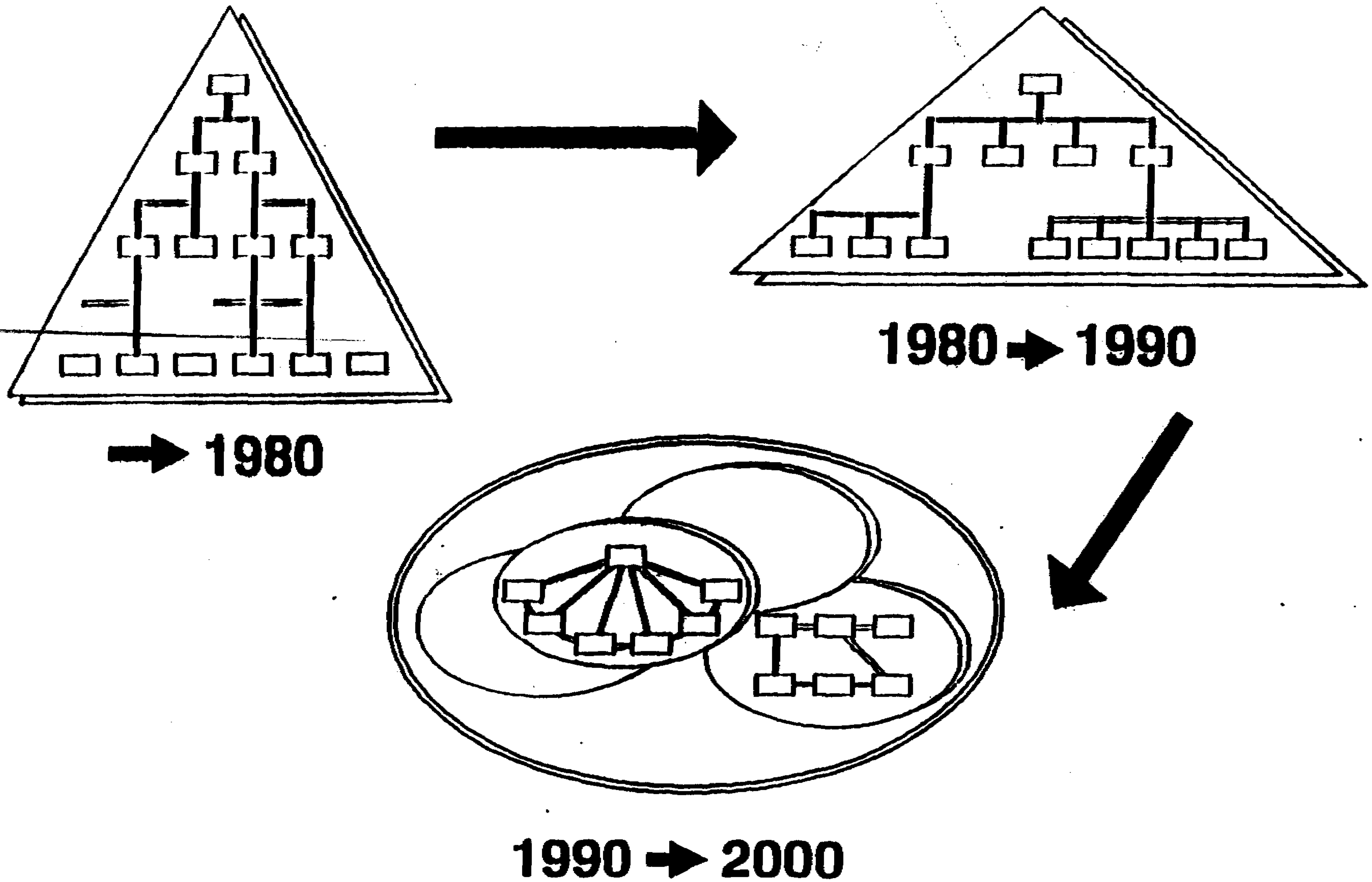


Employees per 10.000 connections
water supply companies in the Netherl.

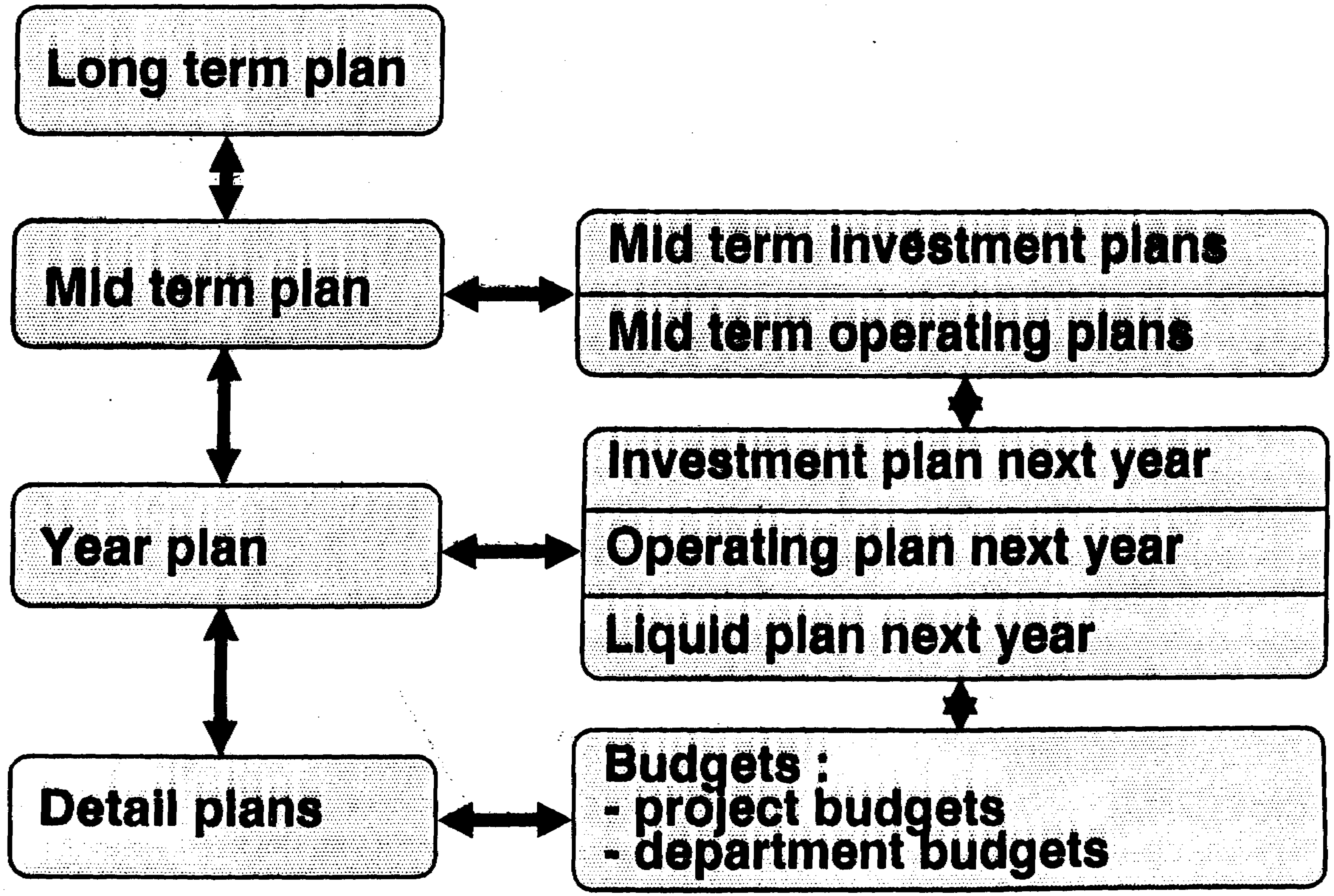


based on average number of connections

WOB


→ 1980
1980 → 1990
1990 → 2000

Total scheme of plans



Tariff scales

Domestic consumption
- price* per m^3 (variable costs)
- connection costs (fixed costs)

Industrial supply
- industrial tariff per m^3 capacity per hour (fixed costs)

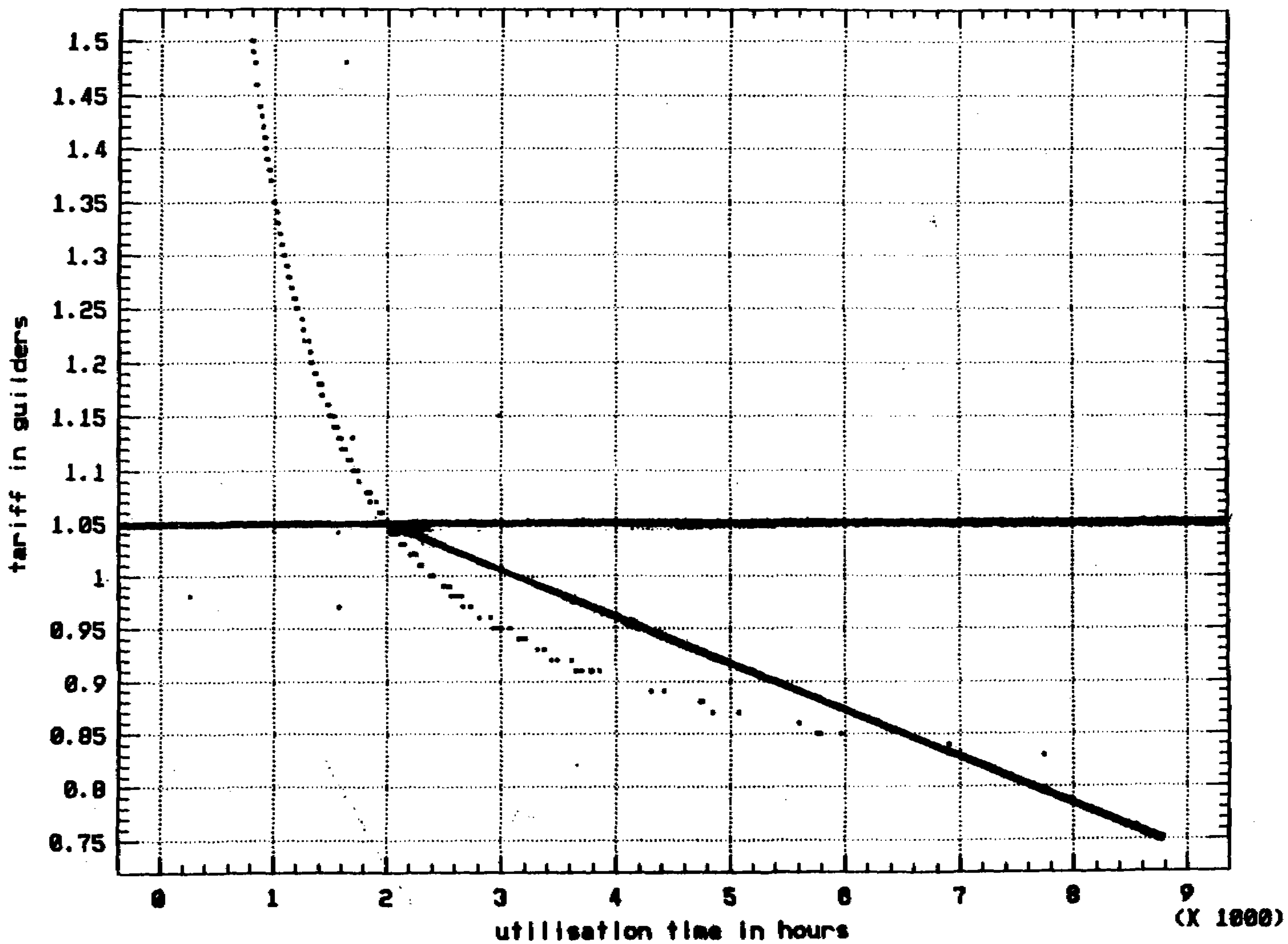
- reduced price* per m^3 (variable costs)
- connection costs (fixed costs)

New connections
- fixed sum
- variable sum/per length of connection

* including so called consumption costs and capacity costs

WOB

Industrial tariff in relation to utilisation time



WOB

Balance sheet

(example)

Assets X 1000 guilders	1993	1992
Fixed assets		
Material fixed assets		
- Property plant	78.182	80.929
- Equipment	57.852	63.699
- Transport and distribution pipes	187.147	186.027
- Other material fixed assets	15.167	17.834
- Work in progress	30.526	4.283
	368.874	352.772
Financial fixed assets	86	86
Currents assets		
- Inventories	3.527	3.426
- Accounts receivable	7.938	8.719
- Cash, bank	515	349
	11.980	12.494
Total	380.940	365.352

Liabilities X 1000 guilders	1993	1992
Capital stock		
Share capital	137	137
reserves	18.771	13.812
	18.908	13.949
Connection contribution	125.758	121.993
Provisions	33.185	32.834
Long loans	151.926	139.483
Short loans and accounts payable	51.163	57.093
Total	380.940	365.352

TREATMENT
Surface water (1)

storage

- reservoir (Biesbosch)
- artificial recharge in the dune area

reduce of chlorine

→ formation of trihalomethanes: risks for public health
→ ozon or ultra violet
→ artificial recharge of ground water

pesticides

- granular activated carbon filtration (GAC)

WOB

TREATMENT
Surface water (2)

pretreatment before artificial recharge of ground water

reservoir

→ coagulation, sedimentation, rapid sandfiltration, GAC, (ozonation), chlorination

WOB

Statement where got, where gone

(example)

X 1.000 guilders

Where got

Decrease fixed assets* (plant & equipment)	19.598
Increase connection contribution	368
Increase provisions	4.572
Decrease accounts receivable	572
	25.110

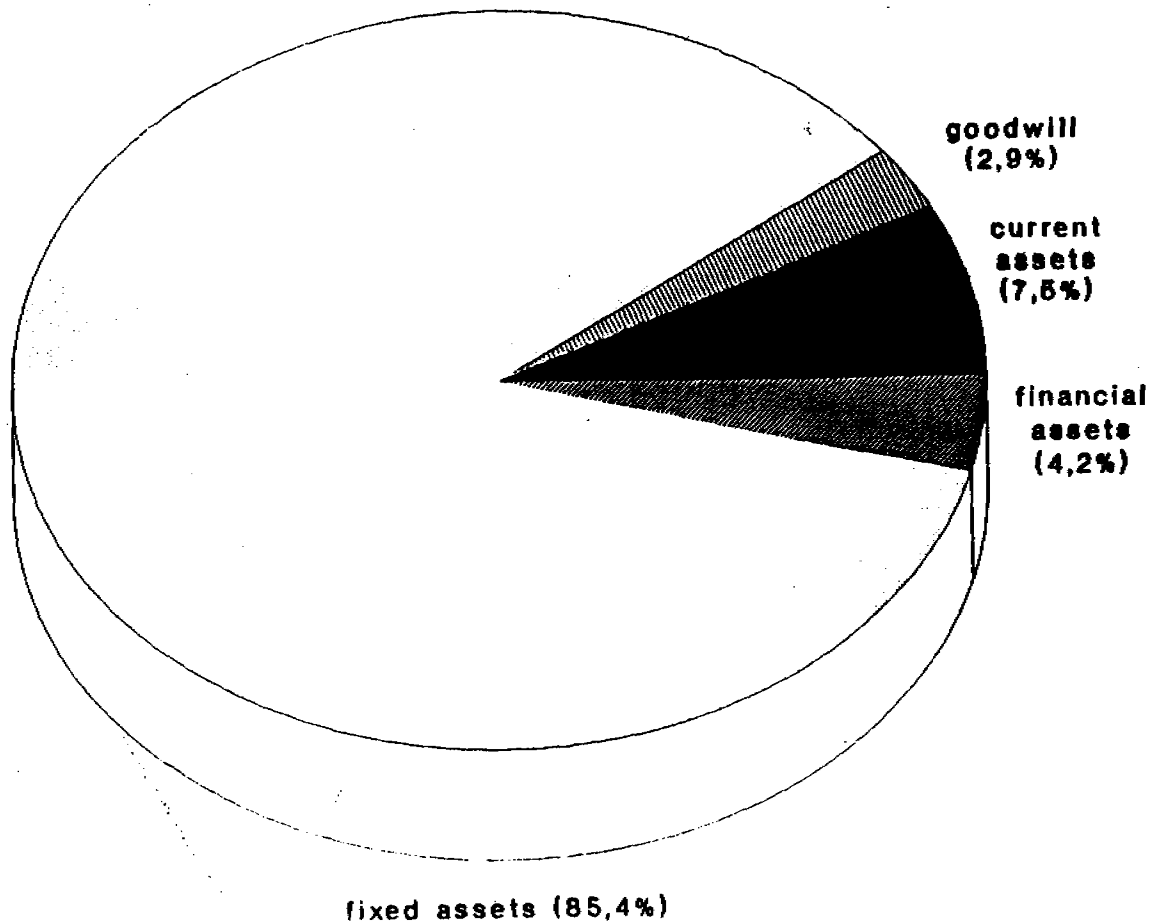
Where gone

Increase Financial assets	47
Decrease long term loans (instalments)	16.005
Decrease short term loans and accounts payable	6.540
Increase inventories	277
Increase cash, bank	637
Operating loss	1.604
	25.110

* investments (9.037) minus depreciation (28.635)

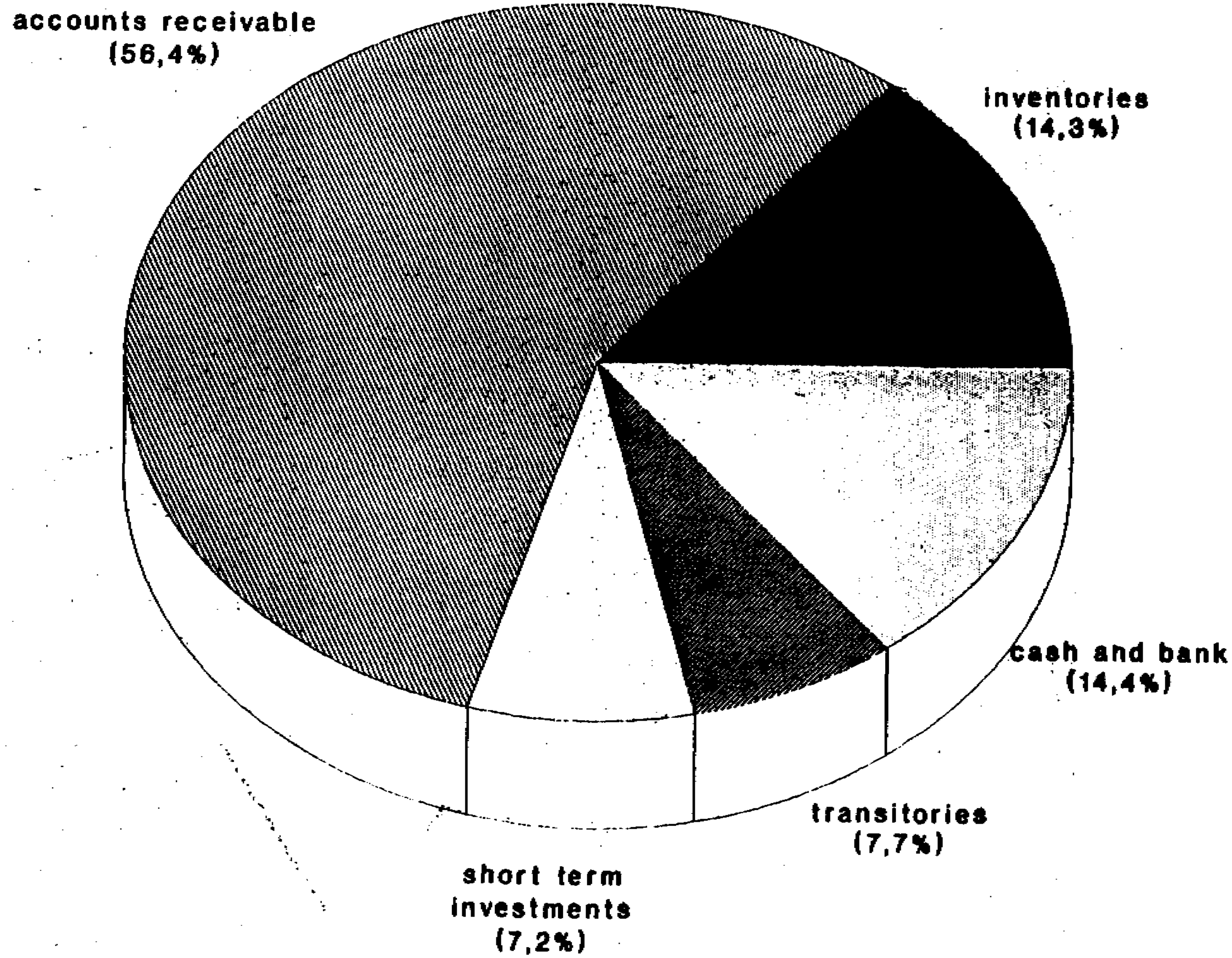
WOB

Assets water supply companies
in the Netherlands (1992)



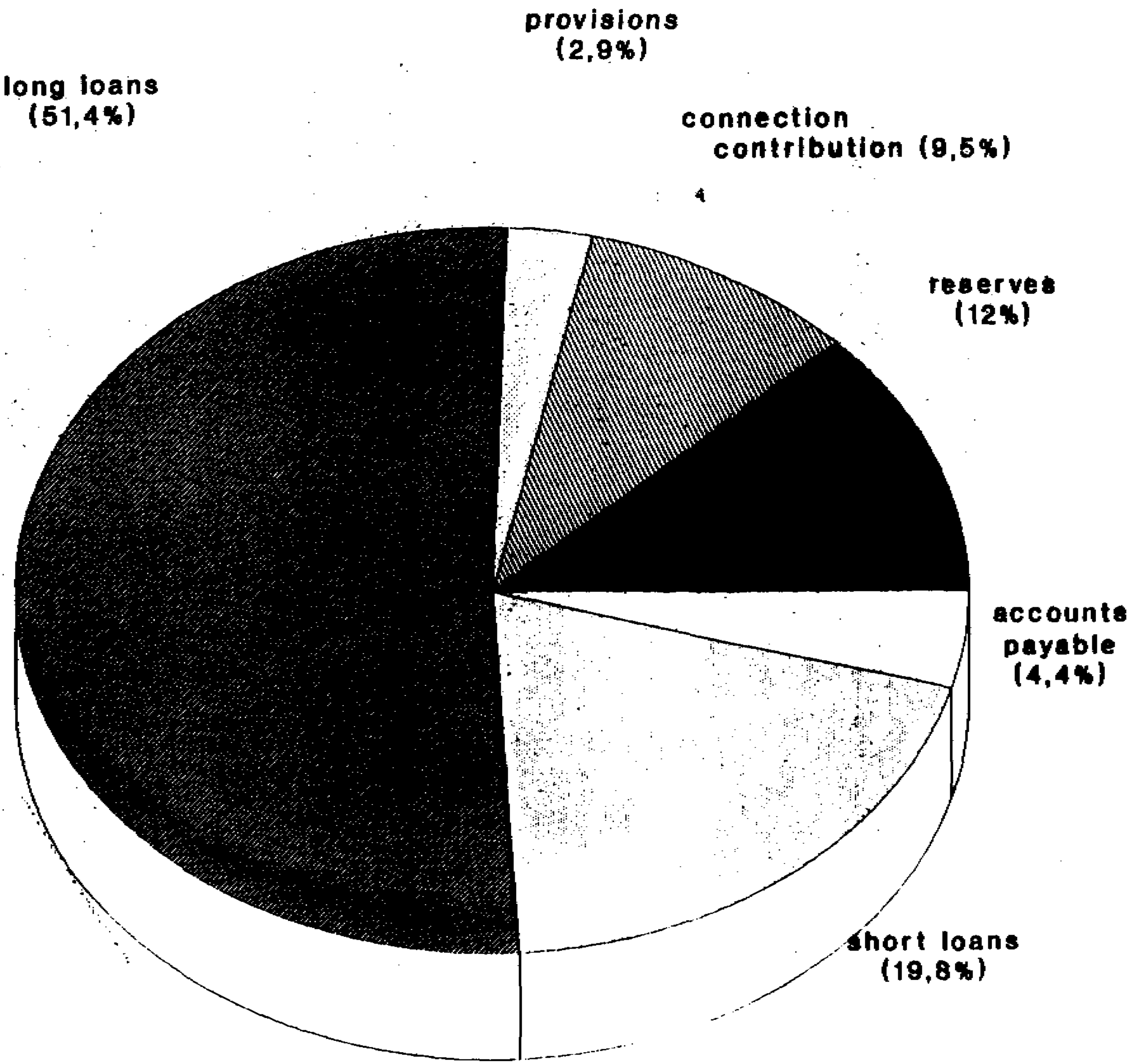
WOB

Current assets water supply companies
in the Netherlands (1992)



WOB

Liabilities water supply companies
in the Netherlands (1992)



WOB

MANAGEMENT - REPORTING

* GENERAL SUMMARIES (IN 3 LAYERS)

  A. MANAGEMENT - INFORMATION

  B. COST - ALLOCATION

  C. WORKFLOW - EFFICIENCY

* SPECIFIC SUMMARIES

  A. BALANCE - AND INCOME ANALYSIS

  B. WATERSUPPLY AND - DEMAND ANALYSIS

  C. TARIFFS AN CONDITIONS

* INQUIRY/STUDIES

WOB

ASPECTS WITH REGARD TO RATIOS

- MUCH ATTENTION FOR UNIFORMITY IN DEFINITIONS
- RATIOS IN A CLOSED CIRCUIT
- ABSOLUTE AND RELATIVE FIGURES
- STANDARD FRAMEWORK WITH SPOTLIGHTS

WOB

Ratios

	1	2	3	4	5	6 etc.	average
1. CHARACTERISTICS							
1 connections x1000	167	251	154	275	177	265	215
2 personnel	230	343	198	416	202	344	289
3 transport length in km	3584	6259	3687	8508	5379	6549	5661
2. PRODUCTION							
1 own production x1M	34	46	32	68	31	59	45
2 purchase from others x1M	0	0	2	4	7	4	3
3 supply to others x1M	2	0	0	6	0	9	3
4 gross supply x1M	32	46	34	66	38	54	45
5 leakage in %	4%	4%	5%	6%	9%	9%	6%
6 net supply in %	96%	96%	95%	94%	91%	91%	94%
3. COST AND RESULT in %							
1 production cost	22%	30%	44%	38%	30%	28%	32%
2 distribution cost	50%	50%	36%	44%	53%	46%	47%
3 sales cost	5%	4%	2%	3%	2%	3%	3%
4 overhead cost	23%	16%	18%	15%	15%	23%	18%
5 total cost	100%	100%	100%	100%	100%	100%	100%
6 total revenues	118%	107%	97%	96%	98%	100%	103%
7 net results	18%	7%	-3%	-4%	-2%	0%	3%
4. SUBMITTED IN *f* /M^3							
1 production cost	0,22	0,56	0,51	0,57	0,43	0,45	0,45
2 distribution cost	0,51	0,93	0,42	0,67	0,73	0,71	0,66
3 sales cost	0,05	0,08	0,02	0,05	0,02	0,05	0,04
4 overhead cost	0,23	0,30	0,21	0,23	0,21	0,36	0,25
5 total cost	1,01	1,87	1,16	1,52	1,39	1,57	1,42
6 total revenues	1,19	1,99	1,12	1,46	1,37	1,57	1,45
7 net result	0,18	0,12	-0,04	-0,06	-0,02	0,00	0,03
5. SUBMITTED IN *f* /CONNECTION							
1 production cost	41	98	108	128	83	81	90
2 distribution cost	94	162	88	150	142	132	128
3 sales cost	10	15	5	11	5	9	9
4 overhead cost	43	52	45	52	41	67	50
5 total cost	188	327	246	341	271	289	277
6 total revenues	221	350	238	327	266	289	282
7 net result	33	23	08	-14	-5	0	8
6. PERSONNEL							
1 connection/personnel	726	733	776	660	876	772	757
2 production perso. in %	15%	20%	24%	22%	26%	18%	21%
3 distribution perso. in %	58%	49%	48%	46%	51%	54%	51%
4 sales personnel in %	8%	14%	11%	12%	10%	11%	11%
5 other personnel in %	19%	17%	17%	20%	13%	17%	17%
6 net cost personnel x1000	68	70	66	68	70	70	69

7. SPOTLIGHT

Comparing year summary

	1	2	3	4	5	6	average
TOTAL COSTS per m³ sales							
1989	0,86	0,89	1,00	1,04	1,05	1,11	0,99
1990	0,91	0,94	1,05	1,10	0,96	1,23	1,03
1991	1,25	1,05	1,16	1,18	1,07	1,36	1,17
1992	1,20	1,16	1,23	1,34	1,01	1,53	1,24
1992/1989	140%	130%	123%	129%	96%	138%	126%
CONNECTIONS per personnel							
1989	794	790	704	665	644	832	738
1990	808	762	751	646	690	835	749
1991	862	778	756	634	710	792	755
1992	888	776	765	660	726	813	771
1992/1989	112%	98%	109%	99%	113%	98%	105%
DENSITY DISTRIBUTION MAINS total connection per km transport mains							
1989	89	41	39	45	44	57	53
1990	89	41	42	46	46	59	54
1991	88	42	42	46	47	59	54
1992	87	42	42	53	47	60	55

WOB

Production

also for :
- Distribution
- Sales
- Overhead

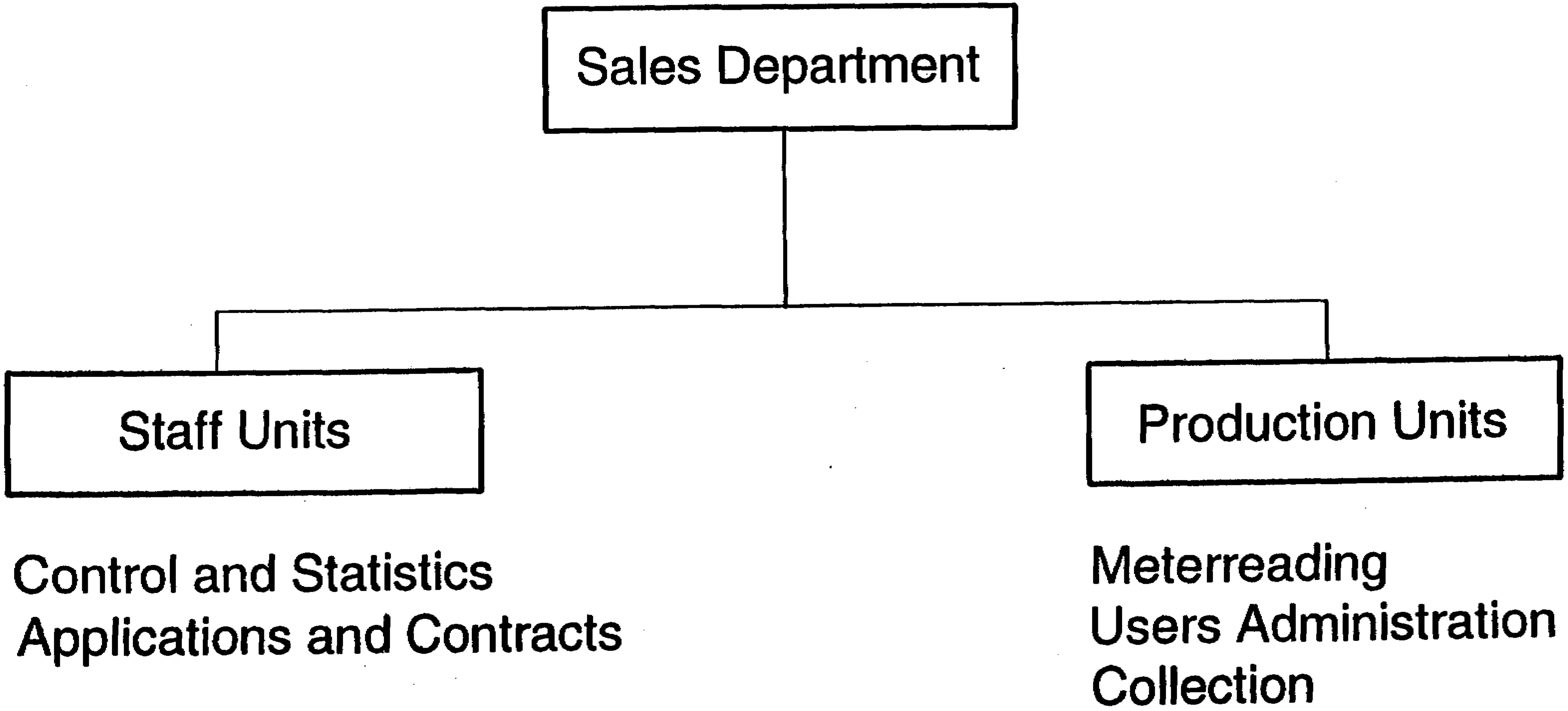
Production fase	Staff and overhead	Purchase raw water	Infiltration	Ground/infil.water Pumping	Ground/infil.water Purification	Surface water Pumping	Surface water Purification	Purchase pure water	Total
cost	1	2	3	4	5	6	7	8	9
Depreciation			X	X	X	X	X		X
Interest			X	X	X	X	X		X
Personnel cost									
- operating					X		X		X
- maintenance					X		X		X
- others	X				X		X		X
Maintenance other dp					X		X		X
Maintenance others					X		X		X
Material cost					X		X		X
Energy + fuel				X	X		X		X
Chemicals					X		X		X
Laboratory cost					X		X		X
Purchase water		X						X	X
Other cost	X		X	X	X	X	X		X
Residue	X								X
a Total		+	+	+	+	+	+	+	=
b m^3 net supply									
c per m^3		+	+	+	+	+	+	+	= Production Ratio
d m^3 purchase raw water		total							
e per m^3		a/d							
f m^3 infiltration water			total						
g per m^3			a/f						
h m^3 pumping				total					
i per m^3				a/h					
j m^3 purification					total				
k per m^3					a/j				
l m^3 pumping surface water						total			
m per m^3						a/l			
n m^3 purification surface water							total		
o per m^3							a/n		
p m^3 purchase pure water								total	
q per m^3								a/p	

WOB

MAIN DATA OF THE DISTRICTS 1992

a) absolute figures	District A	District B	District C	District D	District E	District F	District G	Total
I) DISTRICT								
1 number of service mains								
2 transport mains in kilometers								
3 total costs district								
4 number of employees								
5 of which technician								
6 of which administrators								
7 of which other employees								
II) TRANSPORT MAINS								
8 increase of transport mains in km								
9 number of disturbances/repairations								
10 number of watersamples								
11 hours transport mains (specificated)								
III) SERVICE MAINS								
12 increase of service mains								
13 number of disturbances/repairations								
14 number of meter changes								
15 hours service mains (specificated)								
16 total costs of installation								
17 total contributions of installation								
b) relative figures								
I) DISTRICT								
18 total costs per employee								
19 hours/days transport+service mains per technician								
II) TRANSPORT MAINS								
20 disturbances/repairations per 100 km								
21 disturb./repairations per technician								
22 hours per 10 meter installation								
23 hours per repairation transport main								
III) SERVICE MAINS								
24 disturbances/repairations per 1000 mains								
25 disturbances/repairations per technician								
26 hours per service main								
27 meters service main per hour								
28 hours per repairation service main								
29 meter changes per hour								

Organization Scheme Sales Department



hw.2

WOB

A GENERAL SURVEY ON THE SALES DEPARTMENT AND ITS ACTIVITIES

* OPTIMAL ATTAINABLENESS BY TELEPHONE
* FAST AND SMOOTH PROBLEM SOLVING
* QUIK SERVICE TOWARD CLIENT
* COMPLETELY AUTOMATED
* VERY EFFICIENT OPERATING PROCEDURES
* EFFECTIVE CONTROL SYSTEM
* COLLECTING LOCAL TAXES
* COOPERATION WITH OTHER PUBLIC UTILITIES AND LOCAL AUTHORITIES

WOB

PRODUCTION UNITS

METER READING CORPS

* YEARLY VISITS TO CLIENTS
* IF ABSENT: RESIDENTS CAN READ METER THEMSELVES
* ESTIMATION IS ALLOWED; IF SO (INCIDENTALLY):
  SPECIAL OFFICIAL TO VISIT THE ESTIMATED SCORES
* FULLY AUTOMATED HANDHELD-TERMINAL SYSTEM
* DAILY COMMUNICATION WITH MAINFRAME
* EARLY-WARNING SYSTEM IN HANDHELD-TERMINAL

WOB

PRODUCTION UNITS

USERS ADMINISTRATION UNITS

* DAILY CONTROL OF QUARTERLY BILLS
* MAILING OF ALL QUARTERLY BILLS
* ANSWERING PHONECALLS FROM CUSTOMERS
* REMOVALS ARE DEALT WITH BY TELEPHONE
* IMPLEMENTS TECHNICAL DATA
* DAILY PROCESSING OF PAYMENTS
* ACCESS TO SALES INFORMATION SYSTEM

WOB

PRODUCTION UNITS

COLLECTING UNITS

* **FIELD OFFICIALS FOR COLLECTION**
* **FULLY AUTOMATED WITH HANDHELD-TERMINAL**
* **DAILY COMMUNICATION WITH MAINFRAME**
* **DATA ARE AVAILABLE FOR THE HEAD-OFFICE**
* **PROBLEM SOLVING IN THE FIELD**

WOB

STAFF UNITS

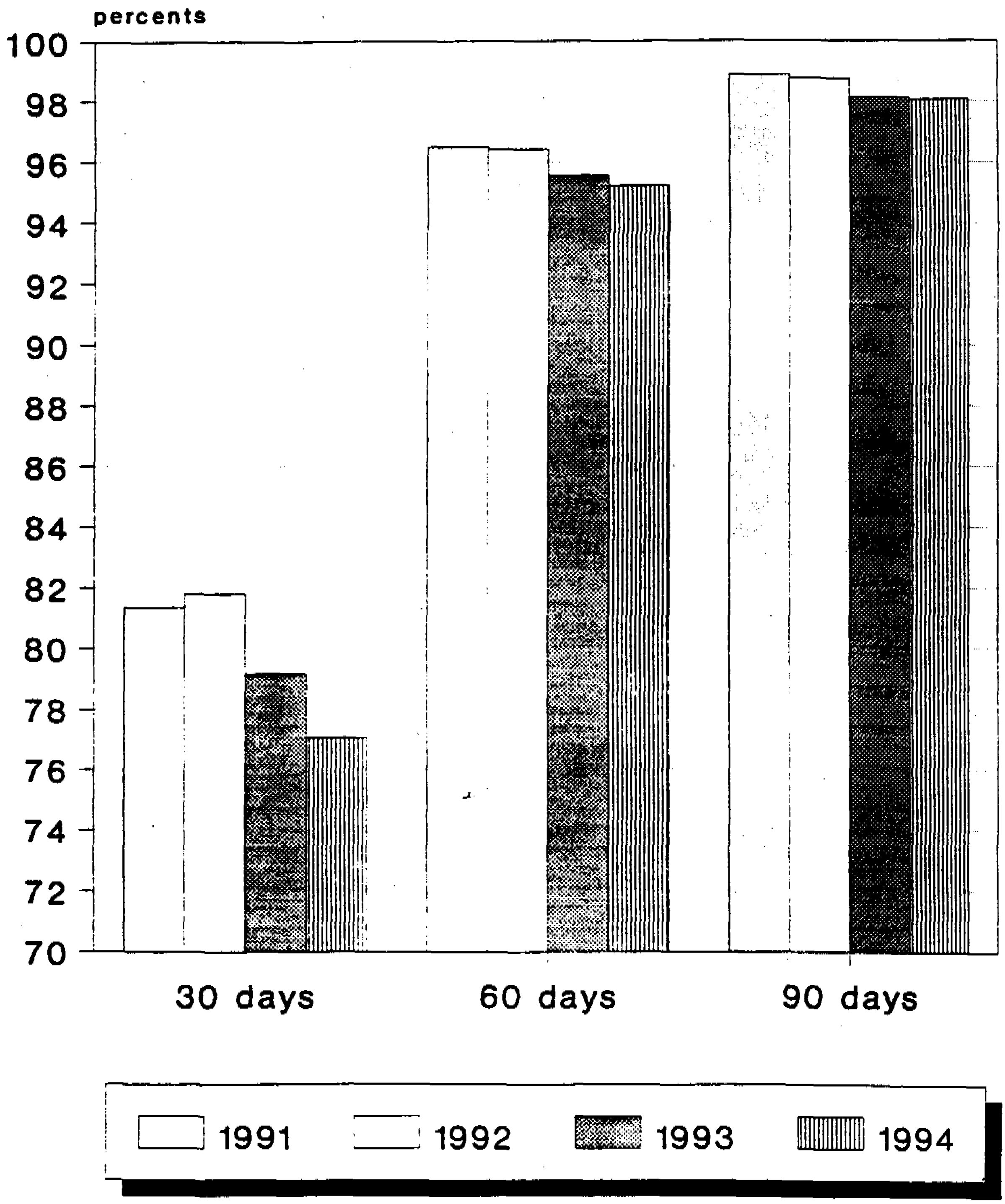
CONTROL AND STATISTICS

* CONTROLS TRANSACTIONS OF THE USERS ADMINISTRATION
* PRODUCES STATISTICS FOR THE WATER COMPANY

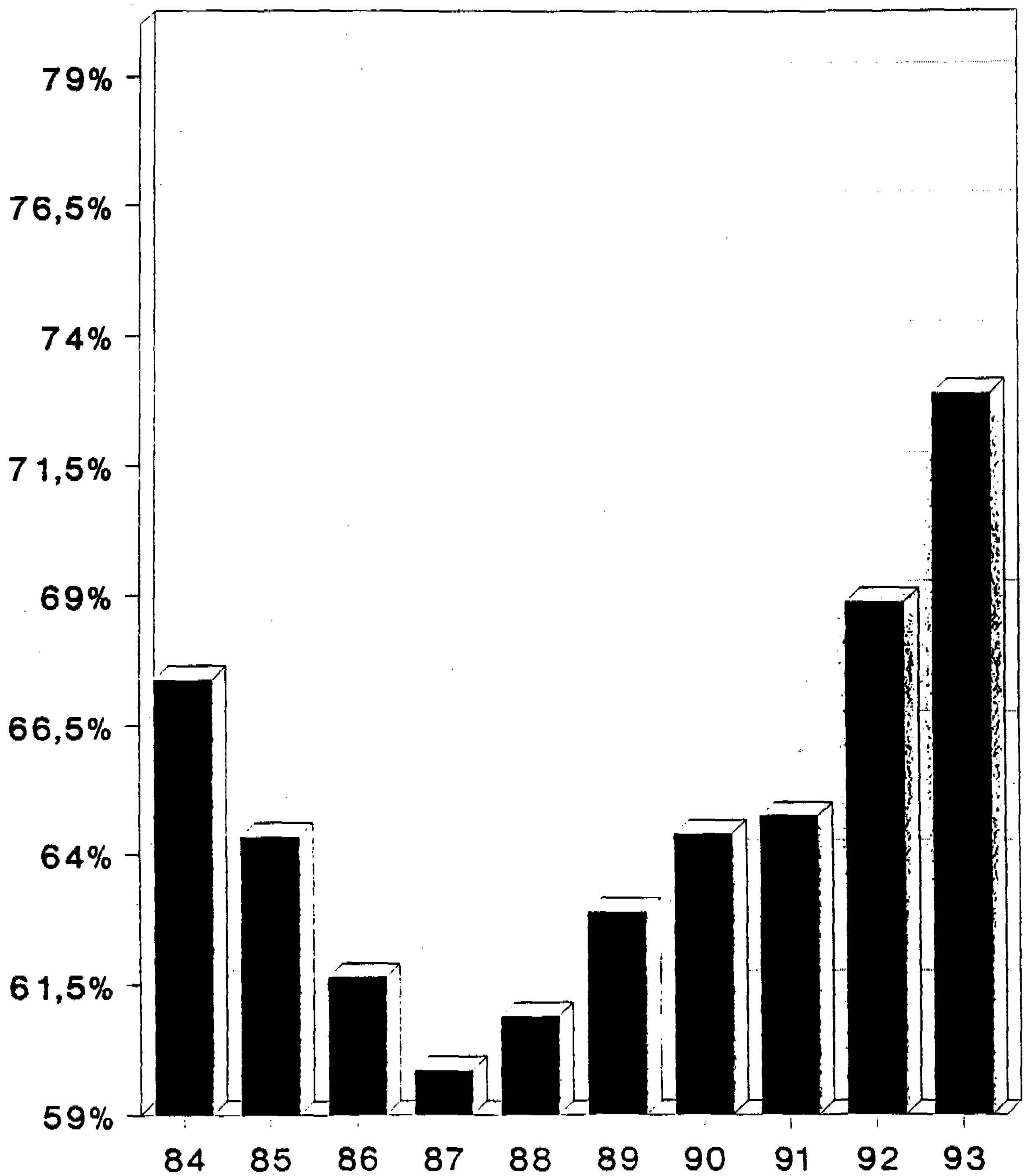
APPLICATIONS AND CONTRACTS

* SUPPORTS THE PRODUCTION UNITS
* WRITES MANUALS CONCERNING THE SALES INFORMATION SYSTEM
* MANAGES BULK USERS AND LOCAL AUTHORITIES

Summary payment conduct in percents

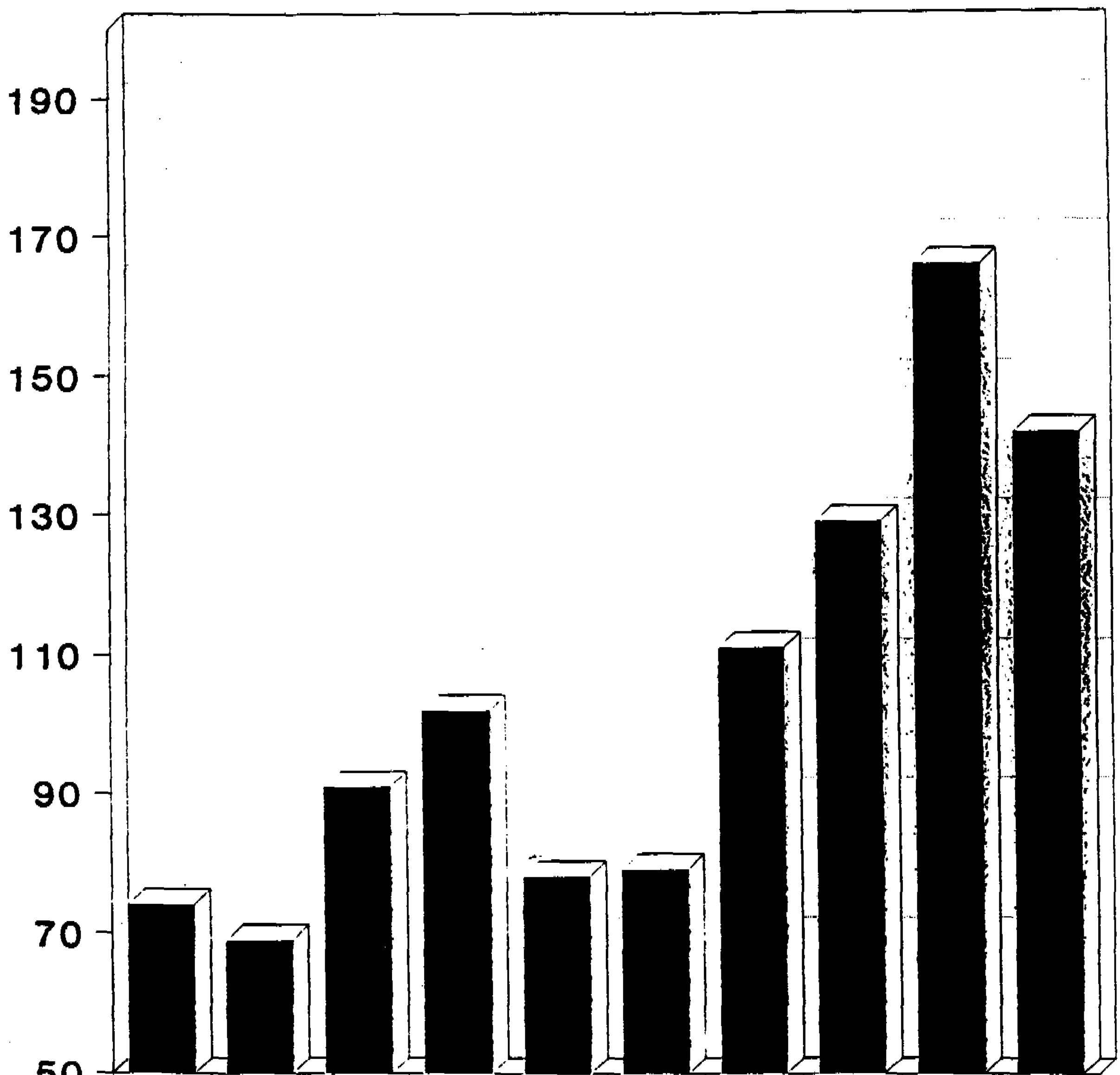


Automatic bank account payment



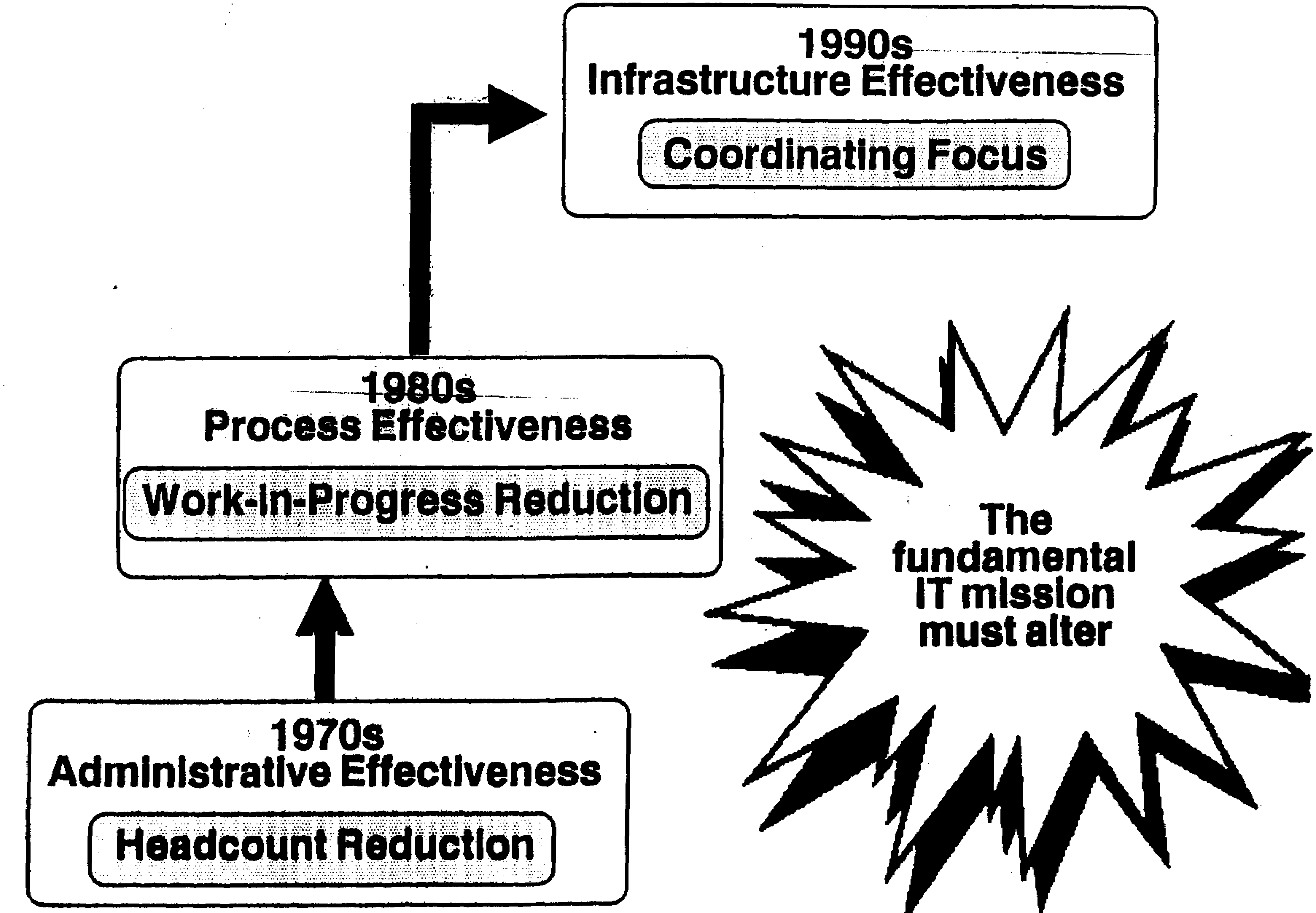
WOB

Bad debts disconnected from the delivery network



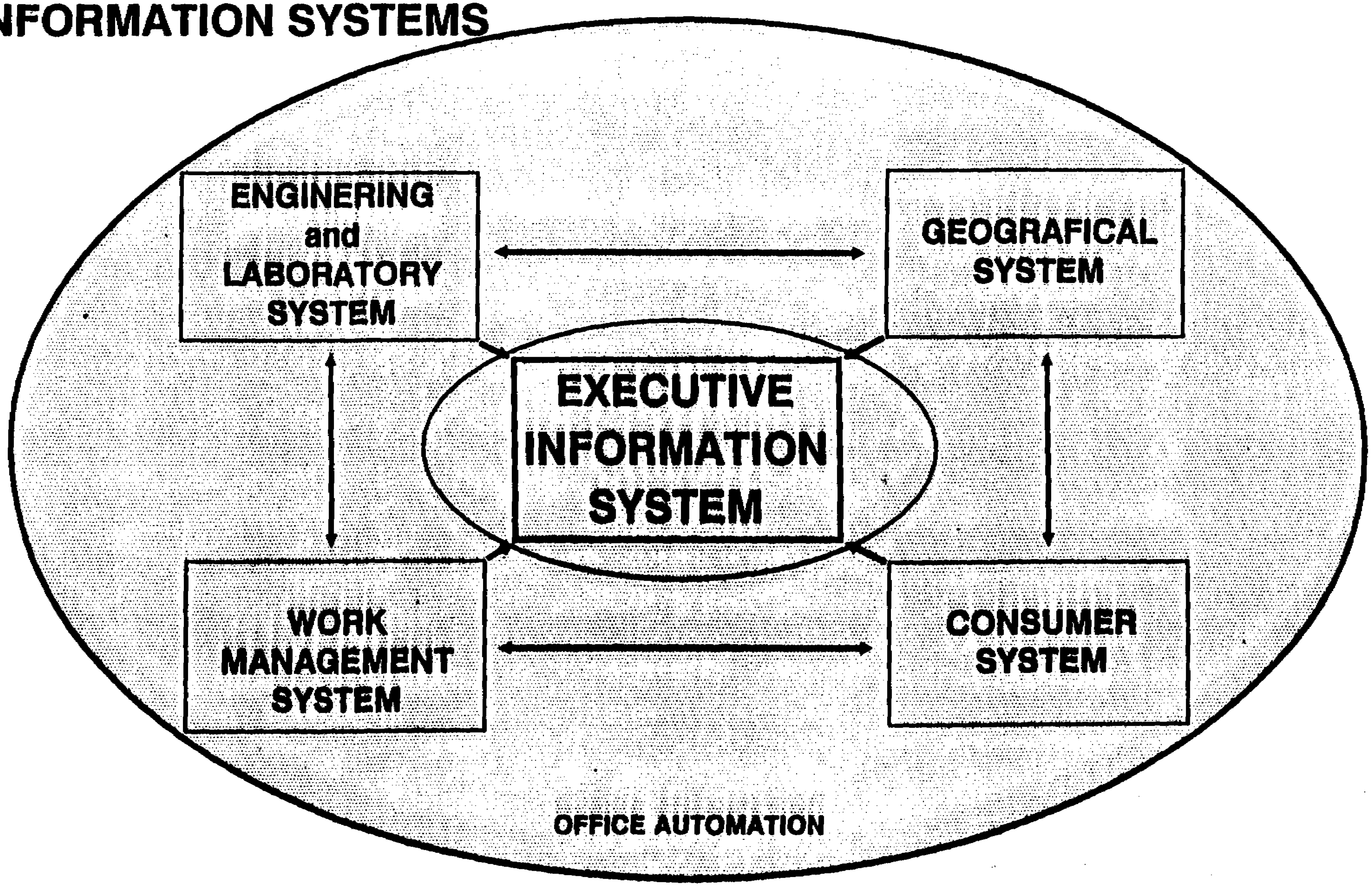
	84	85	86	87	88	89	90	91	92	93
	74	69	91	102	78	79	111	129	166	142

WOB


1990s
Infrastructure Effectiveness
Coordinating Focus
1980s
Process Effectiveness
Work-in-Progress Reduction
1970s
Administrative Effectiveness
Headcount Reduction
The fundamental IT mission must alter

WOB

INFORMATION SYSTEMS



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Management aspects

- informationplanning as a process
- flexible information systems
- strong focus on process and activity description

Key factors of automation

- dataregistration at source
- turn-around principle
- external integration

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Critical success factors

- efficiency and effectiviness
- management involvement
- strong project organization
- interaction core business organization, information

Impact IT

- efficiency and cost reduction
- management information
- communication with customers
- innovation

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Key factors Dutch situation

- ownership province/municipalities
- increasing environmental rules and quality control
- effective large of scale
- 5-10 year production plans (national scale)
- integrated chain for production/distribution
- free pricing mechanism (based on cost recovery)
- subsidising strong limited and only timely
- cost effectiveness (budgets, incentives, ratios)
- strong coordination institutional body (VEWIN)
- centralized/certified research (KIWA)
- continuing comparison of the companies via ratios
- management attitude, focused on short procedures/ standardization
- strong image in public opinion (public relations)
- modern information technology

AUTONOMY

* The water supply company is a private company with limited liability (plc). Shares are kept by the province/municipalities, according to the number of connections.
  Licences are given by provincial government.

* The statutes state limitatively for what events the managing director needs the approval of the Board of Directors or the Shareholders General Assembly.

* The Board of Directors, appointed by the shareholders, supervise the performance of the company and appoints the managing director.

* The Shareholders General Assembly approves of the balance sheet, the profit and loss-account and proposals for tariff-setting

* Civil law is applicable to the limited liability company.
  The authority of the managing director is secured by law.

WOB

WATER MANAGEMENT IN THE NETHERLANDS

POLICY, MEASURES, FUNDING.

november 1991

CONTENTS

WATER MANAGEMENT IN THE NETHERLANDS: POLICY, MEASURES, FUNDING

1 INTRODUCTION

This paper starts by presenting some general facts on the Netherlands, then it describes in general terms our policy on water management, it gives some details of the most important tools we use to carry out this policy and it presents the financial consequences and main elements of our funding system.

2 FACTS.

2.1. In general

The Netherlands is located in the downstream regions of the rivers Rhine, Meuse and Scheldt. The river Rhine is the major source of fresh surface water providing almost two thirds of the total input in an average year. Rainfall counts for less than one third.
The area of the country is about 42.000 km^2. As a result of land reclamation, polder development and subsidence of the soil, about one third of the country lies below sea level, and needs permanent protection against flooding (*figure 1*). Moreover, large areas of the country have to be protected against temporary flooding by storm surges at sea or by high flows on the rivers.
A dense system of pumping stations, canals and sluices has been constructed to distribute water throughout the country and to remove excess amounts of water. A large part of the river flow is used to push back the salt intrusion of sea water through the open waterway of Rotterdam harbour.

The Netherlands is a densely populated country. During the 20th century our population has increased from 6 million to 15 million inhabitants, two thirds of whom live in floodable areas. This increase in population has been accompanied by a process of industrialization, urbanization and modernization of agriculture.

2.2. Water in the Netherlands

The Netherlands has a temperate, maritime climate. The rainfall distribution is more or less even during the year. Due to evaporation a water deficit occurs in summer.
The input of water by rainfall is relatively small compared to the influx of water by the transboundary rivers Rhine and Meuse. Therefore, apart from their economic importance for the Netherlands as shipping lanes, the Rhine and Meuse are very important for the Netherlands' water management (*figure 2*).

Because of the country's development, increasing amounts of waste water from urbanized and industrialized areas call for adequate purification. The increased application of pesticides and fertilizers to farm land and the increased manure production from intensive livestock-breeding in agriculture are a serious non-point threat to the aquatic environment.

Similar development processes took place in neighbouring countries. Hence the transboundary pollution contributes considerably to water quality problems in the Netherlands.

The rivers Rhine, Meuse and Scheldt contribute substantially to the deterioration of the quality of Dutch surface waters and the North Sea. This emphasizes the necessity of an international approach to the improvement of water quality of both inland waters and the receiving sea. That is why the Netherlands attach great value to the North Sea and Rhine Action Programmes and their implementation.

2.3. Organization

The Netherlands has three levels of government: the central government, regional governments (the 12 provinces) and local governments (some 700 municipalities) In addition there are 133 regional water authorities (*figure 3*).

As to the water management a distinction has been made in large waters of national importance (the state-waters) and the smaller waters of regional importance. The central government has control over the large inland waters and the sea.
The primary responsibility for the smaller non-state waters lies with the provinces. The provinces, however, usually delegate this responsibility to regional water boards, which are functional public bodies exclusively authorised with water management tasks.

The municipalities are responsible for the construction and maintenance of the sewerage systems.
And, finally, about 60 water companies are charged with drinking water production and supply. These are public enterprises, about one-third of which are run by municipalities.

3. POLICY

3.1. Past.

Since 1968, the national water quantity management objectives and strategies have been formulated in successive Policy Documents. At first, the emphasis was put on infrastructure necessary to fulfil water demands. Later, water management and distinct water uses (so-called : "functions") were made more coherent.
Simultaneously, from 1975 onwards, water quality management has been covered by Water Action Programmes.
The national Policy Document on Water Management integrates both aspects. The increasing consciousness of environmental threats and the complexity of problems related to water have led to the recognition that groundwater, surface water, sediments, river banks, technical infrastructure and physical, chemical and biological characteristics should be considered as a whole, as a "water system". "Integrated water management" has become a leading principle in the Netherlands in this field of policy making and its implementation. Furthermore, the relations with physical planning, nature and environmental policy have been intensified.

As for water quality, much has been achieved since the first Water Action Programme. The discharges of oxygen consuming substances have fallen from 40 million population equivalents in 1970 down to 7,5 million population equivalents at present, making oxygen depletion a scarce phenomenon in the Netherlands today. Actually, in the Netherlands 92% of all households are connected to the sewerage system.

Almost 90% of the municipal sewage is purified in waste water treatment plants. On the average 90% of BOD, 46% of nitrogen and 42% of phosphorus are removed in these plants. In 1995 nitrogen and phosphorus are scheduled to be removed with an efficiency of 60 and 75% respectively. Heavy metal pollution has also been reduced significantly.

3.2. Actual problems

But still water problems occur. The production of drinking water is becoming increasingly difficult as a result of contaminated water resources. At present the EC standard for nitrates is exceeded at 1% of the pumping stations. Current policy would lead to sincere problems at 15 % of the pumping stations within half a century. Dichloropropane has been detected in groundwater some years ago.
Later other pesticides, formerly believed to remain in upper ground layers or to be degraded, have been found at several locations in concentrations up to 100 ppb (ug/l). Examples are organo-phosphorus compounds, organo-chlorine compounds and in particular triazenes, and persistent metabolites of these products.
Micropollutants in surface waters may render food unfit for consumption and hamper irrigation purposes. And, because of their presence in water sediments, dredging for navigational purposes releases contaminated spoils that cannot be disposed of, neither in water nor on land. Contaminated sediments also pose a problem for human health.
Furthermore, in Dutch surface waters, eutrophication is one of the main problems. Most lakes show symptoms like excessive algal blooms, high turbidity, scum and a species-poor fish-stock (mainly bream). Water supply, fisheries and recreation are adversely affected. The damage to marine waters is becoming more and more evident as well.

It is clear that the current water quality hampers the development of well-balanced ecosystems. The extent to which water systems are "healthy" can be illustrated by means of the so-called Amoeba-approach. (A general Method Of Ecological and Biological Assessment). This approach compares the present ecological condition with the conditions prevailing in the past. For freshwater 1900 is chosen as reference year, for the marine environment 1930.
By placing the abundance of various species of the reference year on the rim of a circle and plotting the present day's abundance in relative position with respect to the circle the changes in the ecosystem can be illustrated. Both the river ecosystem and the marine ecosystem show a dramatic impoverishment when compared to conditions at the beginning of this century. It is clear that both for marine and for freshwaters the amount of algae is far beyond equilibrium. Furthermore former common species such as the otter and the salmon have vanished completely and seal populations have diminished considerably.

3.3. Objectives for the future.

Both the environmental policy as formulated in our National Environmental Policy Plan (Plus) and the water policy primarily aim at sustainable development.
In the Policy Document on Water Management the main objective has been formulated as follows: "**to have and to maintain a safe and habitable country and to develop and maintain healthy water systems which guarantee sustained use**". A start with this development has been made.
The general sustainability objective has been translated into targets per type of water

system. This is illustrated by the following examples.

Rivers should be transport arteries and should facilitate the return of salmon as well.
Eutrophication of lakes should not occur and ecosystems should be in equilibrium. This includes the return of the otters.
As for groundwater, pollution and dehydration should not occur and coastal dunes (which are infiltrated with river water) should be safe for drinking water storage.
Estuaries should be fit for shipping and provide a broad offer of recreation facilities; in addition, seals and porpoises should return.
The seas should contain healthy fish and seals, simultaneously serving as a source of raw materials, food and energy and as a tourist attraction.

To reach these targets, programmes containing concrete policy goals have been developed. Of course current policies should be continued but additional efforts are inevitable. When developing a strategy for these efforts, the complexity of water systems should be taken into account. Some examples are :

- *Hydraulic constructions*, at first instance, are the typical instruments for water quantity management. But dikes and especially barrier dams, weirs and shiplocks have undesired side effects, such as obstructing migrating fish.
  Stone, concrete or asphalt covered banks disturb natural transitions from land to water, and adversely affect recreational possibilities.
- Brackish seepage is a threat for agriculture. Commonly, this is counter-acted by flushing with river water, but this introduces river contaminants in agricultural areas.
- Since *groundwater* and surface water are in direct contact in the Netherlands, changes in either quantity or quality in one type of water inherently affects the other. Groundwater abstractions may cause ditches to fall dry and disturb terrestrial and aquatic ecosystems. Conversely the groundwater table is often controlled by surface water management; if sediments are polluted this may cause groundwater pollution. It will cause such pollution, if groundwater streams are directed to aquifers.

Integrated water management therefore inherently needs a multi-track approach, giving a higher return than the sum of the parts. These tracks, or - choosing the Policy Documents' wording - these "screens", are threefold, each having its goals:

1) Reduction of pollution at source.

The cleaning programme for oxygen consuming substances should be completed and sewerage systems should function properly. Phosphate and nitrogen emissions should be cut by about three quarters, heavy metal emissions should be reduced more than 50 % and organic micropollutants emissions by some 90 %.
These goals reflect the agreements laid down in the Rhine and North Sea Action Programmes in accordance with the precautionary approach.
In addition, sediments should not pose a hazard to man and the environment while dredged spoils should be dispensable and reusable.
Finally ecosystem disturbances by accidental spills should be prevented.

2) Hydraulic design

Shores and banks should be fit for multiple purposes. The ecological main structure should be restored and conserved.

3) Rational, or "guided", use of water, in particular groundwater
Dehydration should be reduced and water use should meet sustainability requirements. Water demand and supply should fit more tightly.

Execution of these ambitious programmes requires improvements in the water management organization, the instruments, including funding methods. Development and implementation of these improvements can be regarded as a separate indispensable, fourth track.

3.4. The role of quality objectives.

In order to evaluate water quality in chemical and physical terms, actual data from measurements should be compared to standards. In the Netherlands a general quality standard for the year 2000 for both water and water sediment has been drawn up based on eco-toxicological considerations, taking into account no-effect-levels and combination toxicity.
Also standards have been laid down following EC directives for surface waters with specific functions:
- surface water intended for the abstraction of drinking water;
- bathing water;
- water for cyprinids;
- water for salmonids;
- shellfish water.

Quality standards for groundwater have not been developed. Quality guidelines for soils are used as a basis to derive these quality objectives.

The comparison of the general quality standards for water and sediment with actual concentrations, makes clear that additional efforts are necessary. Often heavy metals exceed objectives and nutrient objectives are exceeded almost everywhere. Moreover, organic micropollutants, such as polycyclic aromatic hydrocarbons (PAH) and lindane in particular, occur in too high concentrations in water at many locations, while PAH, PCB, pesticides and heavy metals are primarily responsible for non-compliance in sediments.

It should be borne in mind that compliance to the general standards is a physico-chemical condition for healthy water systems. Compliance is a policy goal, not a legal requirement. In the Netherlands efforts are primarily aimed at reduction at source, so legal instruments have been developed and applied first and foremost to tackle discharges into surface waters.

3.5. Monitoring.

The quality objectives act as a reference for water quality monitoring. The parameters monitored regularly (the so-called M-List) and those measured occasionally (the I-list) in state-managed waters have been laid down in the national policy document. These lists also provide guidance for monitoring programmes of regional water boards. Water companies also monitor a wide range of substances in surface water at drinking water intake points.

In addition to physico-chemical monitoring, national authorities are elaborating a continuous monitoring programme for target biological species. The results from this programme can be used to establish whether the Amoeba is becoming more balanced as a result of measures taken at source.
Biological early-warning systems are employed, in order to identify otherwise un-noticed peaks of hazardous pollutants caused by spills upstream. These systems facilitate appropriate actions such as ceasing drinking water intake or by-passing seriously contaminated water volumes from vulnerable areas.

Apart from their problem-identifying role, monitoring results are used as the basis for new research or new programmes and measures.

4. TOOLS AND MEASURES OF DUTCH WATER POLICY

In order to reach the objectives of our water policy several tools are used. A distinction can be made between tools primarily aimed at the causes of water problems (source oriented tools) and those primarily aimed at the effects (effect oriented tools).
Considering source oriented measures, separate instruments are used for point sources such as industry and sewage plants on one hand, and diffuse sources such as atmospheric deposition and agriculture on the other.
Effect-oriented instruments can be differentiated according to the effects they seek to combat, such as hydraulic obstructions, contaminated sediments and eutrophication.
For each of these tools, the Water Management Policy Document describes how current measures should be intensified and which new measures must be taken from 1990 onwards.

SOURCE-ORIENTED TOOLS

4.1. Point sources

4.1.1. Legislation

The five main Acts relating to water are the Water Management Act, the Pollution of Surface Waters Act, the Groundwater Act, the Soil Protection Act and the Drinking Water Supply Act.
The **Water Management Act** has a twofold function. On the one hand it aims at effective management for the water regime as a whole. To that end it provides for integrated planning with regard to the management of surface waters (quality and quantity) and groundwater. On the other hand it provides instruments for water quantity management. Because of the tight relationship between water quantity and quality management this law is of major importance for water quality management.
The purpose of the **Pollution of Surface Water Act** is to regulate discharges and to keep surface waters as clean as possible. This law provides a framework and instruments to regulate the discharge of harmful substances into the surface waters. The intention of the **Groundwater Act** is to provide tools for the administration of groundwater. It contains instruments concerning the abstraction and infiltration of groundwater. The Soil Protection Act covers soil and groundwater quality.
Finally, the management of drinking water supply -including planning, organization and

supervision- is regulated by the **Drinking Water Supply Act.**

The most important legal basis for pollution reduction is the second law, the Pollution of Surface Waters Act of 1970. This act features 3 main points:

1. Every single discharge of waste water into surface water is subject to a discharge licence from the authority competent for the receiving water. This authority can make conditions concerning the quality and quantity of the effluent.
2. Both dischargers of waste water into surface waters and sewers have to pay a pollution charge according to the principle "the polluter pays".
3. Every 5 years a Water Action Programme has to be drawn up for the combat against water pollution in the Netherlands.

Initially, legislation was limited to direct discharges into surface waters. At present licences are also required for discharges into sewerage systems for 18 industrial sectors, e.g. the chemical industry, textile industry, surface treatment plants and wood impregnation plants. New legislation will make possible the establishment of general rules.

4.1.2. Licensing.

The two basic principles of the policy on waste water discharges are (1) emission reduction and (2) the stand-still principle. **In general**, the *emission reduction principle*, closely linked to the precautionary principle, implies that pollution should be minimized, irrespective of the types of substance concerned. Industries should select processes and conduct operations accordingly ("good housekeeping"). Where major remedial efforts are required, and particularly if purification plants are to be constructed, a distinction is made between different types of pollutants.
In the case of **black-list substances** the objective is the elimination of pollution, or at least to come as close as possible to a zero-discharge situation. Control must involve the use of the best technical means available (BTM).
"Other substances" include a large number of pollutants, ranging from substances of low toxicity that occur naturally in surface waters to xenobiotic substances, showing relatively high levels of toxicity, persistence and mobility. The action taken in respect of such substances depends on the degree of damage they are likely to cause.

For hazardous non-blacklisted substances (including nutrients) control efforts are required that do not depend directly on the quality objectives for the receiving waters into which they are discharged, and in this respect the approach resembles the approach for black-list substances. However, instead of the best technical means available, the best practicable means (BPM) should be applied. Water quality standards are used as a back-up check. Failure to achieve standards may lead to the imposition of more far-reaching measures.
As for substances with a low degree of toxicity which occur naturally in surface waters (such as sulphates and chlorides), the degree to which measures are needed to limit discharges of such substances mainly depends on the quality objectives applying to the receiving waters.
The second policy objective, *the stand-still principle*, for **black-list substances** means that the total discharges in a particular administrative area (provinces and administrative areas of the central government) should not increase.
For **other substances**, water quality may not deteriorate significantly. The water quality

standards should not be exhausted.

This policy scheme is applied on a case-by-case basis. In each individual case, the contents of BPM and BTM (together commonly referred to as Best Available Technology or BAT) and the residual discharge level attainable, are determined separately. It should be noted though, that for industrial sectors containing large numbers of comparable companies, general guidelines have been developed. These guidelines, are generally incorporated in individual licences. The continuous improvement of the technical means is taken into account.

4.1.3. New measures.

Within the scope of the Pollution of Surface Waters Act the Water Policy Document indicates several additional measures that should be taken. More stringent requirements for organic micropollutants and accidental spill provisions should be made. Furthermore licensing should start for grit blasting.
The most far-reaching measure in the Policy Document is the BPM-requirement for nutrients, demanding nutrient removal in municipal sewage treatment plants. In 1985 the total tertiary treatment capacity for phosphorus removal amounted to only 5% of the total treatment capacity.
In 1989 an agreement was signed between the Government and the water authorities to reach a phosphorus removal efficiency at sewage plants of 75% in 1995 as a regional average for all municipal sewage plants per regional water board. In addition, limit values for the P-content of effluents for new (or considerably enlarged) sewage treatment plants were established. The limit values are 1 mg P/l for sewage plants with a treatment capacity of 100,000 p.e. or more and 2 mg P/l for sewage plants with a treatment capacity between 20,000 and 100,000 p.e., both as an average. A reduction of 68% in the period 1985-1995 is expected, the annual P-discharge decreasing from 10,800 to about 3,500 tonnes.

A nitrogen-reduction programme for sewage plants was elaborated last year, aiming at a removal efficiency of 75% in 1998 as a regional average. Moreover, a limit value of 10 mg total N/l (annual average) was included in this programme for new treatment plants. Decisions on the implementation of the programme are about to be taken. As a result of this implementation the annual N-discharge from sewage plants will be halved to about 20,000 tonnes.
A similar approach was also chosen in the recently adopted EC Directive on urban waste water.
Apart from the legal instruments use is made of gentlemen's agreements with "target groups", e.g. with the detergent manufacturing industry on the replacement of phoshates in detergents. At present, about all detergents sold are phosphate-free. As a result the phosphate content of domestic sewage has been reduced substantially.

4.2. Diffuse sources.

Often the controls over diffuse emissions into surface waters and groundwater are beyond the scope of water policy. Therefore the Policy Document does not deal extensively with all the tools and measures in this field.

Atmospheric deposition of pollutants on surface waters is an important source for some pollutants, like polycyclic aromatic hydrocarbons (PAH), volatile organic compounds and some pesticides. The presence of these compounds is caused by industrial air pollution, traffic and agriculture. Industrial air pollution is regulated by the Air Pollution Act, which is implemented by the provinces. Extensive programmes on BAT have been adopted in recent years. As for traffic, the financial stimulation of clean engines is a main regulatory tool. Agriculture will be discussed later, when dealing with run-off.

A second important diffuse source of water pollution are (tar) products applied on wooden shore and bank protection materials to combat decay, and onto vessels to combat fouling. Product measures are planned in this field, research into alternatives being an important issue.

The third and most important diffuse source is run-off and leachate from agricultural land, containing nutrients and pesticides. As for nutrient emissions, these are closely connected to the excessive application of manure.

In 1985 leaching and run-off accounted for 17% of the total P-input and for 67% of the total N-input from inland sources. In order to prevent adverse effects on soil and water quality a comprehensive set of legal measures was developed. Main point of the policy is the objective to achieve a balance between the application of manure and chemical fertilizers on the one hand and the uptake by the crops on the other hand by the year 2000. A statutory reduction programme for manure application came into force in 1987. These standards are intended for general basic soil protection. However, provincial authorities may establish more severe standards for areas where the soil needs additional protection, such as ground water protection zones. From 1995 onwards these standards will take the application of chemical fertilizers into account.
Further, the atmospheric ammonia emissions from agriculture are to be reduced. Additional application rules for manure and chemical fertilizers in relation to nitrogen are under consideration.
The present rules regulate the periods and method of manure spreading, manure accounting, payment of surplus charges and the foundation of a National Manure Bank as well. Moreover, restrictions on the establishment of new farms and the enlargement of existing farms are included in the legislation in order to prevent a further increase of the manure production.
A programme for large-scale manure-processing aimed at a capacity of 6 million tonnes in 1994 and about 20 million tonnes in the year 2000 is being elaborated. Further, an agreement on the reduction of nutrient and heavy metals in fodder is expected, and activities for the development of an integrated nutrient management system are being promoted.
Supplementary measures will be taken, if by 1992 it is demonstrated that the prospects for achieving the objectives are insufficient. These measures may include live-stock reduction. Unfortunately, there is a considerable time lag between taking the measures and the results, reduction of nutrient leaching, becoming obvious. As a result, a substantial increase of phosphate leaching in the coming years is inevitable. For nitrogen positive results will be gained much sooner.

An EC Directive on nitrate from agricultural sources has been adopted recently.

Distribution of pesticides from agriculture into surface waters by run-off, into groundwater and into the air is combated by three types of measures. Firstly the use of certain pesticides harmful to the aquatic environment is completely prohibited. Secondly the use of other les harmful pesticides is restricted, and thirdly emissions are reduced by application methods according to best environmental practice.

5. EFFECT-ORIENTED TOOLS.

5.1. Hydraulic design.

5.1.1. Introduction.

Hydraulic design refers to the structure of water systems and in particular to the fysical and biological features. Fysical features are for example the depth, clarity and current velocity, the shape and materials of the banks and the bed. Plants and animals constitute the biological components.
Man-made structures in water systems have until recently been aimed primarely at flood protection, water supply and abstraction, shipping and commercial fisheries. Effects on ecosystems were hardly ever taken into consideration. The Policy Document describes several measures to restore adverse effects on the ecosystem, and encourages nature development by appropiate hydraulic design.

5.1.2. Water-to-land transitions.

Along state-controlled and other large waters there are some 10.000 kilometres of banks in the Netherlands. In addition, there are several hundreds of thousands of kilometres of banks along smaller waters. In the past hard construction materials were often used to mark the water-to-land transition, depriving the banks from their natural and recreational possibilities.

Recovery and maintenance of natural banks are aimed at, whereas pesticides should no longer be used in bank maintenance. Development and construction of various forms of "environment-friendly" bank protection are necessary to that end. The national authorities will take the lead using such bank protection methods in Lake IJssel and in the Meuse estuary.
Furthermore, water-to-land transitions like floodplains and salt-marshes give possibilities for nature development. As a first step land-use will be made less intensive in these area's.

5.1.3. Accessibility for fish.

The free migration of fish is prevented by weirs, ship-locks and flood barriers.
In the coming years fish passes will be constructed at more than ten weirs.
Flushing regimes at sea barriers will be adapted to the needs of eel and salmomids to facilitate their migration.
Water authorities are urged to construct or maintain small, shallow, richly planted water accessible to fish. They should also restore shelter, spawning and growing grounds.

5.2. Sediments

Reduction of pollution at source is of course the most important measure to prevent future contamination of sediments. But sediments already seriously contaminated ask for solutions to reduce risks for man and the environment now. A large problem is the lack of full-scale environmentally safe processing and cleaning methods. Research on this topic is extended considerably. In the mean time storage facilities will be necessary.
Two large-scale facilities are planned for the near future.

5.3. Eutrophication.

In addition to the general emission-oriented approach the Government is encouraging regional effect-oriented measures in order to accelerate the restoration of affected waters. A wide variety of measures can be taken, depending on the local situation. Relevant examples of measures are the following.

Increased phosphate removal

The external nutrient loading of specific lakes might still be too high to enable recovery. Possible additional measures are: enhanced phosphate removal at mstp's, removal of point sources, dephosphating suppletion water, extension and improvement of the sewerage system. Nutrient removal of the suppletion water can be brought about by adding chemicals or by creating a helophyte filter ("artificial wetland") at the inlet point.

Hydrological isolation

If it is difficult or impossible to remove nutrients from incoming water, hydrological isolation has to be considered. This is especially the case where agriculture is a non-point source for nutrients.

Lake flushing

Flushing the lake decreases the residence time and diminishes the risk of getting algae blooms. When nutrient-poor water is at hand, flushing may also have a favourable effect on nutrient loading.

Handling nutrient rich sediments

If the external phosphorus loading has been reduced the sediment may become an important non-point P-source. In this case the sediment would have to be treated. This can be done in two ways: dredging or chemical treatment to reduce P-availability. A newly developed technique is the treatment of the sediment by injecting phosphate-fixating chemicals, like iron-chloride. This measure is relatively cheap compared to dredging, and the implementation is fast and easy. The results of the first whole-lake experiment seem to be promising.

Biomanipulation

Eutrophic lakes are often characterized by a fish-stock which is dominated by benthivoric fish like bream.
These fishes increase the turbidity by foraging in the sediment, which also prevents plant growth. Biomanipulation or fish-stock management, i.e removing the stock of bream and introducing a predator like pike, may trigger ecosystem restoration.

Reducing wind influence

If the lake is exposed to wind influences, a temporary reduction of the wind fetch may reduce resuspension and thus stimulate macrophyte colonization.

Guided use

Restoring aquatic ecosystems may require certain regulations for the use of waters for purposes like recreational boating and agriculture with a view to reduce nutrient inputs. Moreover, increase of agricultural water demand in dry periods may conflict with inflow reduction of nutrient-rich water.

6. FINANCIAL IMPLICATIONS, FUNDING

Water management costs money. In 1988 almost 2,2 milliard Dutch guilders (about 1,2 billion US dollars) was paid by the various authorities in water management costs. In additon the municipalities spent nearly 1,5 milliard Dfl. (800 million $) on the sewerage system and about 500 million Dfl. (280 million $) was spent by industry on water quality measures.
The costs to be made by the government can be funded by the ordinary tax-payers money which enters the general budget or it can be funded by a special budget that is fed by specific levies or charges. Both systems are applied in the Netherlands where waterquality measures are funded by a special budget and the other water management costs (water quantity, shipping, dikes) are paid from the general budget. Differences occur between teh central government and regional governments depending on the fact whether the cost have been made on the large state-waters or on the regional waters.
For the state-waters the central government uses the general state-budget to cover the water management costs related to water quantity (transport of water), shipping (maintenance of canals, shipping routes) and flood protection (dikes, dunes, barriers). The costs for water quality measures are covered by a levy that must be paid by everyone who discharges polluting substances into state waters ("polluters pay principle").
For the regional, non-state waters the costs relating to waterways that have a local shipping function are covered by the general budget of the province. The costs related to water quantity and flood protection are paid for by the water authorities from a general budget that is filled by a tax imposed on the estate owners of built-on or unbuilt-on area's of land within the area covered by the water authority. The water quality costs of regional waters are again covered by levies, as well for discharges directly into surface waters as for discharges into sewers.

In 1991 the total income by way of discharge levies amounted to a special budget of almost 1,5 milliard Dutch guilders. Water authorities collected 75%, provinces 18% and the central government 7% (100 million Dfl.)

The construction and maintenance of the sewerage system is funded by the municipalities through a municipal sewerage tax or a real estate tax imposed on the citizens.

7. CONCLUSIONS

Water plays an important role in the Netherlands. Because of the high abundance of water and the high population density, a rather complex administrative structure and a sophisticated technical structure are necessary for integrated water management.

Central government manages the most important surface waters (state-waters) and determines the general policy, while local authorities and public bodies are responsible for regional waters, drinking water supply, sewer systems and municipal waste water treatment.

Because of its location at the downstream end of three important transboundary rivers, the Netherlands' water management problems should often be set in an international context.

Major water quality problems in the Netherlands are:
- pollution of surface waters by nutrients, heavy metals and organic micropollutants;
- pollution of sediments by organic micropollutants and heavy metals;
- pollution of groundwater by pesticides and nitrate.

Because of the scale and complexity the solution of most of these problems needs an integrated approach, covering measures in several sectors of government and policy. It requires the use of water quality management instruments, water quantity management instruments as well as those of other water policy fields.

The freshwater and marine ecosystems have deteriorated. The Amoeba approach indicates a route to improved equilibrium. In order to arrive at healthy water systems, facilitating sustained use, a multi-track strategy has been chosen in the Netherlands, covering emission reduction, hydraulic design and guided use. Measures in the field of emission reduction are attuned to the agreements in the North Sea and Rhine Action Programmes, in view of the large dependance of the Netherlands upon activities windward and upstream.
The role of water quality objectives is supplementary to the reduction of emissions at source, according to the precautionary principle. Monitoring is a tool for observing trends and detecting accidents and therefore provides excellent feedback to policy-makers.

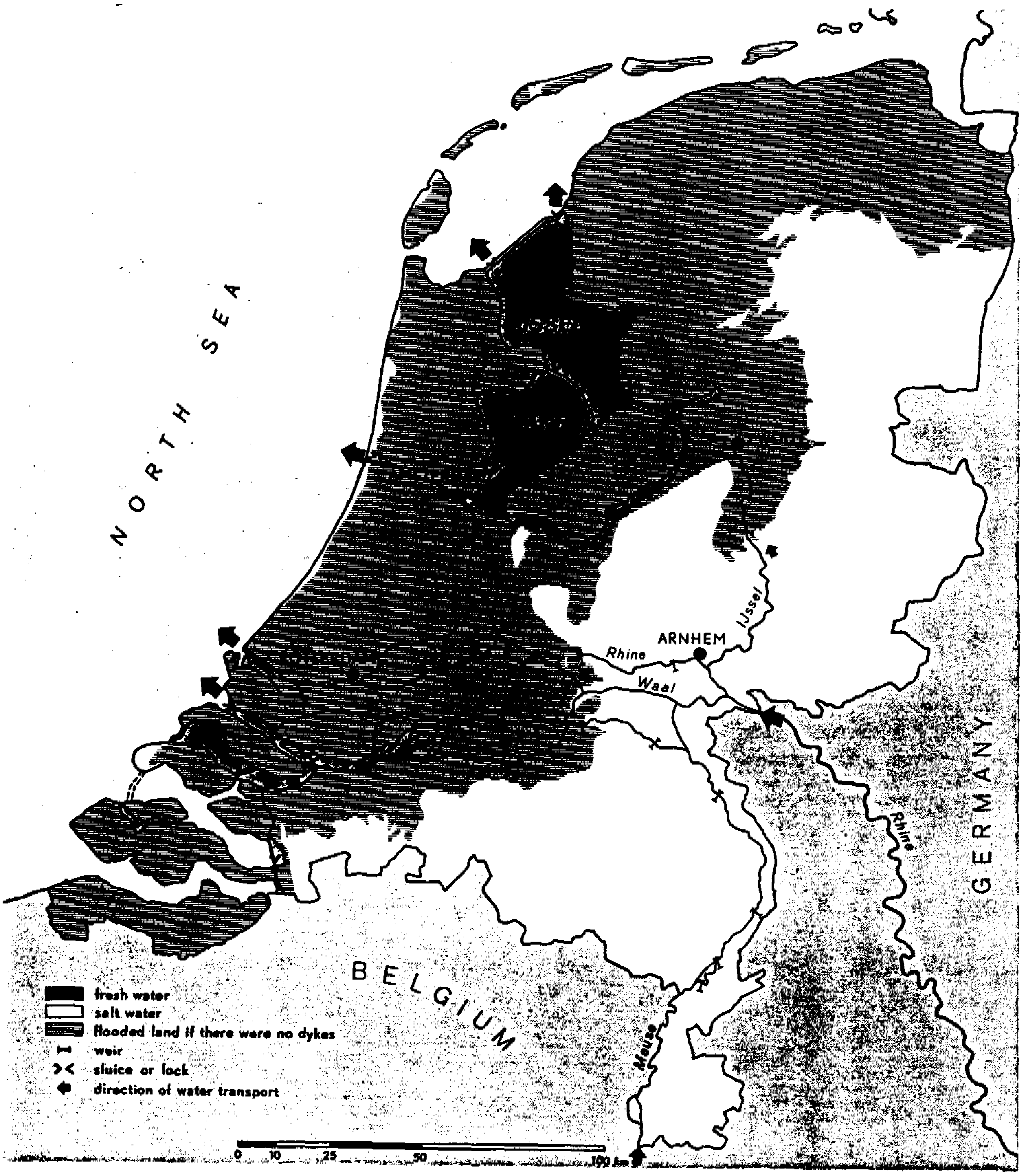
Mainly source-oriented tools and measures are used
- account is taken of the precautionary principle and the stand still principle
- discharge permits are issued on a case-by-case basis, applying BTM/BPM. General guidelines are developed for certain industrial sectors.
- diffuse sources have increased in importance, agriculture in particular. BEP is developed and applied for these sources.

Effect-oriented measures are used in order to
- speed up the clean-up process (eutrophication)
- create favourable conditions, nature development (hydraulic design)
- avoid acute problems, both with respect to health and to shipping (sediments)

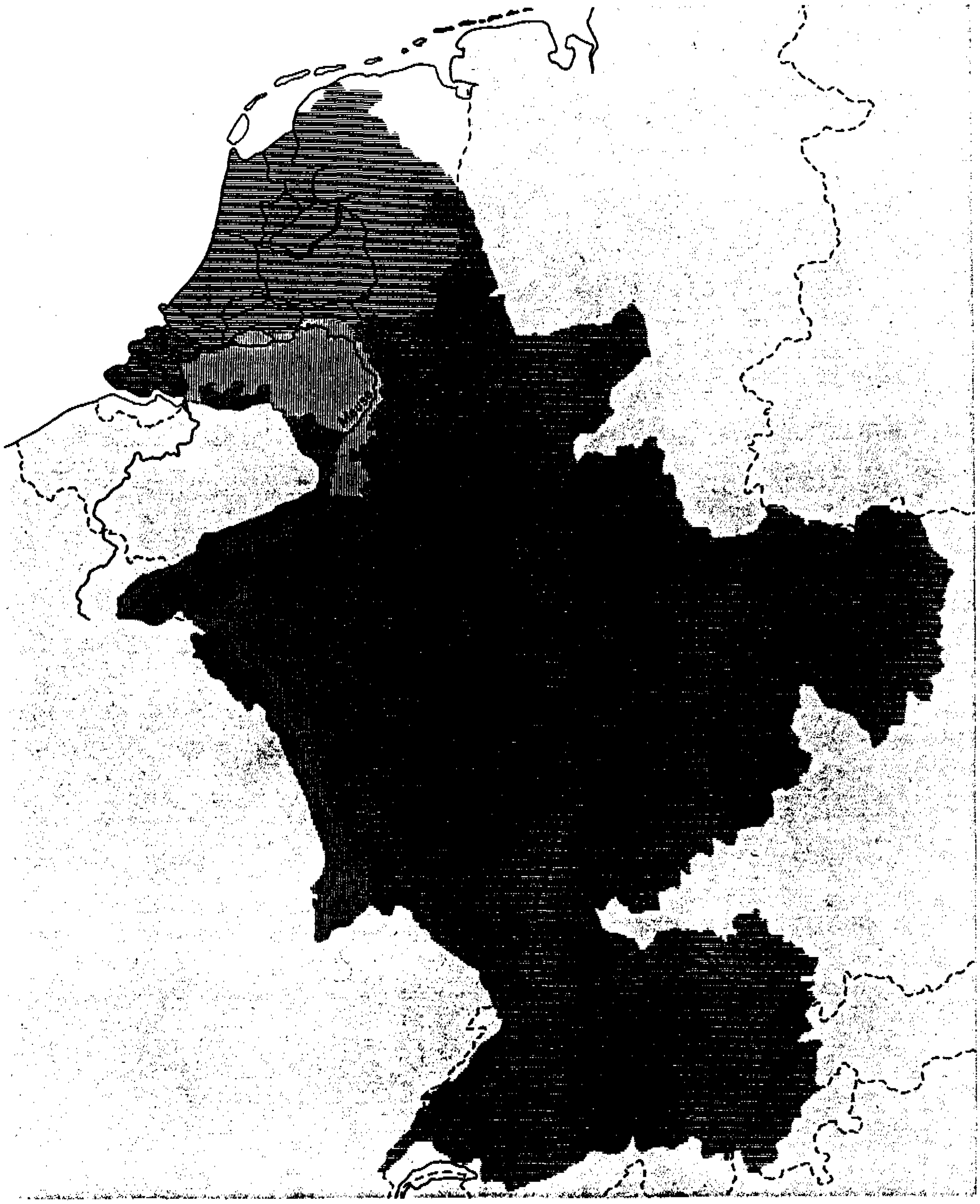
Funding of water quantity management takes places through general budgets, water quality management is funded by levies (polluters pay principle)
- effluent charges for discharges into state-waters are imposed by the central government;
- emissions into sewers and into regional waters are charged by the regional authorities.

Sewerage taxes are imposed by municipalities

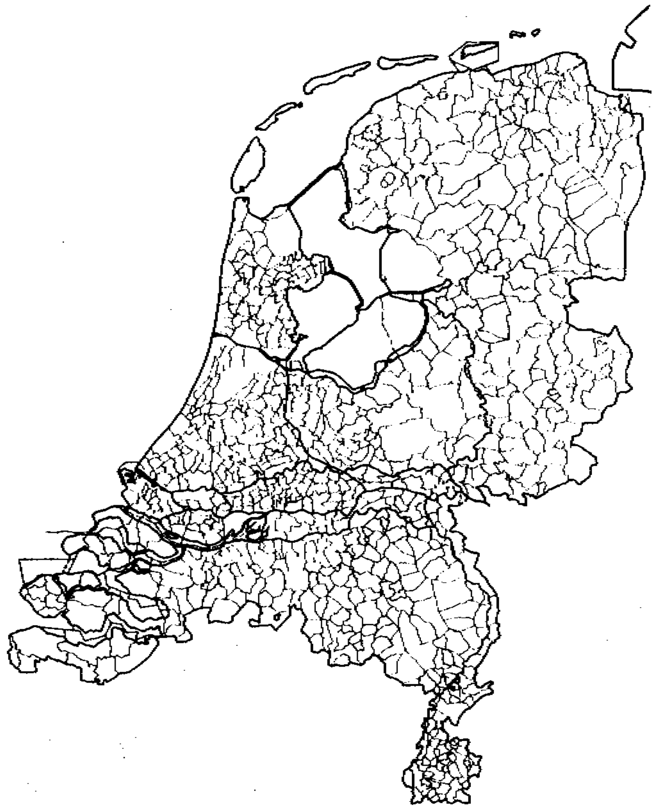
THE WATERSYSTEM OF THE NETHERLANDS



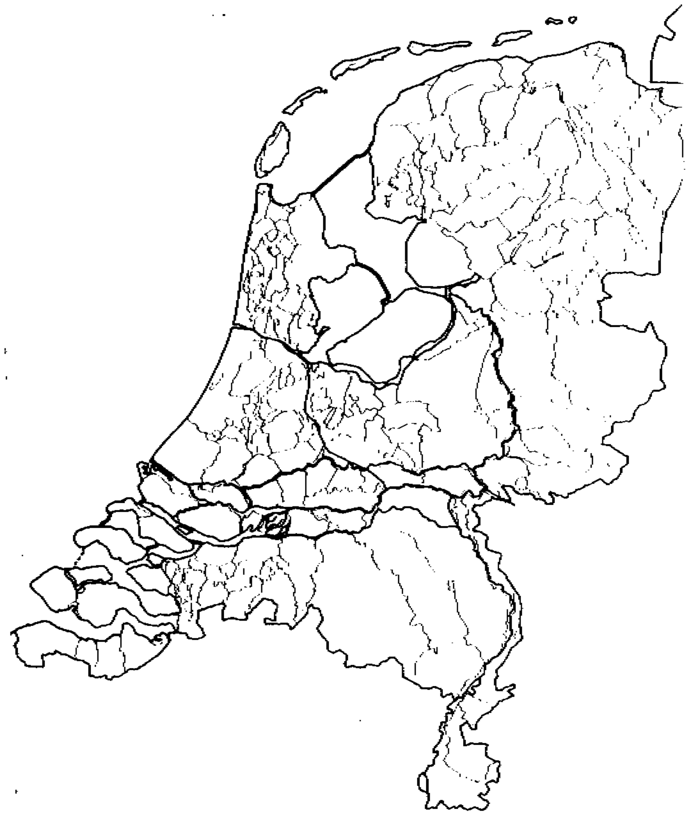
RIVER BASINS OF
RHINE AND MEUSE



12 PROVINCES



600 MUNICIPALITIES



110 WATER AUTHORITIES

WATER MANAGEMENT
IN THE NETHERLANDS

ir. R.H.DEKKER

HEAD OF INTERNATIONAL
WATER POLICY DIVISION

THE NETHERLANDS
THREE LEVELS OF GOVERNMENT

1°.	**CENTRAL:**	**14 DEPARTMENTS**
2°.	**REGIONAL:**	**12 PROVINCES**
3°.	**LOCAL:**	**~ 600 MUNICIPALITIES** **~ 110 WATER-BOARDS**

ENVIRONMENT POLICY DEPARTMENTS

- MINISTRY OF HOUSING, SPATIAL PLANNING & ENVIRONMENT
- MINISTRY OF TRANSPORT, PUBLIC WORKS & WATER MANAGEMENT
- MINISTRY OF AGRICULTURE, NATURE PROTECTION & FISHERIES
- MINISTRY OF ECONOMIC AFFAIRS

MINISTRY OF TRANSPORT, PUBLIC WORKS & WATER MANAGEMENT

1. DIR.-GEN. PUBLIC WORKS & WATER MANAGEMENT
2. DIR.-GEN. TRANSPORT
3. DIR.-GEN. SHIPPING & MARITIME AFFAIRS
4. DIR.-GEN. CIVIL AVIATION
5. DIR. TELECOMMUNICATIONS & POST
6. ROYAL NETH. METEOROLOGICAL INSTITUTE
7. DEPT. ROAD TRANSPORT

DIRECTORATE-GENERAL OF PUBLIC WORKS & WATER MANAGEMENT (RIJKSWATERSTAAT)

CORE ACTIVITIES:

1. FLOOD PROTECTION

2. WATER MANAGEMENT

3. NATIONAL INFRASTRUCTURE

4. ROAD SAFETY

PERSONNEL: **10.000 PEOPLE**
BUDGET: **3 BILLION US$**

	PERSONNEL	BUDGET BILLION US$
FLOOD PROTECTION	950	0,3
WATER MANAGEMENT	3120	0,6
INFRASTRUCTURE	5370	1,9
ROAD SAFETY	250	0,1

ORGANISATIONAL STRUCTURE OF RIJKSWATERSTAAT

1 HEAD OFFICE

11 REGIONAL DEPARTMENTS

1 CONSTRUCTION DEPARTMENT

5 RESEARCH DEPARTMENTS:
- INLAND WATER MANAGEMENT & WASTE WATER TREATMENT
- COASTAL ZONE MANAGEMENT
- ROAD & HYDRAULIC ENGINEERING
- TRAFFIC & TRANSPORT
- SURVEY & MAPPING

WATER MANAGEMENT POLICY

1968, 1984 WATER <u>QUANTITY</u> MANAGEMENT	**1975, 1980, 1985 WATER <u>QUALITY</u> MANAGEMENT**

1990
INTEGRAL WATER MANAGEMENT
3RD NATIONAL POLICY DOCUMENT
MULTIPLE TRACK APPROACH:
- o REDUCTION OF POLLUTION
- o HYDRAULIC DESIGN
- o GUIDED USE
- o IMPROVED INSTRUMENTS OF ADMINISTRATION AND POLICY

○ REDUCTION OF POLLUTION

TARGETS:

- OXYGEN CONSUMING SUBSTANCES
- NUTRIENTS
- HEAVY METALS
- ORGANIC MICRO-POLLUTANTS
- AQUATIC SEDIMENTS
- ACCIDENTAL SPILLS

○ REDUCTION OF POLLUTION

POLICY APPROACHES:

- STAND-STILL PRINCIPLE
- PRECAUTIONARY PRINCIPLE
- POLLUTER PAYS PRINCIPLE
- EMISSION REDUCTION AT SOURCE
- BEST AVAILABLE TECHNIQUES
- BEST ENVIRONMENTAL PRACTICE
- DESIGNATION OF FUNCTIONS
- WATER QUALITY OBJECTIVES

○ HYDRAULIC DESIGN

- ENVIRONMENT FRIENDLY RESTORATION OF SHORES AND RIVERBANKS
- BUILDING OF FISHPASSAGES
- CREATION OF SPAWNING GROUNDS
- ECOLOGICAL RESTORATION OF WATERCOURSES
- ENCOURAGING NATURE DEVELOPMENT

○ RATIONAL USE

- ADJUSTING WATER DEMAND AND SUPPLY
- SUSTAINED USE OF GROUNDWATER
  REDUCING DEHYDRATION IN NATURE AREAS
  RESERVING GROUNDWATER FOR NATURE AND DRINKING WATER
- ZONING OF WATER USES

○ IMPROVED INSTRUMENTS OF ADMINISTRATION AND POLICY

- INTEGRATION OF WATER MANAGEMENT TASKS
- FORMING DISTRICT WATER BOARDS PER HYDRAULIC UNIT
- INTEGRATION OF LEGAL REGULATIONS
- MODIFICATION OF FINANCIAL INSTRUMENTS
- STRENGTHENING INTERNATIONAL COOPERATION

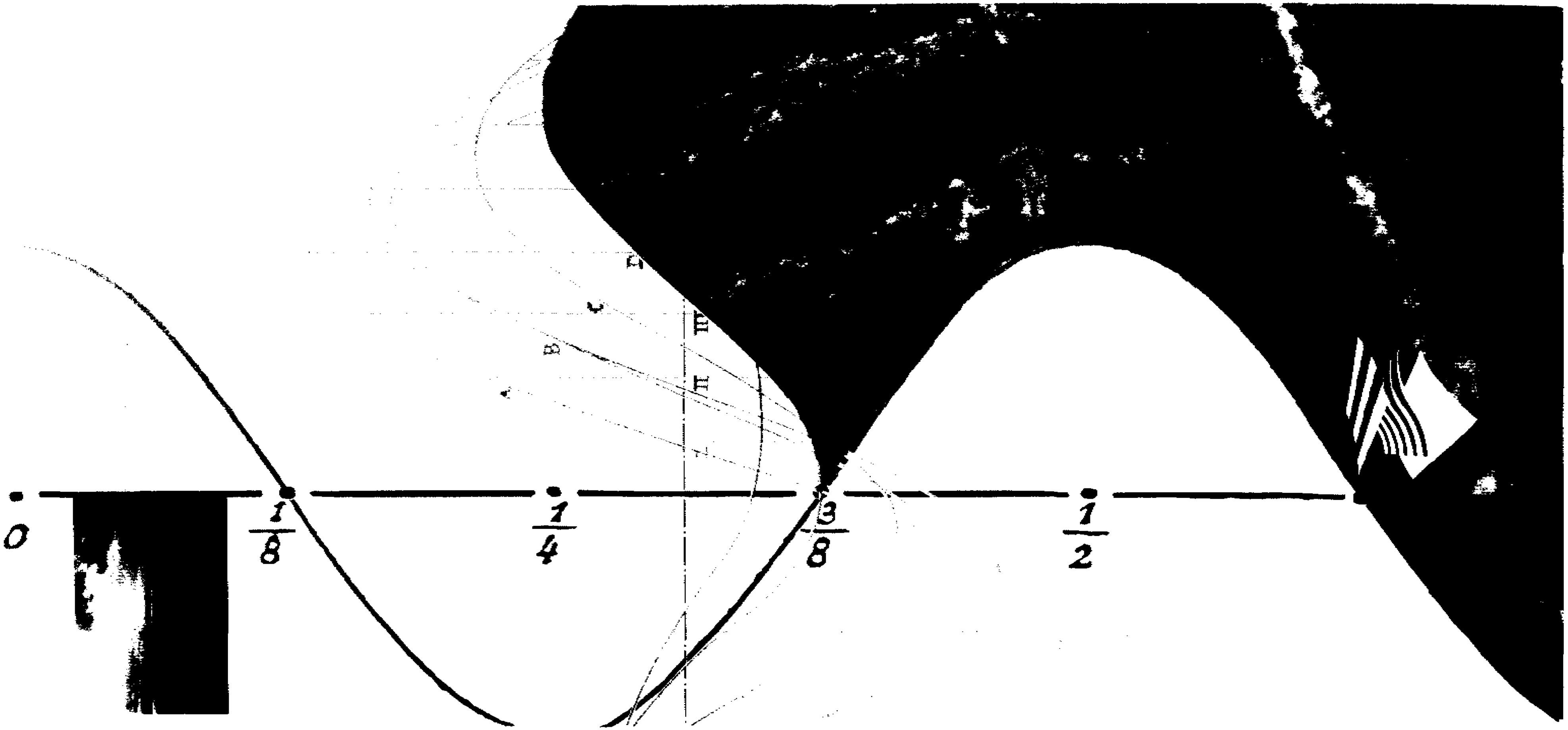
SUSTAINABLE DEVELOPMENT

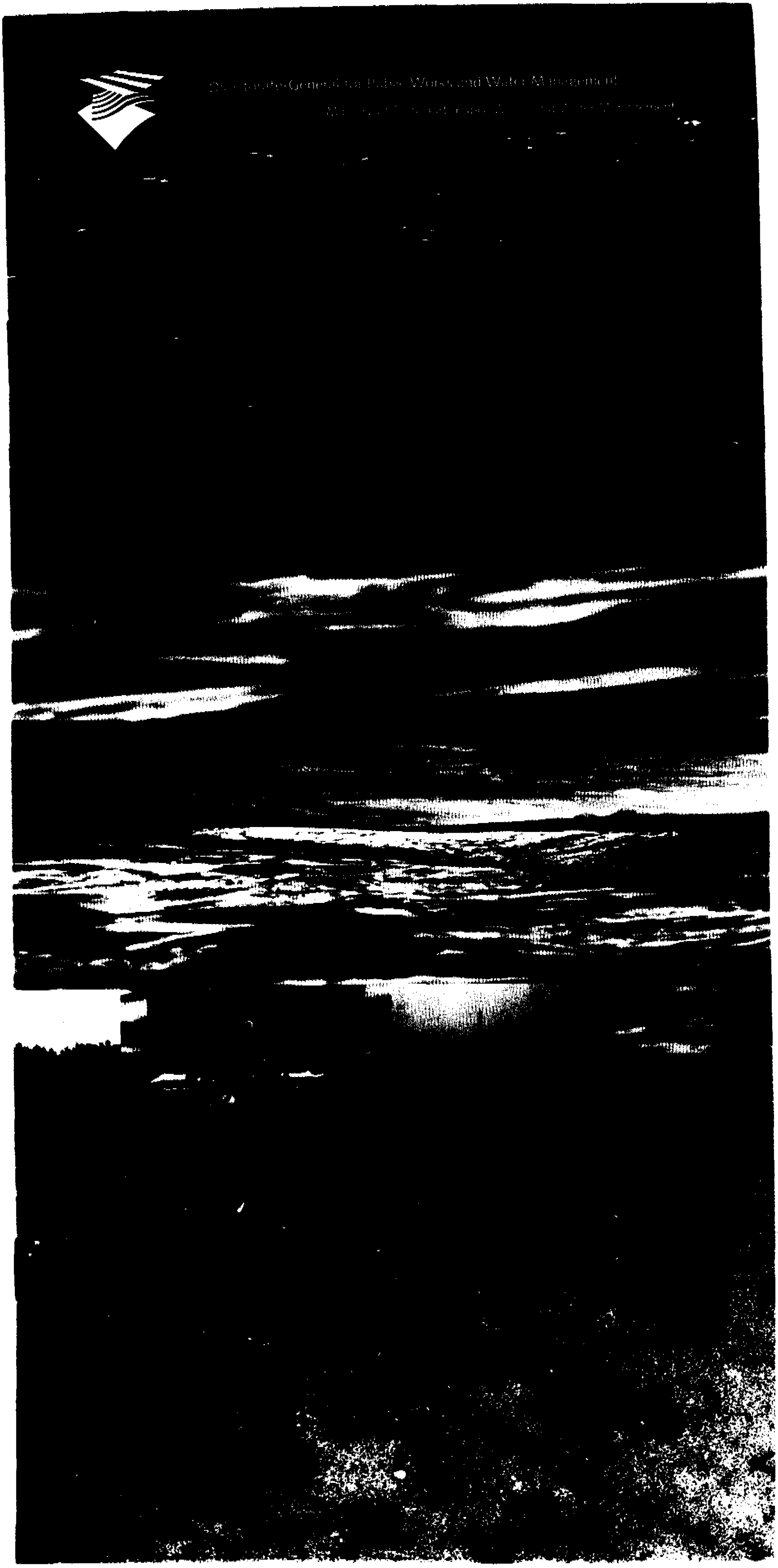
SATISFYING OUR OWN NEEDS WHITHOUT ENDANGERING THE NEEDS OF FUTURE GENERATIONS

BASIC NEEDS:	DRY FEET, DRINKING WATER
ECONOMIC NEEDS:	AGRICULTURE, SHIPPING, FISHERY
FUTURE NEEDS:	ECOLOGICAL DIVERSITY

RIZA: **Protection against flooding**

Ministry of Transport, Public Works and Water Management
Directorate-General for Public Works and Water Management

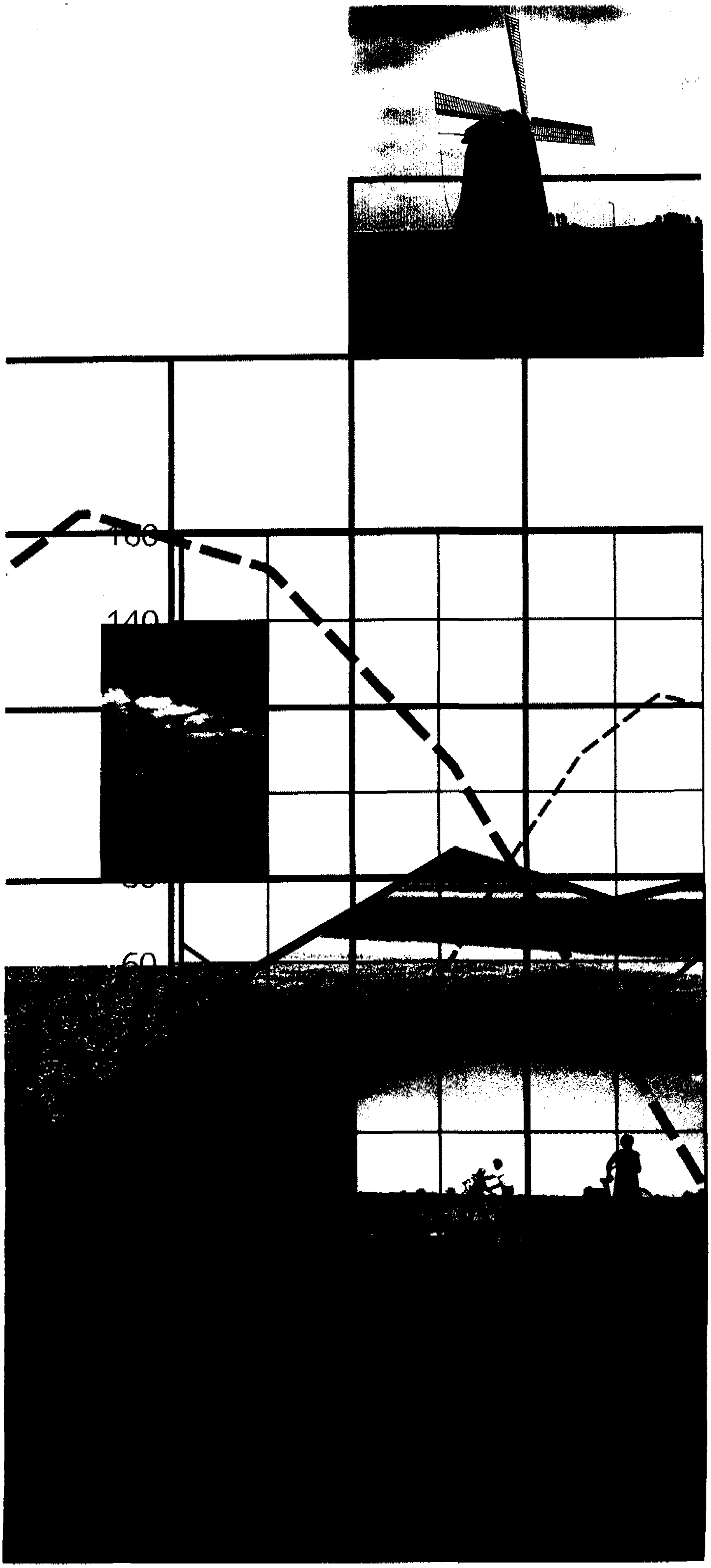



Directorate-General for Public Works and Water Management

Ministry of Transport, Public Works and Water Management

Directorate-General for Public Works and Water Management

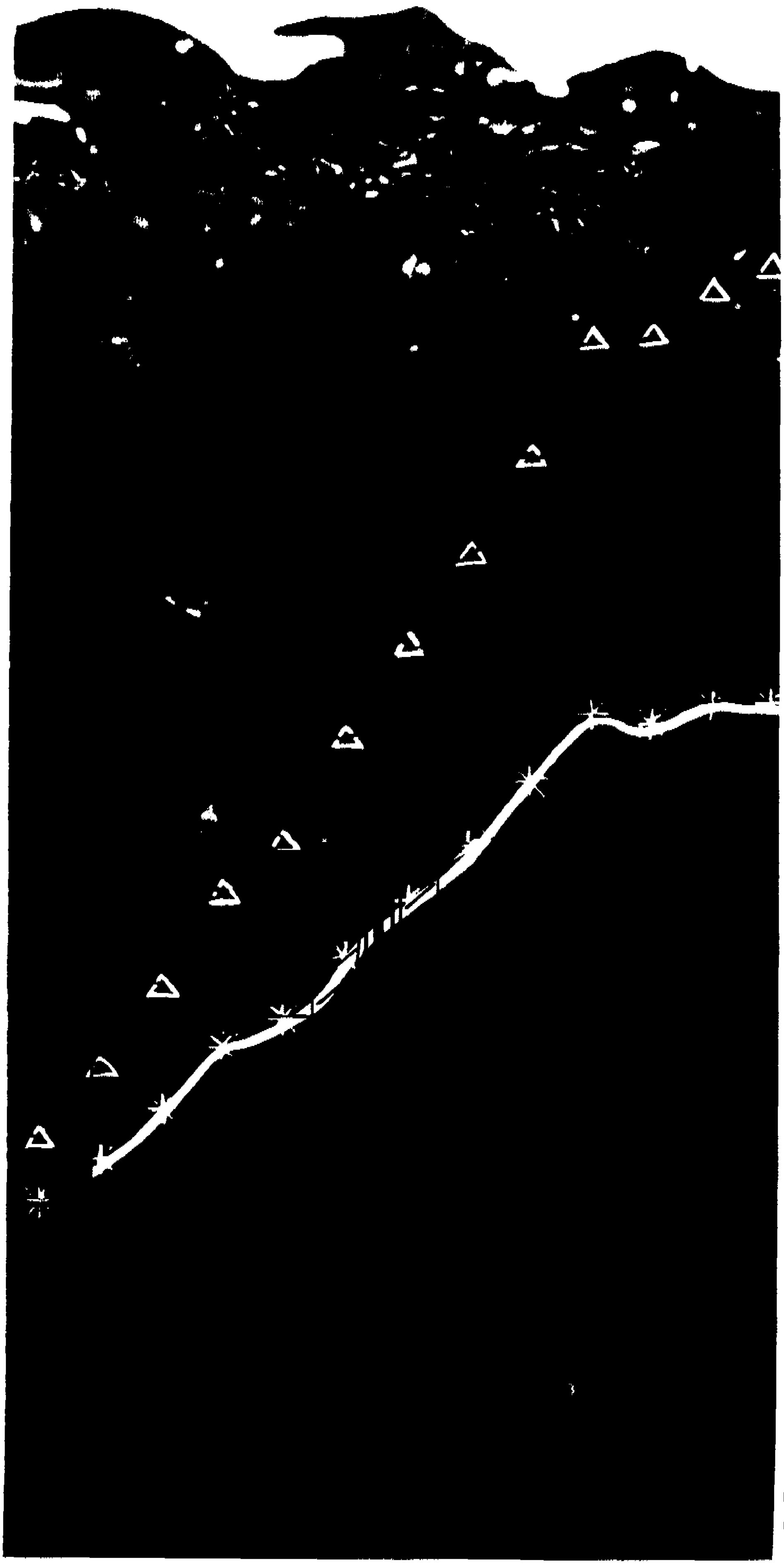
RIZA: The Netherlands



Directorate-General for Public Works and Water Management

Ministry of Transport, Public Works and Water Management

RIZA: AWZI-2010 treatment of industrial waste water



Ministry of Transport, Public Works and Water Management

Directorate-General for Public Works and Water Management

Institute for Inland Water Management and Waste Water Treatment

Rivers

Ministry of Transport, Public Works and Water Management

Directorate-General for Public Works and Water Management

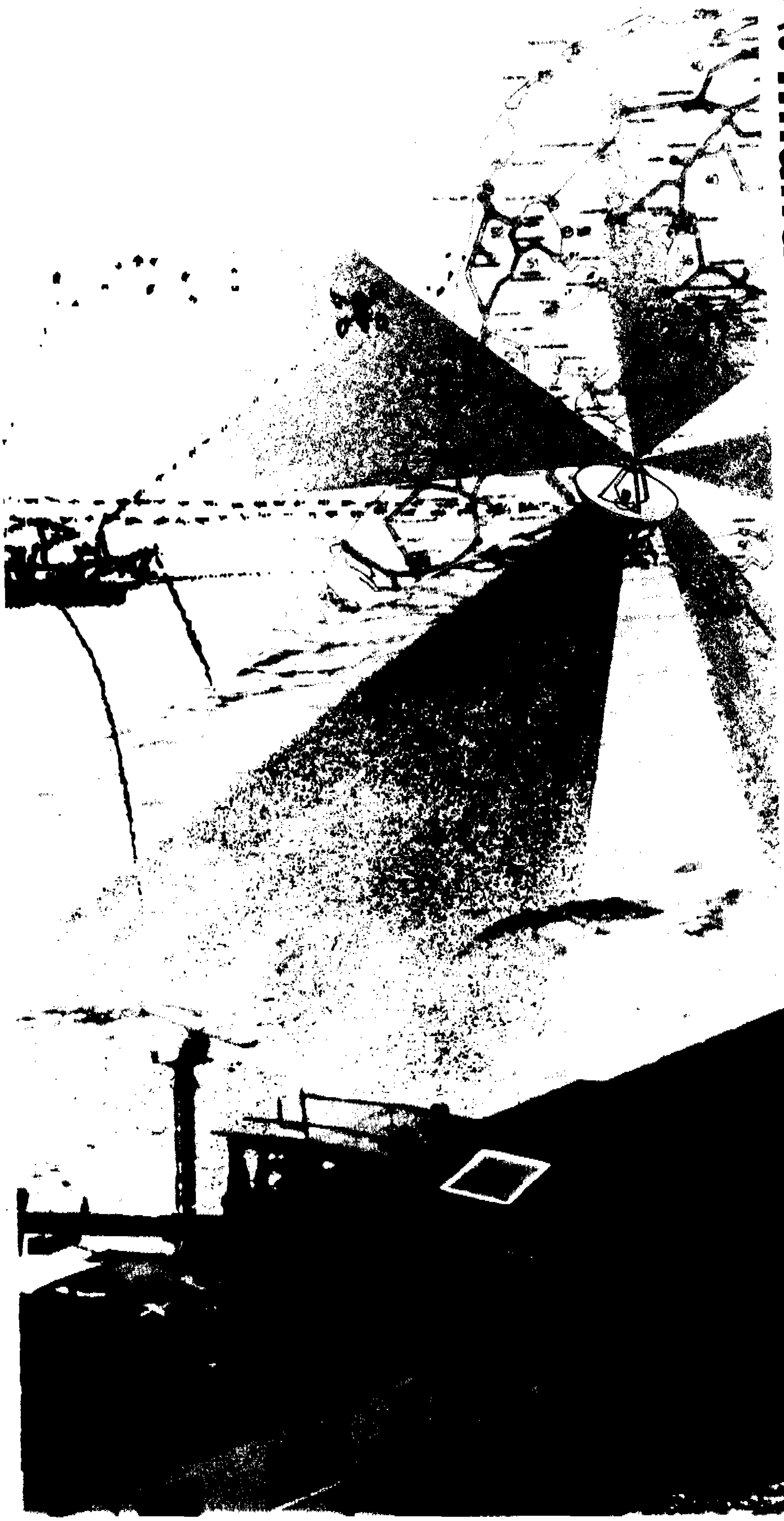
RIZA: International

Ministerie van Verkeer en Waterstaat

Directoraat-Generaal Rijkswaterstaat

Rijksinstituut voor Integraal Zoetwaterbeheer en Afvalwaterbehandeling RIZA

RIZA: Inland Water Information and Warning Centre



Ministry of Housing,
Spatial Planning and the Environment

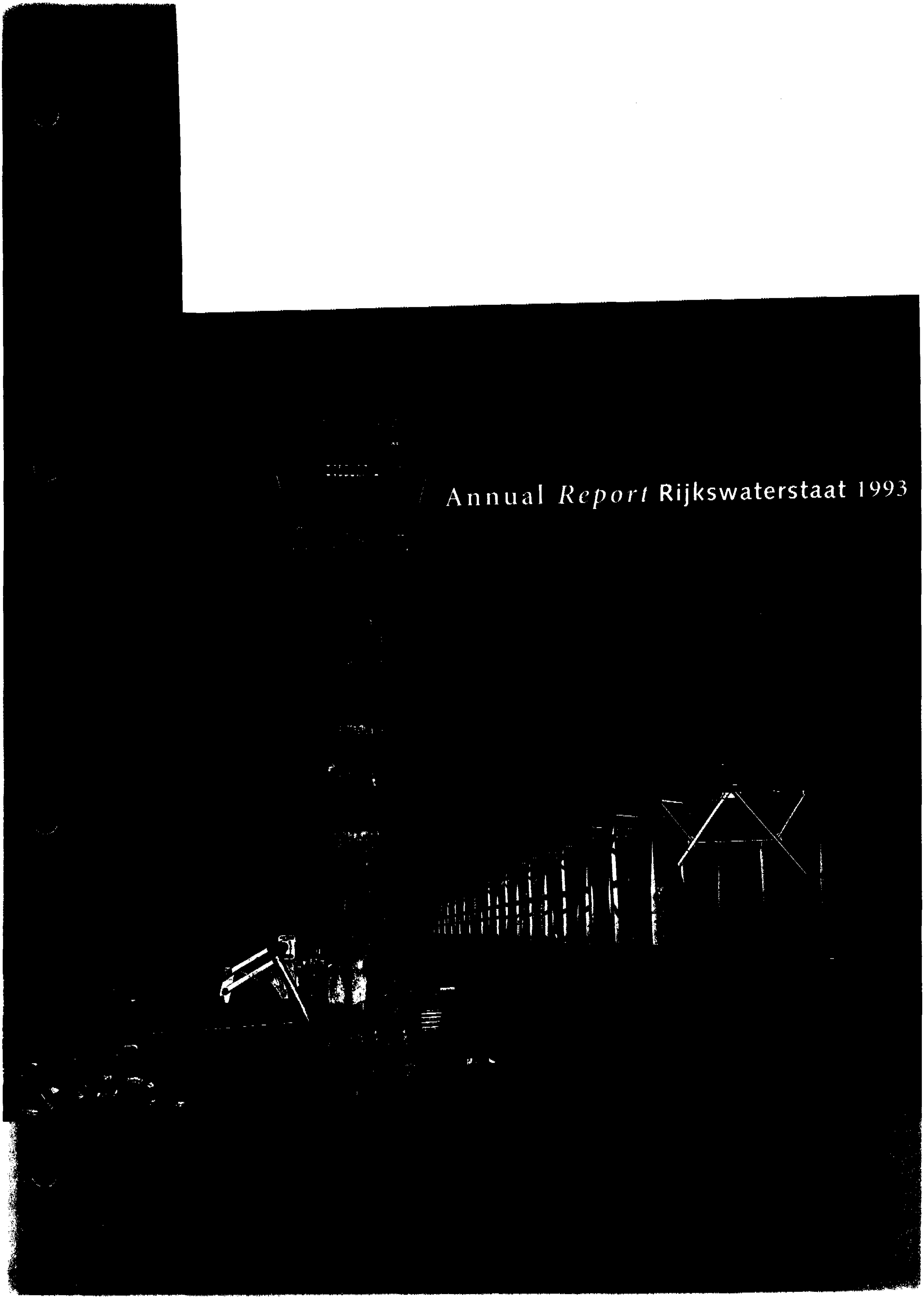
Drinking water in the Netherlands

National Environmental Policy Plan 2

Summary

The environment: today's touchstone

Annual *Report* Rijkswaterstaat 1993



Water in The Netherlands: a time for action

ENFORCEMENT OF THE SURFACE WATERS POLLUTION ACT

Lecture by J. Rus.

RIZA
(Dutch Governmental Institute for Inland watermanagement and Waste watertreatment)

Contents

ENFORCEMENT OF THE SURFACE WATERS POLLUTION ACT

Lecture by J. Rus.

RIZA

1. The history and objective of the Surface Waters Pollution Act (SWPA)

At the end of the last century, the first efforts were made to create a form of statutory regulation with respect to combating water pollution; however, without result.

At the end of the 1950's the first public protests against the pollution of our surface waters made themselves heard. Eventually the SWPA came into force in 1970. This meant that one of the first Environmental Protection Acts had become a fact.

In its explanatory remarks, the Act contains the following with respect to the objective of the SWPA: "The objective of the SWPA is to combat and prevent the pollution of the surface waters taking account of the various functions which these waters fulfil within our society".

This is why, in order to achieve this objective, it is forbidden to discharge waste products, polluting or harmful substances into the surface waters without a licence.
This meant that, from 1970, thousands of waste water discharge licences had to be issued. This represented an important new task for water quality managers in the Netherlands.

2. <u>The organisation and tasks of water quality managers in the Netherlands</u>

The surface waters in the Netherlands may be subdivided into the so-called government-controlled waters and those which are non-government controlled.
The Department of Public Works is responsible for the management of the government-controlled waters, such as the large rivers the Rhine, Meuse and Scheldt; the large canals such as the Amsterdam-Rhine Canal, Ijssellake Lake, Wadden Sea, West-Scheldt - North Sea and all the harbours with open access to these waters. Everyone who wishes to discharge waste products, polluting or harmful substances into these waters must apply to the Department of Transport and Public Works (Rijkswaterstaat) for an SWPA licence. The Department of Transport and Public Works (Rijkswaterstaat) forms an integral part of the Ministry of Transport, Public Works and Watermanagement. The Department has approximately 9000 employees.

The organisation of the Department of Transport and Public Works (Rijkswaterstaat) is as follows:
The Directorate General is located in The Hague and the Department has 10 Regional Directorates located throughout the Netherlands. The regional Directirates are supported by the so-called specialist services or scientific research institutes. The RIZA (Dutch Governmental Institute for Inland Watermanagement and Wastewatertreatment) is <u>one</u> of these services which provides support in the form of: the collection of information, carrying out research, providing both policy and technical advice in the field of both surface and ground water management. Among the tasks of the regional managements are the following:

- The protection of the countryside against water
- The construction and maintenance of roads, navigable channels, shipping routes, bridges and tunnels.
- Waterquantity management (sluices, weirs)
- Waterquality management.

This last task is a direct consequence of the Surface Waters Pollution Act.

The Department of Public Works is responsible for the issuing of licences for discharges into government controlled waters.

The water quality task with respect to the non-government controlled waters has been given to the Provincial Authorities. The majority of these authorities have delegated this task to District Water Boards. At present, the Netherlands has a total of 29 water quality managers who are responsible for the non-governmental controlled waters.
Since 1970, large numbers of biological purification installations have been constructed by these water quality managers. In 1970 the Department of Transport and Public Works (Rijkswaterstaat) the Provincial Authorities and the Water Boards began issuing licences to companies and authorities which discharge waste water. A great deal of attention was paid to reducing discharges of oxygen-combining substances and heavy metals. The introduction of a pollution-charge with respect to the discharged pollution has also resulted in a pronounced improvement. Hundreds of biological purification installations were built.

The Department of Transport and Public Works (Rijkswaterstaat) is involved in dealing with the following:

Direct discharges into **Government-controlled waters**

*	larger industrial companies	: 900
*	small to very small companies	: 700
*	sewage water purification installations	: 100
*	houseboats, dike-housing, discharge of dredging material, soil remediation, sand-blasting, etc.	: 4,800

	Total	: 6,500

After the SWPA came into force, with respect to its implementation, the emphasis was initially placed on improvement measures and the issuing of licences. Gradually, it became clear that there were quite a few bottlenecks with respect to the implementation of the SWPA.

3. Bottlenecks in the implementation of the SWPA

The catching-up operation, which had to be carried out within a short space of time, demanded both sufficient manpower and expertise on the part of the water quality managers in order for them to be able to draw up good licences. It appeared that it was not always possible to draw up good, enforceable licences. In 1981, research indicated the existence of the following bottlenecks:

- an inadequate instrument of enforcement;
- a poor degree of cooperation between authorities;
- permits which could not easily be enforced;
- an unclear sanctions policy;
- a shortage of personnel;
- a backlog in the granting of permits.

The need for an improved and more intensive enforcement of the environmental legislation quickly became apparent. An important recommendation was the need to implement a clear function demarcation. This meant that the issuing of the permit and its enforcement should be carried out

as separate functions.
This brings me to:

4. Enforcing the SWPA

Enforcement is part of the so-called regulation chain.

Policy planning

1. Act and issuing of regulations

5. Enforcement

2. Standards

4. Implementation

3. Granting of permits.

For years, enforcement was regarded as the weakest link in the chain. This is no longer the case. In recent years, many authorities have invested in manpower, expertise and means with respect to the enforcement of environmental legislation.

Enforcement may be briefly defined as:
"the exercise of surveillance and detection".

Who are now carrying out this function and what does the daily task of the body enforcing the SWPA look like?

Since 1986, each regional Department of Public Works management board has an "SWPA Enforcement Department". The employees of these departments possess so-called supervisory powers. They may enter company premises, examine documents, take samples, require cooperation, etc.
The majority of the civil servants with supervisory powers also possess investigatory powers. This is to say that they are empowered to take out warrants on behalf of the Public Prosecutor's Office.
Every day there are tens of SWPA-enforcement officials under way in the Netherlands to carry out inspections and take samples of waste water. On average, the following

activities are carried out by the Department of Public Works each year:

- 5000 visits are made to companies
- 7000 samples are taken
- and 70,000 laboratory analyses are carried out.

SWPA Control Team

Together with a number of representatives from the Directorate General and RIZA, the managers of the Enforcement Departments within the regional Directorates of the Department of Transport and Public Works (Rijkswaterstaat) form the so-called SWPA Control Team. The team provides an important consultation framework for the enforcement of the SWPA and has a number of important tasks. Policy and practice are examined with respect to each other during regular meetings.
Apart from the preparation and development of the SWPA enforcement policy, the team devotes considerable attention to co-ordination, training, instruction and the provision of information. The SWPA Control Team organises an annual enforcement symposium and an intensive nationwide permit inspection action.

An important memorandum has recently been published which has been compiled by the SWPA Control Team. This memorandum, entitled "Enforcement has to be done!", consists of practical guidelines and information for the benefit of SWPA-enforcement officials.

The memorandum examines in depth the instruments of enforcement which are currently available, together with the strategy of how these instruments should be applied.

The most important instruments of enforcement are:
- judicial (or legal) action and
- administrative action.

The judicial instruments provide a considerable range of options in the event of serious environmental offences.

Among the sanction options are:

- fines
- terms of imprisonment
- removal of any wrongfully obtained financial (or other) advantage which has been gained by committing an offence
- closure of the company concerned.

"The administrative authority" i.e. (that is to say) the Department of Transport and Public Works (Rijkswaterstaat), the Provincial Authority or the district Water Board also possesses an administrative instrument of enforcement.
A number of the more important are:

- Warning (verbal or in writing)
- Administrative pressure, also called police pressure. The government may write to the offender ordering the offender to put a stop to the offence, or it may itself put a stop to it, the costs involved having to be paid by the offender.
- Withdrawal of the permit.
- Amendment of the terms of the permit.
- The imposition of financial damages to force compliance.

The Rijkswaterstaat and the various Water Boards, Provincial Authorities and Local Authorities have made use of this administrative instrument of enforcement on a number of occasions in order to put an end to illegal discharges. Finally, I will briefly examine a number of related developments.

5. Developments

There are a number of important developments which may be mentioned in the fields of:

- criminal law
- internal environmental care in industries
- inspection (or surveillance) techniques and
- cooperation.

Let us begin with those developments which are currently being given a great deal of attention by the various members of the Public Prosecutor's Office. For a number of years now, a considerable number of Dutch public prosecutors have been specifically designated as "environmental prosecutor". The increasing interest in the environment, the considerable expansion in the amount of environmental legislation over the last 20 years and the continued improvement in the enforcement of the environmental legislation were partly the reason for this development. For a considerable period of time, the Public Prosecutor's Office remained somewhat aloof and was used as a last resort or "Ultimum remedium". This is now <u>really</u> a thing of the past.

<u>Internal environmental care</u>
This is a new phenomenon for enforcement officials. Is governmental enforcement still required if every company has a good internal company environmental care management system?

The setting up of internal company environmental protection management systems is stimulated by the government.

It is striking that many companies have already assumed their own responsibility in the field of environmental protection without any insistence to do so on the part of government. Within industry, matters relating to the environment have been placed higher on the agenda and at the same time, the external environmentally-related pressure on industry has also increased. The environment is no longer a matter which is dealt with exclusively between government and industry. Whether directly or indirectly, a large number of pressure-groups are also involved. We need only think of insurance companies, banks, local residents and environmental groups.

Enforcement officials can also stimulate companies to carry out their own investigations and to set up their own environmental protection management systems. A very important factor in this process is the expertise possessed by the enforcement official. If he/she is to have an insight into the production process, the waste flows and the environmental care management system and be in a position to discuss this system and provide good advice, this requires that the government have well trained officials at its disposal.

Inspection or surveillance techniques
Until now, the most important inspection technique within the framework of the SWPA has been the taking of samples, followed by laboratory analysis.
In recent years, aerial surveillance in order to detect illegal discharges has also increased.

In order to be able to carry out the enforcement task more effectively and efficiently, more attention will be paid to the following in the future:
- in-situ measurements;
- the monitoring of waste water flows;
- remote sensing from aircraft.

In-situ measurements: this is the ability to immediately carry out a measurement of one or more parameters at the sample-taking location and this should result in sampling techniques which are more selective.
In many cases the enforcement official currently takes samples while he/she perhaps already knows from experience that there is no question of an offence within the terms of the discharge licence. A prior screening of the discharge water may result in more effective enforcement. In this way, the capacity of the laboratory is also used more efficiently. However, the availability of compact, fast-working, measuring equipment which can be used for a large number of parameters, is still a problem at present.

The monitoring of waste water flows

It is not always clear at which moment, within a period of 24 hours, discharges occur which do not satisfy the terms of the licensing regulations. In order to obtain a greater insight into this problem, the Rijkswaterstaat will shortly be carrying out continual measuring and sampling of the waste water flows during periods of, for example, 1 to 3 or 4 weeks. Sampling equipment, which can be sealed, is available on the market for this purpose. For example, one could have a sampling bottle filled every hour during a period of 24 hours.
It is also possible to have the sampling aimed at a pre-selected parameter, for example; temperature, pH, conductivity, oil and heavy metal, etc.

Remote sensing from aircraft

Remote sensing is carrying out observation at a distance. In fact, visual observation and photography are forms of remote sensing. This form of enforcement is often applied during normal aerial surveillance.

The Rijkswaterstaat has an ultra-modern aircraft of the Coast Guard at its disposal which is fitted with equipment which can detect illegal discharges both during the day and at night.

The new Coast Guard aircraft is also being used for detection activities above the Dutch inland waterways as well as for such activities over the sea.

The final "development" which I would like to bring to your attention is: Cooperation.

If all the environmental protection permits in the Netherlands were to be issued and enforced by a single authority, there would be no need to discuss the question of cooperation with respect to the enforcement of environmental legislation.

However, with respect to the issuing of permits and their enforcement, environmental legislation in our country is divided among a large number of governmental bodies such as the Government itself, the Provincial Authorities, Local Authorities, Water Boards and the Police.

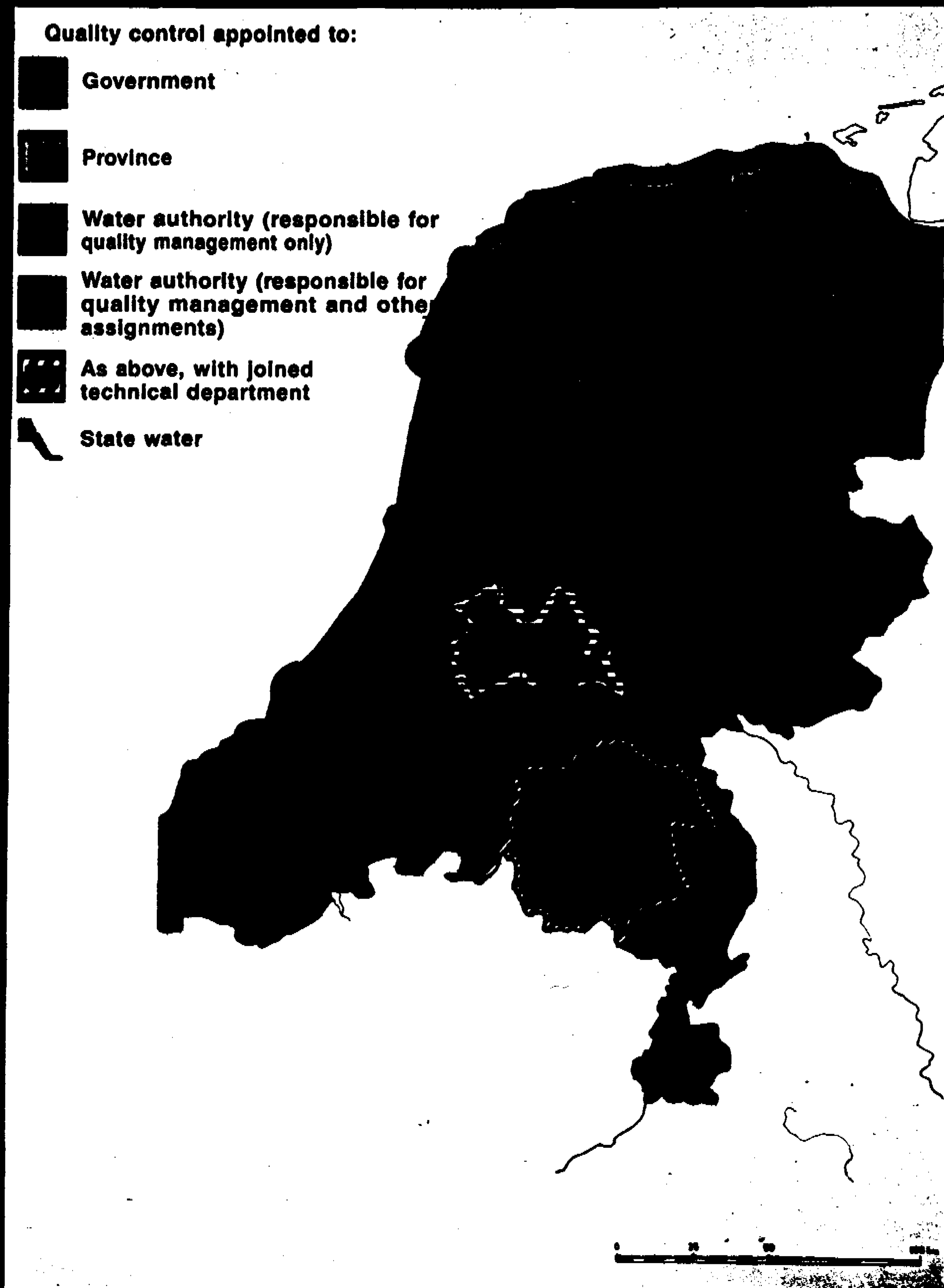
In the field of enforcement, there is no statutory organised cooperative structure.

In order to prevent a situation in which the different enforcement authorities all simultaneously, or at very short consecutive intervals, carry out inspections or even duplicate each others' work, efforts are currently being made to promote cooperation between the parties concerned.

Cooperation is a good thing. Making use of each others' strengths can be very effective.

6 Conclusion

Ladies and gentlemen, I hope that my address has provided you with a greater insight into the origins and development of the enforcement of the environmental legislation in general and the SWPA in particular.
Thank you for your attention.


Quality control appointed to:
Government
Province
Water authority (responsible for quality management only)
Water authority (responsible for quality management and other assignments)
As above, with joined technical department
State water

Catchment area of the Water Authority Hollandse Eilanden en Waarden

Responsibility

Increasing and maintaining the surface water quality in the southern part of South-Holland

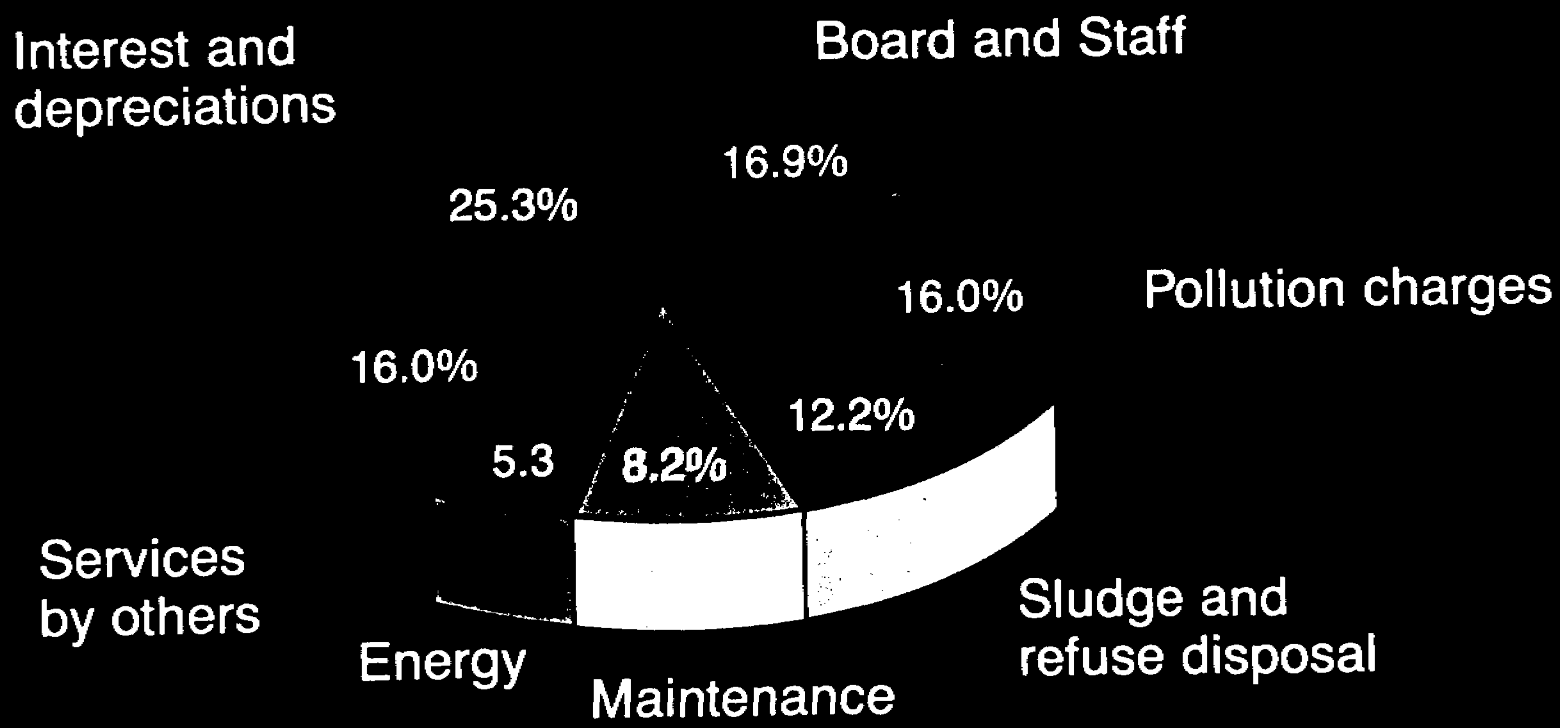
Instruments

- Discharge permits granting
- Permit control and maintaining
- Purification of waste water
- *Dredging and refreshing*
- Pollution charges
- Information and education

130 liters tap water per person per day

• Bath / shower	59 liters
• Flushing the toilet	36 liters
• Washing	20 liters
• Cleaning	5 liters
• Cooking and drinking	4 liters
• Caring for domestic animals, plants, sprinkling the garden, etc.	6 liters
Total	130 liters

Costs 1993


Interest and depreciations
Board and Staff
16.9%
25.3%
16.0%
Pollution charges
16.0%
12.2%
5.3
8.2%
Services by others
Energy
Maintenance
Sludge and refuse disposal

The Board

- General Assembly
  (Executive Board and Chairman included) 41

Structure of General Assembly

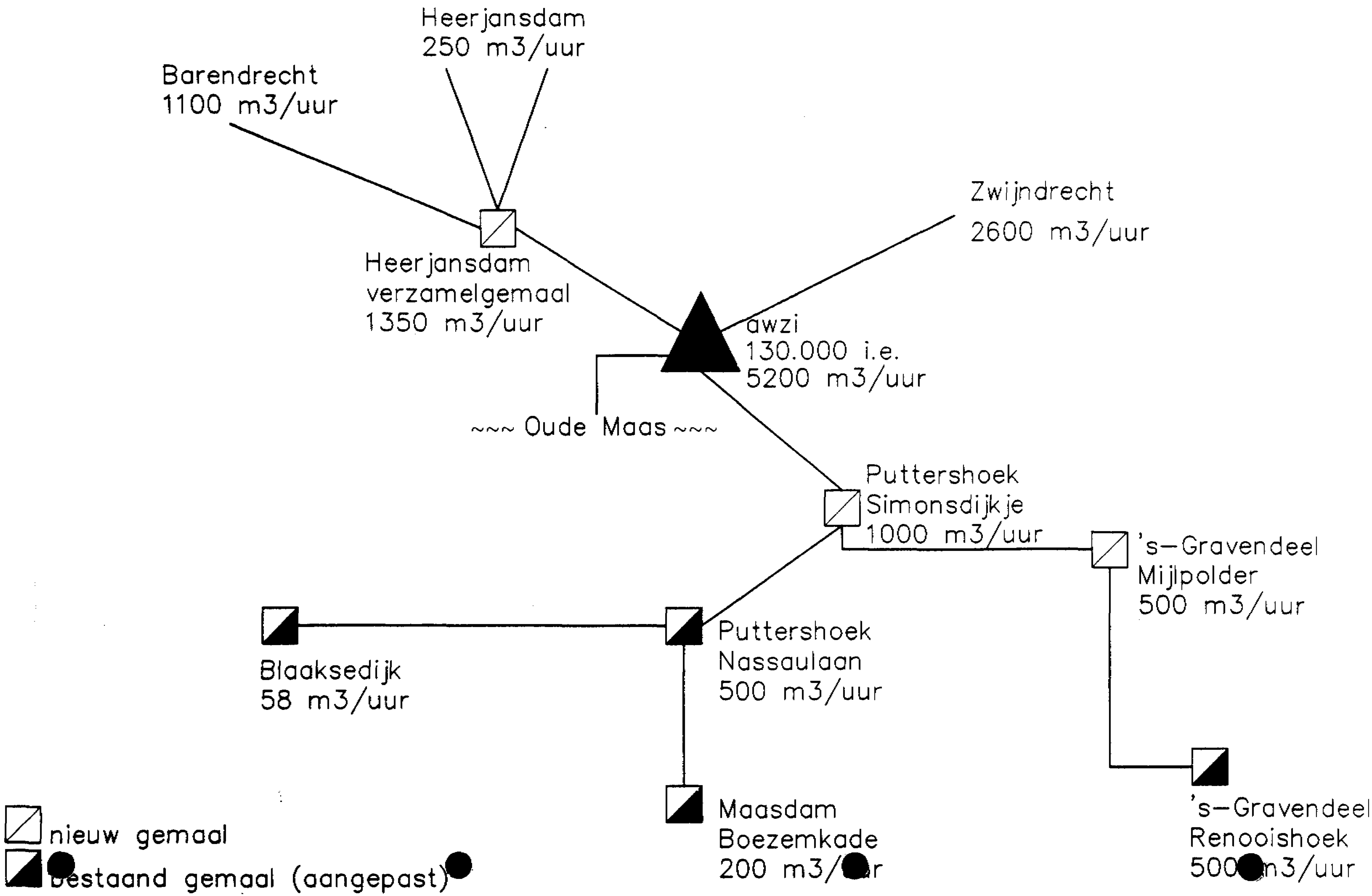
✓ Domestic polluters	17
✓ Water Quantity Authorities	6
✓ Chambers of Commerce and Trade	5
✓ Agricultural Organization	4
✓ Environmental Organization	2

- Executive Board (Chairman included) 7

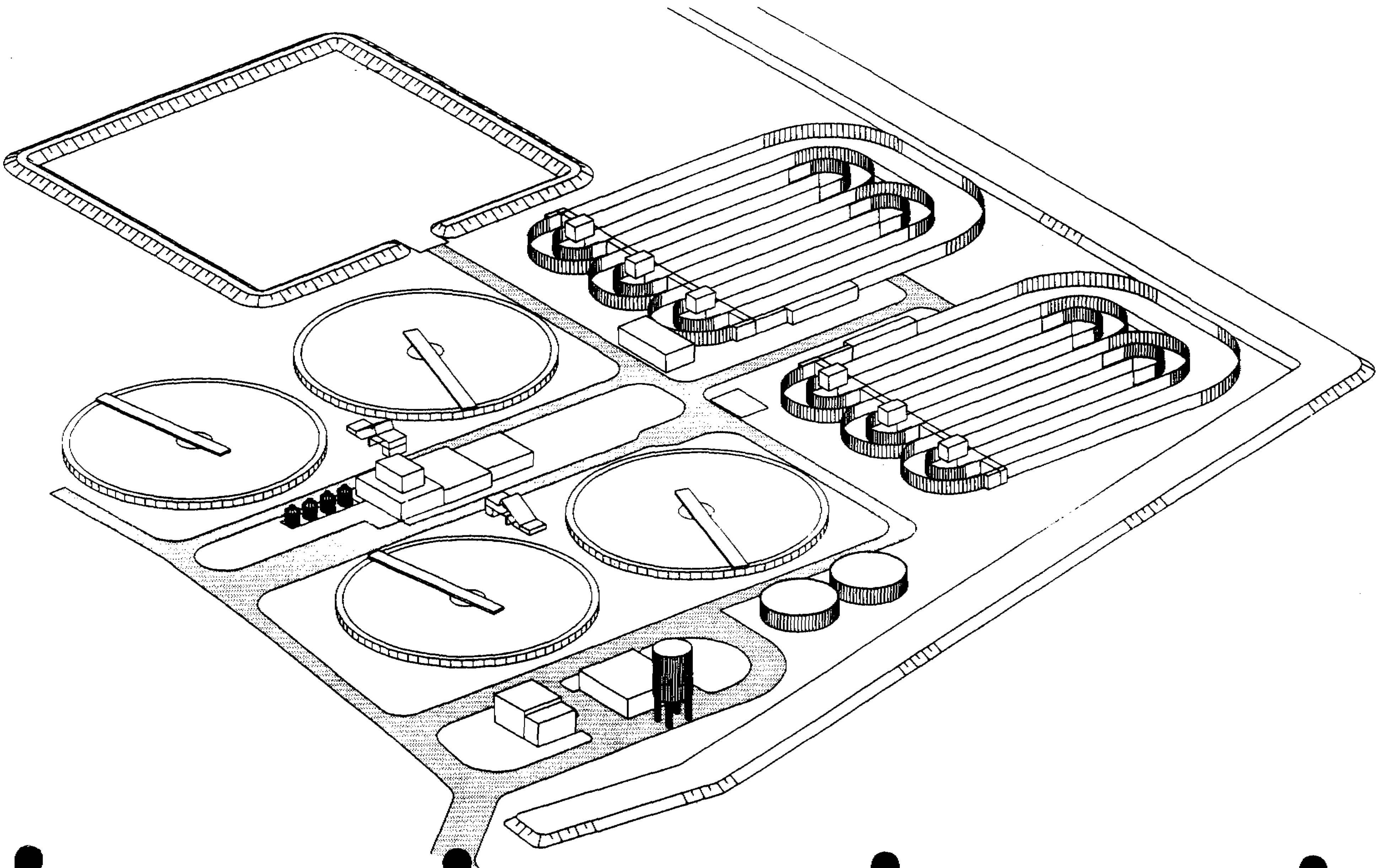
The Water Authority in brief

• Communities	43	
• Water Quantity Authorities	6	
• Total land area	139,000	ha
• Total water area	8,750	ha
• Recreational water	1,500	ha
• Number of polluting equivalent	1,470,000	ve
✓ domestic population	1,000,000	ve
✓ industrial population	470,000	ve
• Waste water treatment plants	47	
• Sewage pumping stations	94	
• Total annual turnover	Dfl. 126 mln.	

Transportsysteem awzi Zwijndrecht



awzi Zwijndrecht



IWACO

Profile
1994

Consultants for water and environment

Water resources management | Environment | Water supply and sanitation | Institutional development

DESCRIPTION OF MAIN PROJECTS *in Central & Eastern Europe.*

ALBANIA 1994 - 1995

Client : Dutch Ministry of Housing, Physical Planning and Environment
Financed by : Dutch Ministry of Housing, Physical Planning and Environment

Drinking Water Supply and Sanitation in Albania

The project comprises three phases. During phase 1 a review is made of the water supply and environmental sanitation sector (WS&ES) in Albania, followed by the selection of a town on which further project activities focus. A participative workshop following the Objectives Oriented Project Planning (OOPP) methodology, yielded insight in the hierarchy of problems and their solutions concerning water resources management and the WS&ES situation in thee selection town.
During phase 2 a training course is presented. The course consists of formal class and in-service training and focuses on the priority problems and their solutions, and prepares the attendants for phase 3.
During phase 3 a masterplan for the WS&ES of the town is prepared by a multi-sectoral and multidisciplinary working group comprising of local experts guided by consultants of IWACO and AQUANET. The masterplan gives directions for long-term strategy and a short-term action plan for direct measures for urgent problems concerning institutional, technical, financial and consumer relations issues.
All project activities are coordinated with other donor's activities in the water resources management and WS&ES sectors.

CZECH AND SLOVAK REPUBLICS 1992 - 1992

Client : Ministry of Defence, the Netherlands
Financed by :

Demonstration Project Tackling Soil Pollution on Military Sites

Demonstration of Dutch strategy (step-by-step approach) for investigation of contamination of soil and groundwater. The services provided by IWACO included:

- execution of historical and field surveys;
- guidance during environmental soil investigations;
- hazard assessment;
- feasibility studies of remedial actions;
- training in investigation strategy and remediation techniques.

Remedial actions were evaluated considering technical, environmental and financial criteria. The results were used by the Czech Ministry of Defence to make a more accurate estimate of the scale of soil pollution at military sites in the Czech and Slovak Republics.

CZECH REPUBLIC 1992 - 1992

Client : Province of Groningen, the Netherlands
Financed by : Ministry of Housing, Physical Planning and the Environment, the Netherlands

Course Soil Quality Management

The course, presented in Prague, is developed for government and corporate employees in charge of soil protection and pollution abatement. The course includes practical training such as organoleptical assessment of pollutants and sampling, but also planning of environmental soil investigations with restricted budget and the estimation of restoration costs.

CZECH REPUBLIC 1992 - 1994

Client : Ministry of Environment, Czech Republic
Financed by : Ministry of Housing, Physical Planning and the Environment, the Netherlands

Management of Groundwater Pollution at Uranium Mining Area "Straz Pod Ralskem-Hamr"

Development of a computer based Information System for aquifer rehabilitation at this uranium mining area of approximately 30 km² in North East Bohemia. The groundwater which is locally polluted up to a depth of 200 m, threatens nearby well fields for the drinking water supply and surface water which discharges into transboundary rivers. The services provided by IWACO included:

- modelling of groundwater flow with the finite element package TRIWACO-TRACE;
- modelling of contaminant transport with the three-dimensional finite element package METROPOL;
- set-up of a data base and user interfaces with the Geographical Information System ARC/INFO; and
- development of the Contaminant Transport Information System on a HP 720 workstation.

The Contaminant Transport Information System will be transferred to the client who will use it for the technical and environmental evaluation of alternatives for the rehabilitation and management of the regional groundwater resources.

CZECH REPUBLIC 1993 - 1993

Client : KAP Consultants
Financed by : Ministry of Environment, Prague

Hradcany Airbase

At Hradcany Airbase soil and groundwater are severely contaminated. A project for further investigation and remedial measures was set-up early 1993. The clean-up activities are expected to last 5 years. The services provided by IWACO in cooperation with KAP Consultants were to review the existing studies and clean-up activities, to develop an effective and cost efficient approach and to advise in the hydrogeological modelling.

CZECH REPUBLIC 1993 - 1994

Client : Ministry of Environment, Czech Republic
Financed by : Ministry of Housing, Physical Planning and Environment

Soil Restoration at the Former Soviet Army Base "Bechyne"

Demonstration project on polluted soil and groundwater remediation techniques. The project is carried out on a military base of the Ministry of Defence ("Bechyne") in the Czech Republic. The project includes a feasibility study and feasibility laboratory and field tests for mitigating measures at a site that is heavily contaminated with petroleum products. 4 clean-up alternatives are selected and elaborated up to design level. The selected alternatives are evaluated on technical, financial and environmental aspects (reduction of impact). The project is executed in close cooperation with a Czech consulting firm.

HUNGARY 1991 - 1993

Client : Ministry of Transport, Communication and Water Management
Financed by : EU-PHARE Programme

Groundwater Pollution Study

The project deals with the selection and application of tools and methods for soil and groundwater protection. The tools and methods will be used at national and regional level for the preparation and implementation of plans for the management and protection of groundwater. Some of the selected tools and methods are tested in a pilot area with a well field mainly abstracting bank filtered water from the Danube. The well field is threatened by accidental waves of pollution in the Danube and by diffuse and point pollution sources in the hinterland. Application of methods such as hazard assessment and environmental ranking using a tool-box comprising GIS and modelling software, resulted in a protection plan for the well field. A general strategy for groundwater protection in Hungary was elaborated and during two courses staff members of regional water and environmental authorities are trained in the use of concept methods and tools for soil and groundwater protection.

HUNGARY 1992 - 1993

Client : Multinational Brewer
Financed by : Multinational Brewer

Feasibility Study for the Water Supply of a Brewery

Water resources assessment and technical and financial evaluation of alternative options for the water supply of the brewery. Preliminary design of the selected alternative.

HUNGARY 1992 - 1992

Client : Oil Company
Financed by : KGI

Planning of Environmental Intervention of 20 Gasoline Stations

At 20 gasoline stations environmental soil investigations were conducted by local and foreign firms. These studies resulted in a global picture of the type and occurrence of soil and groundwater pollution in the vicinity of the gasoline stations. IWACO was requested to give recommendations for further preventive and remedial actions. The application of methods like hazard assessment, environmental ranking resulted in a plan which includes when, where and what kind of actions should be taken and what means are needed to carry out this actions.

HUNGARY 1994 - 1996

Client : Ministry of Transport, Communication and Water Management
Financed by : EU PHARE

Active Protection of Drinking Water Resources for Conditions Prevailing in Hungary

The project's aim is to develop government expertise in the active management of polluted aquifers to prevent (further) deterioration of drinking water production wells. Active aquifer management means the application of techniques intended to isolate contaminants and contaminant plumes from drinking water abstraction wells. The project comprises a review of techniques of active aquifer management in international practice, a compilation of EU case studies of active aquifer management and a study tour of selected case sites in EU-countries. The most considerable part of the project comprises feasibility-level design studies for remediation in three pilot areas in Hungary. The remediation techniques comprise all sorts of techniques to interfere in the groundwater flow system e.g. selective pumping (abstraction from selected wells or depths), interception wells, dilution, artificial recharge (or injection), impervious screens, etc. Also the use of lower-quality water for industrial use can be considered as an alternative. The source oriented measures like clean-up measures and preventive measures are included to obtain the most effective measures. Technical adequacy should be weighed against the costs (installation and operational). Besides, environmental effects and site specific conditions should be evaluated.

HUNGARY 1994 - 1995

Client : Ministry of Environment and Regional Policy
Financed by : EU-PHARE

Environmentally Beneficial Cultivating Technologies to Protect Subsurface Water Resources of Drinking Water Protective Areas

The project aims at the contribution to the expertise of the governmental technical staff to control agricultural pollution of drinking water sources. The project comprises the following activities:
- a study of groundwater pollution of Szentendrei Sziget Durâny as a pilot area;
- a review of laws, regulations and enforcement methods in three EEC-countries;
- a review of technologies found effective to reduce agricultural pollution of shallow water tables;
- set-up of recommendations and guidelines;
- study tour;
- training course.

HUNGARY 1995 - 1995

Client : Ministry of Environment and Regional Policy
Financed by : Ministry of Housing, Physical Planning and Environment

Study Tour of Hungarian Experts on Groundwater Protection

Study tour and training of Hungarian policy-makers, staff of regional authorities and water works. During the 10-days tour, Hungarian staff is exposed to the backgrounds of the Dutch groundwater protection policy, to the recent evaluation of the environmental efficiency and cost-effectivity of this policy, and to the recommendations for improvement. During the second part of the study tour, discussions with Dutch policy-makers and experts focus on the identification of realistic and feasible policy interventions for the solution of typical Hungarian issues for the protection of groundwater resources for drinking water supply.

KAZAKHSTAN 1994 - 1994

Client : IUCN/5 Central Asian Republics
Financed by : UNEP, UNDP

Central Asian Countries - Biodiversity Project

In September 1994 a workshop was organized in Almaty/Kasachstan by the Kasach Ministry for Ecology and Natural Resources. IWACO was represented by drs. P. Veen, specialist in ecology and environment. During the workshop the participants of the 5 countries presented a paper concerning biodiversity in the different countries. IWACO presented a paper concerning mapping the ecological networks in Central and Eastern Europe and the possibilities for Central Asia. The methodological and monitoring aspects were included in this paper. The paper will be published in the Proceedings of the workshop by IUCN.

LATVIA 1993 - 1993

Client : Drinking Water Supply Company "Udeka", Ventspils
Financed by : Rijnmond Environmental Control Agency (NL)

Pre-feasibility Study for the Rehabilitation of Ventspils Urban Water Supply

An assessment of water consumption, water sources (surface and groundwater), production and distribution of drinking water and water quality aspects was followed by an evaluation, cost estimate and priority ranking of measures to improve the drinking and industrial water supply. Priority measures include improvement of consumer relations, installation of water meters, the construction of a simple groundwater treatment plant and relatively cheap measures to rehabilitate the distribution network and the surface water treatment plant. More expensive measures, such as the application of cement lining in cast iron and steel distribution pipes can be tackled later and implemented during a longer period of time.

POLAND 1993 - 1993

Client : NOVEM
Financed by : NOVEM

Project Preparation for Feasibility Study for the Re-use of Mining Waste

Preparation of an article in which the results of a Dutch feasibility study on the re-use of mining wastes in construction materials via fluid bed combustion and combined energy utilization, are presented and the possibilities of the method for a Polish region discussed. Presentation of the article at the 4th International Symposium on the Reclamation, Treatment and Utilization of Coal Mining Wastes (6-10 September 1993, Krakow).

POLAND 1995 - 1996

Client : Ministry of Environmental Protection, Natural Resources and Forestry
Financed by : EU-PHARE/National Fund for Environmental Protection and Water Management

Strengthening Quality Assurance in Environmental Laboratories

The project is directed to enhance Quality Assurance in environmental monitoring laboratories in Poland in accordance with Polish and European EN-45001/3 standards. A training manual is developed and a training programme organized for 130 representatives of laboratories selected by the State Inspectorate for Environmental Protection. The training is performed in consultation with the Polish Centre for Research and Certification (PCBC). In addition to the training programme in Poland, the trainees visit certified environmental monitoring laboratories in the Netherlands at IWACO and two governmental laboratories. IWACO as lead consultant implements this project in collaboration with partners from the United Kingdom and Poland.

POLAND, HUNGARY, SLOVAK REPUBLIC, CZECH REPUBLIC 1992 - 1996

Client : International Union for the Conservation of Nature (IUCN)
Financed by : Dutch Programme Supporting Central and Eastern Europe (PSO)

Project National Nature Plans

The National Nature Plans in the 4 Central European countries are started for enlarging the EECONET-concept to the Central European countries. The EECONET-concept was prepared by the Institute for European Environmental Policy on behalf of the Dutch Ministry for Agriculture, Nature Management and Fisheries to provide in a sustainable network of nature reserves in the countries of the EC. In the National Nature Plans the natural values are mapped and additional proposals for policy making are planned. In the project are involved a large number of scientists in the Central Europe countries.

ROMANIA 1994 - 1995

Client : Ministry of Waters, Forestry and Environmental Protection
Financed by : UNDP

Action Plans for Reducing Environmental Hazards from Industry

The activities resulted in an Environmental Action Plan for the heavily polluted industrial region of Onesti-Borzesti-Bacau. For this purpose, environmental audits at industrial enterprises are carried out. Furthermore, environmental impact assessment (EIA) of air pollution, surface water pollution and soil/groundwater pollution by industrial enterprises, a power plant and solid waste disposal sites (landfills), provides a basis for priority setting and planning. The Action Plan gives directions for sustainable industrial development for the long-term and a short-term action plan with 20 priority investment projects to address immediate risks to human health. The project is executed in a participatory way and includes 'on-the-job' training of Romanian counterparts.

ROMANIA 1994 - 1996

Client : Ministry of Water, Forestry and Environmental Protection
Financed by : EU-PHARE

Long-term Assistance to the International Programmes and Projects Unit (IPPU) in the Ministry of Waters, Forestry and Environmental Protection

The Romanian Ministry of Water, Forestry and Environmental Protection has established an International Programmes and Projects Unit (IPPU) to be responsible for the identification, assistance in preparation, appraisal, financing and supervision of the implementation of environmental programmes and projects financed by PHARE and other foreign multi-lateral and bilateral development agencies. Through long-term assignments IWACO assists in the building of a well functioning and efficient unit. The services focus on:

- policy development and the translation of objectives into operational targets, plans and budgets;
- set-up of organizational arrangements, procedures and systems for administrative, financial and physical project implementation;
- supporting through technical and operational advice, the implementation of PHARE projects such as the National Environmental Monitoring Master Plan;
- training and human resources development;
- advise of the Secretary of State and the Minister on matters of environmental policy and management, particularly on integrating environmental aspects into the restructuring of Rumanian industry.

RUSSIA 1994 - 1995

Client : Purneftegas Oil Production Association (PNG)
Financed by : EBRD

West Siberia Oil and Gas Rehabilitation Project - Environmental Management and Monitoring

The project aims at institutional strengthening of the Environmental Protection Unit (EPU) of Purneftegas Oil Production Association (PNG) and the establishment of an Environmental Laboratory in Western Siberia. IWACO is responsible for the establishment of the laboratory. The flooding activities are implemented in close cooperation with relevant organizational units of PNG:

- elaboration of short term and long term objectives of the environmental laboratory, its tasks and responsibilities and its relations to the other organizational units of PNG;
- definition of operational priorities in terms of collection and analysis of samples;
- design of the laboratory;
- procurement and testing of laboratory equipment;
- planning and development of processes and procedures;
- implementation of the processes and procedures;
- training of laboratory staff and sampling teams;
- evaluation of the performance of the laboratory.

SLOVAK REPUBLIC 1994 - 1995

Client : Dutch Ministry of Agriculture, Nature Management and Fisheries (LNV)
Financed by : Dutch Ministry LNV

Inventory of the Natural Heritage of the Ipel' River Catchment Area, Phase 1

The project is closely related with an identical project in Hungary (started in 1992). The goal of the projects is to make investigations of the natural and cultural values in the project area. Also the water management is taken-up in the projects. The data of the investigations have been integrated in a spatial concept of a Transboundary Nature Heritage Park Danube-Ipoly. In the spatial concept also actual land use is an important factor by analyzing the involvements of reprivatization. The final outcome of the project is an integrated concept.

SLOVAK REPUBLIC 1994 - 1994

Client : EBRD
Financed by : EBRD

Investigation of Soil & Groundwater at ZSNP and Slovalco facilities

Study included environmental baseline investigations at the alumina plant facilities of ZSNP and Slovalco in Ziar, Slovakia. The investigations identifies issues and areas of concern related to soil and groundwater contamination affecting the plant facilities from on-site and off-site sources. With the results of the baseline surveys three risk based scenarios of remedial measures were developed and evaluated on environmental efficiency and costs. A masterplan was prepared for the selected scenario and legal aspects and liabilities elaborated. The study covering an area of 40 ha has been completed within a tight time schedule of 3 months.

SLOVAK REPUBLIC 1995 - 1996

Client : Slovak Ministry of Environment
Financed by : SENTER (the Netherlands)

Transfer of Know-how on Soil Remediation Techniques to Slovak Environmental Engineering Offices

The project is directed to transferring knowledge and practical experience during the preparation of a masterplan for contaminant, mitigation and clean-up measures to be taken at Sliac Airport. Sliac Airport is a large former Russian airbase and known as the most polluted site in the country. Before the project started, various studies and clean-up measures have been carried out, revealing the serious risks for public health and the environment but also the lack of experience in the country with the planning and implementation of large soil quality management projects. Apart of the transfer of technical concepts, methods and tools, sufficient attention is paid to increase the project planning and management abilities of the Slovak participants of the project team, and to elaborate working mechanisms and procedures between the different actors, such as governments, consultancy firms and contractors. The Slovak participants are key-staff of 6 Slovak consulting firms and an research institute of the Slovak Ministry of Environment. Parallel to the preparation of the master plan other activities are carried out such as: (i) implementation of courses ("Soil Quality Management" and "Project Management"); and (ii) the establishment of a Help Desk/Commission Soil Quality Management at the aforementioned research institute. Tasks of such a help desk are being elaborated but can include the maintenance and distribution of courses and software, a knowledge base for local governments, industries, consulting firms, etc., and advise to policy makers of the Ministry of Environment on new policies legislation, methods and tools.

UZBEKISTAN 1994 - 1994

Client : World Bank
Financed by : IBRD

Consulting Services for a Review of the Right Bank Collector Drain (RBCD)

In-depth review of the existing feasibility study plans and designs prepared for this 1.050 km long drainage canal on the right bank of the Amu Darya river. The drainage canal with design discharges from 13 m^3/s at its upper end to 160 m^3/s at the Aral Sea, should prevent further deterioration of the quality of the river water which would have detrimental effects on irrigation and drinking water supply, particularly in the Amu Darya delta. IWACO is charged with the ecological aspects for the assignment, including:

- identifying the main environmental issues related to irrigation and drainage;
- reviewing the linkage between the development of water retaining basins/polders on the exposed Aral Sea bed with water supplied from the RBCD;
- identifying any specific environmental issues related to the construction of the RBCD, including the need for water quality enhancement;
- preparation of terms of reference for an irrigation and drainage environmental sector review and an environmental impact assessment for the RBCD;
- reviewing the need for and feasibility of possible water quality enhancement projects related to the RBCD (desalinization, biological treatment, constructed wetland).

IWACO

IWACO, Consultants for water and environment

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Seminar

October 12, 1994

Rehabilitation of the River Hollandse IJssel

IHE DELFT

International Institute for
Infrastructural, Hydraulic and
Environmental Engineering

The Netherlands

Rehabilitation of the River Hollandse IJssel

IHE
DELFT

INSTITUTIONAL LEAFLET

Institute:

International Institute for Infrastructural, Hydraulic and Environmental Engineering (IHE)

Goal of the institute:

To contribute to the international exchange of knowledge and skills in science and technology among professionals in order to achieve a more equal distribution of knowledge and to increase the capacity of institutions in the under-developed and developing countries.

Core disciplines:

Education, training and research in:

* Infrastructural Engineering: Transportation and road engineering; Physical planning; Port management; Inland waterways.
* Hydraulic Engineering and Hydrology: River engineering; Coastal estuarial and harbour engineering; Land and water development; Hydroinformatics; Surface water hydrology; Groundwater hydrology; Water resources management.
* Environmental Engineering: Water supply and sanitation; Environmental science and technology; Water quality management; (marine, freshwater, terrestrial) Ecology; Environmental sanitation and management.

Type of expertise:

The following expertise related to infrastructure, water and environment is available at IHE:

Education, training and transfer of technology
- Regular Diploma and M.Sc. Courses in Delft
  Intended for professionals, particularly junior and mid-career personnel, from countries in Asia, Africa, Latin America and Central and Eastern Europe.
- Regular Short Courses in Delft
  Specialized, regular, short, non-degree management and refresher courses. Intended for selected groups of senior professionals, managers and administrators.
- Tailor-Made Courses in Delft or Abroad
  Designed especially to meet the training needs of the target group concerned: ministries, water authorities, environmental agencies and non-governmental organizations.

Institutional strengthening/restructuring/capacity building
- Strengthening of technical education, training and research institutions by means of staff development, curriculum development, management upgrading, training materials development, facilities upgrading etc.
- Human resources requirements studies/training needs assessments.
- Transfer of full-course programmes from IHE to institutions in the developing world.

Strategic and applied research
- Research design/evaluation
- Research capacity building by, among others, Ph.D. programmes at IHE
- Contract research

Advice
- Short term technical assistance and advisory services.
- Project identification and formulation.
- Project monitoring and evaluation.

Contact address

Rector:	Prof.ir. W.A. Segeren
Tel.:	015 - 151715
Telex:	38099 ihe nl
Fax:	015 - 122921

Countries

Czech Republic, Slovak Republic, Hungary, Poland and Latvia

Counterpart

Institute of Environmental Engineering
University of Technology, Warsaw, Poland

Aims

To acquaint the participants of the course with all relevant aspects of environmental management

External Support Agency

The Netherlands Government/Ministry of Housing, Physical Planning and Environment

Duration

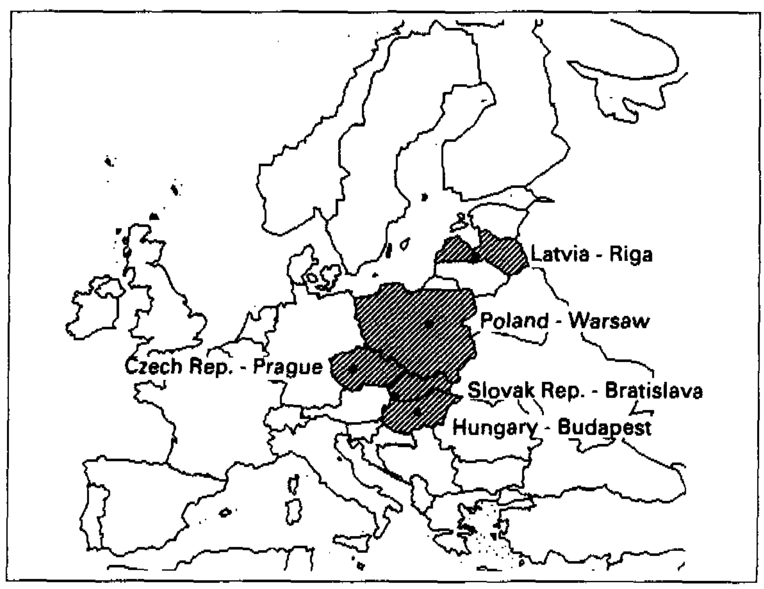
October 1990 - present

One year postgraduate course on Environmental Sanitation and Management (ESM)
for Central and Eastern Europe

Description

With the opening of the former socialist countries in the late 80's, it became clear that the environment in these countries had been seriously neglected for decades. Consequently, the need for large-scale environment rehabilitation programmes became evident. However, in line with the general attitude towards environmental issues, adequately trained staff to address the environmental challenge, was not available. The Dutch Ministry of Housing, Physical Planning and Environment (VROM) together with other ministries have adopted a programme aiming at improving the conditions for environmental rehabilitation, also by contributing to the process of capacity building.

The Environmental Sanitation and Management (ESM) course deals with the management of the environment in general. Attention has been given also to compound management, specifically to the compounds with a large environmental impact including micropollutants. Sequentially, the source, the fate, the environmental impact and the detection and analysis of compounds are discusse followed by legislative and process technological aspects.The target countries were Poland, Czechoslovakia and Hungary during the first courses. In the future the course will also be targetted to other countries in Central and Eastern Europe as well as to the rest of the world.



IHE DELFT

Infrastructure
Hydraulics
Environment

Because of the explicit policy of the funding agency, the Ministry of VROM, to transfer in due time the course to one of the countries for which the course was intended (Poland, Hungary and Czechoslovakia), the first phase initially will be organized in Warsaw, Poland. Extensive contributions from Polish lecturers in addition to limited contributions from lecturers from Hungary and Czech Republic were the basis for the transfer of the course. Also during part of the next course the first phase will be organized in Warsaw, Poland, in order to continue the process of transferring the course to Central Europe. The Institute of Environmental Engineering in Warsaw has received a grant for their government to contribute to the next course.

Project Activities

- Training and education of junior and mid-career staff of government agencies focused on:
  - Enhancing scientific/engineering expertise
  - Improving a problem solving attitude
  - Enhancing oral communication and writing skills
  - Improving insight into and overview of links between environmental compartments, processes, events.

- Training of trainers

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Cable **Interwater**

Rector: **Prof. Wil Segeren**

IHE
DELFT

Infrastructure
Hydraulics
Environment

Education, Training and Transfer of Technology
- Diploma Courses
- PhD Programme
- MSc Courses
- Short Courses
- Tailor-made Courses

Institutional Strengthening/ Restructuring/ Capacity Building

Strategic and Applied Research

Advice

Country

Czech Republic

unterpart

Technical University of Prague,
Faculty of Civil Engineering,
Water Management Branch

Aims

Institutional strengthening of the Czech Technical University in Prague through capacity building in the priority areas of environmental protection and water management

External Support Agency

Commission of the European Community, TEMPUS

ration

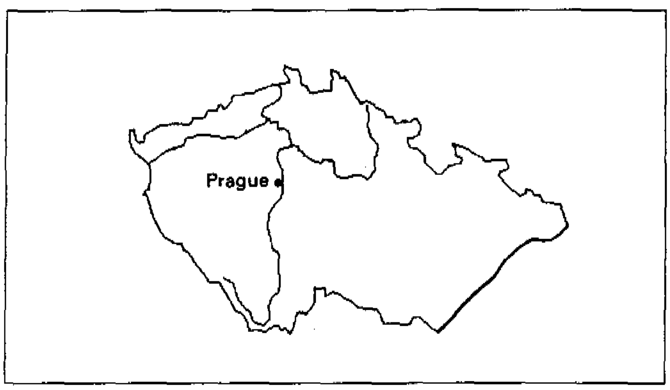
ecember 1990 - 30 September 1993

An institutional strengthening programme on Hydroinformatics for Advanced Environmental Engineering

Description

In order to reduce the scientific isolation of university staff members in Central and Eastern Europe through the establishment of contacts with organizations and institutes in European Community member states, the TEMPUS (Trans-European Mobility Scheme for University Studies) was set up by the EC.

Under this programme IHE implemented an institutional strengthening programme in 'Hydroinformatics for Advanced Environmental Engineering' with the Czech Technical University of Prague, Water Management branch and various specialized Czech organizations, such as among others The Czech Hydro-meteorological Institute, Institute for Hydrodynamics and Prague Sewer and Water Board. Other subcontractors involved were Delft Hydraulics and Danish Hydraulic Institute.

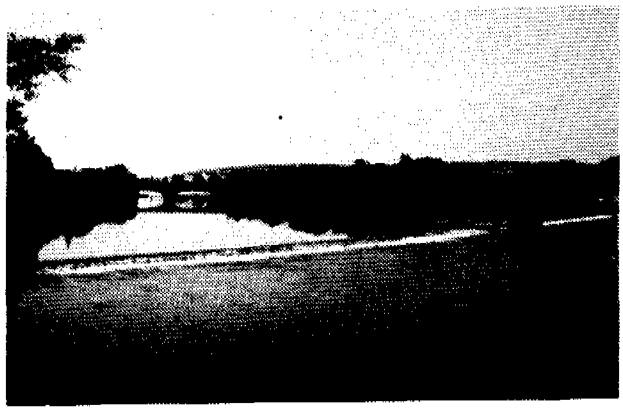


Czech Republic

Project Activities

- Education management development
- Staff development
- Training of trainers
- Curriculum development
- Development and organization of short courses
- Staff exchange
- Supply of teaching aids

Czech Technical University, Prague



Vltava River, Prague

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Infrastructure
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Education, Training and Transfer of Technology
- Diploma Courses
- PhD Programme
- MSc Courses
- Short Courses
- Tailor-made Courses

Institutional Strengthening/ Restructuring/ Capacity Building

Strategic and Applied Research

Advice

Rehabilitation of the River Hollandse IJssel

Introduction and Objectives

Maarten Siebel
Martin Bijlsma
Ton Jacobs

IHE-Delft

Rehabilitation of the river Hollandse IJssel

1. OBJECTIVES

The objective of the seminar is to give the participants an insight into the formal and informal aspects of governmental project planning, decision making and execution in a large environmental issue in The Netherlands. It will show the many actors and opinions which are involved in such an issue and illustrate the complications in reaching an unambiguous decision in The Netherlands.

The rehabilitation project of the river Hollandse IJssel will be used as an example. Sanitation or clean up of this river is urgently required to improve quality of river water and of the land along the river banks, making it again fit for recreational use and for housing and other land uses, respectively. However, river sanitation will result in the generation of large amounts of heavily polluted solid waste and sediments.

The issue of solid waste disposal will play a central role in the seminar. Due to the lack of disposal capacity in The Netherlands, it has been proposed in 1991 by the provincial government to construct a very large solid waste disposal site near Moordrecht, a small town located along the river Hollandse IJssel. Although the residents of Moordrecht would benefit from a rehabilitated river, the proposed disposal site, essential for the sanitation project, is considered unacceptable by the same residents (an example of the *Not In My Backyard* effect).

The provincial government is therefore faced with the problem that, although the need for river water and river bank sanitation is clear for all parties involved, the chosen option for the disposal of the solid waste is considered unacceptable by environmental protection groups and by the local residents.

It will be the objective of the seminar to find a solution for this environmental problem, by looking at the situation of the river from different points of view. These different points of view will be simulated by means of a role play, in which a variety of interest groups will be represented. The seminar participants are therefore invited to assume the role of one of the groups having an interest in the sanitation project and to study and discuss the rehabilitation project.

The actual developments in the past years which have finally led to a decision taken by the Province will be discussed after the outcomes of the role play have been presented. These developments and resulting decision will then be addressed in a plenary session.

2. BACKGROUND

2.1 Pollution of the river Hollandse IJssel

The river Hollandse IJssel is one of the smaller rivers in the centre of The Netherlands. The river section under consideration in the seminar is bordered by the town Gouda in the north and the town Krimpen aan de IJssel in the south. The main source of water for the Hollandse IJssel is the water from the surrounding polder areas, which are drained by means of sixteen pumping stations. Furthermore, the river receives the discharge water from industries and the effluent from five domestic waste water treatment plants, while water from the river Nieuwe Maas (New Meusse) is entering the Hollandse IJssel river in the south.

The river water contains nutrients, heavy metals, pesticides, PCB's and PAH's (Polycyclic Aromatic Hydrocarbons) as a result from all these contributing sources. Since the eighties, the river is considered as the most polluted river in The Netherlands. Consumption of fish caught in the river is prohibited. The water pollution is also causing problems for the surrounding polder areas, which take in river water during the dry summer periods, resulting in spreading of the pollution into the 'clean' polders. Although the prime use of the river is transport, the river is still used for recreational purposes, fishing, sailing and even swimming, in spite of the poor water quality.

The water quality is continuously affected by the heavily polluted river bottom sediments. River depths have reduced as a result of sediment accumulation and dredging of the river is urgently required to allow for proper navigation. Rijkswaterstaat, the organisation responsible for river management, has closed the river for larger ships already. The river bottom sediments contain high levels of organic and inorganic micro pollutants. The sediment pollution is derived from the past, when the river Hollandse IJssel acted as a kind of sedimentation basin for the previously heavily polluted river Rhine. Due to tidal action, the water in the Hollandse IJssel remains quiescent during several hours each day, allowing even the finest - and therefore most polluted - sediment particles to settle down. Swimming and fishing is forbidden as boat traffic continuously resuspends polluted sediments. Concluding, the river water poses significant risks to public health.

Besides the river water, also the land along the banks of the river Hollandse IJssel, the so-called *'zellingen'*, are severely polluted. This is a result of uncontrolled disposal of - hazardous - solid waste during the fifties by companies in the Rotterdam region. At that time, these areas along the river banks or *zellingen* were practically used as solid waste disposal sites, resulting in the present situation that these areas are not fit for domestic use, such as housing.

The river pollution has resulted in deterioration of living conditions in the area along the river Hollandse IJssel; the population is moving away and economical activity is decreasing. Therefore, in

1987, six municipalities located along the river (Gouda, Moordrecht, Ouderkerk, Nieuwerkerk, Krimpen and Cappele aan de IJssel), request measures to be taken by the province of Zuid-Holland, to improve the living conditions through an extensive river sanitation project. As a result, a Steering Committee Hollandse IJssel is formed in 1988, consisting of representatives from the six municipalities, three regional Water Boards and of three Governmental Ministries. The provincial government of the Province Zuid Holland chairs this committee.

2.2 Project "Rehabilitation of the Hollandse IJssel"

The Steering Committee charged in 1988 a consultants group with the execution of a study on the integral rehabilitation of the polluted river and its banks. The study consists of two phases; the initial phase and the final phase. The initial phase of the study primarily inventorizes the present conditions of the river and its banks and inventorizes the available clean-up methodologies, while it furthermore proposes alternative approaches for the clean-up procedure on the basis of various scenarios for river and river bank use. The second and final phase of the study will lead to the actual rehabilitation, to be decided upon on the basis of the results of the initial phase.

In 1991, on the basis of the results of the initial phase, the Steering Committee takes two decisions. A 'decision in principle' is taken, determining the frame work for the Rehabilitation Project. This 'decision in principle' describes the basis of the Hollandse IJssel Rehabilitation Project, which is to assure that public health hazards from the use of the river and of the *zellingen* after completion of the rehabilitation project should be negligible.

Furthermore, the 'decision in principle' indicates the area in which disposal sites for the polluted river bottom sediments and waste from the rivers banks should be located. As treatment of the polluted sediments is considered economically and technically unfeasible, the Province decides for disposal of the waste. However, disposal poses a big problem, as disposal sites for - hazardous - solid waste in The Netherlands are almost non-existing. The second decision is therefore to produce a starting document for conducting an environmental impact assessment study for the construction of a large disposal site in the Zuid Plas polder, near the town of Moordrecht.

The key findings of the initial study phase are

- Present-day (1991) technology is not (yet) adequate for the large scale treatment of the polluted sediments. Consequently, sediment dredging and disposal at an isolated and controlled site is the only possibility for rehabilitating the river sediments.

- A total of 3.3 million m^3 of polluted river sediment and approximately 800,000 to 1,000,000 million m^3 of polluted soil from the river banks or *zellingen* and approximately 730,000 m^3 waste water treatment sludge will have to stored at a disposal site.

- A disposal site with a surface area in between 60 to 80 ha is needed for the storage of these amounts of waste.

- Total project costs are provisionally estimated a 1.6 billion dutch guilders (approximately 809 million US $).

In the frame work of public information and participation, details of the rehabilitation project including the proposed disposal site were publicized by the Province in local and national newspapers, while furthermore public participation meetings were held. The Steering Committee regularly meets with a Platform Committee, consisting of interest groups which are in any way involved in the project.

The non-governmental organisation Nature and Environment (*Natuur en Milieu*), an environmental protection organisation, considers construction of the disposal site in the Zuid Plas polder unacceptable, as it would affect the so-called Green Heart of Holland. The Green Heart of Holland consists of a natural and agricultural area in the middle of The Netherlands, surrounded by the large Dutch cities Utrecht, Amsterdam, The Hague and Rotterdam. This green area is kept free of large - industrial - projects to maintain its present function of providing a relatively undisturbed nature reserve.

After publication of the proposed river rehabilitation project, local residents, who are concerned about the consequences and effects of the rehabilitation project for their neighbourhood are organizing themselves in pressure groups. Although the residents of the city of Moordrecht would benefit from the sanitation of the river Hollandse IJssel, they consider a large disposal site in the - still - unpolluted polder near the city an unacceptable solution.

3. SEMINAR ORGANISATION

The seminar consists of introductions by resource persons involved in the river sanitation project; discussions of the environmental problem by means of a role play and a plenary discussion.

Resource persons are invited from i) the Province of South Holland, the governmental body responsible for decision taking; ii) Rijkswaterstaat, the central government organisation responsible for the management of the river Hollandse IJssel and implementation of the dredging project; iii) Nature and Environment (*Natuur en Milieu*), the non-governmental organisation for environmental protection and iv) the Moordrecht Environmental Association, representing the Moordrecht residents.

The morning session of the seminar will deal with the environmental problem in 1991, after the Province has announced the rehabilitation project of the river Hollandse IJssel, including the plan for the construction of a disposal site nearby the small Town of Moordrecht. The situation at that stage will be described by the resource persons from the Province, Rijkswaterstaat and Nature and Environment. The resource persons will explain their point of view and the role of their organisation in the decision making process.

The seminar participants will then be invited to form small groups to discuss the described problem and to come up with answers to the questions brought forward by the resource persons. This will be done in the form of a role play, in which each group will act as one of the interest groups or institutions (government, ngo/local population). The results of these discussions will be presented briefly. The objective of the role play is to come up with an approach of the problem agreed upon by the various interested parties.

After the presentations by each of the role play groups, the developments between 1991 and 1994 will be addressed. During these three years, the local residents in Moordrecht have organised themselves in an environmental association, which has successfully challenged the Province's choice for a large disposal site near Moordrecht. The actions of the Moordrecht Environmental Association have, although among other parallel developments, resulted in the decision by the Province not to proceed with the disposal site as originally proposed in 1991.

The developments which have led to the cancellation of the original proposal will be presented by the resource person from the Province. The representative from the Moordrecht Environmental Association will explain how they successfully acted against proposal from 1991.

These two presentations will then be followed by a panel discussion in which the seminar participants are invited to give their opinion on the procedures as presented by the two representatives.

Role Play

The objective of the role play is to make an integrated and flexible plan for the Hollandse IJssel problem, based on the information presented by the resource persons on the situation in 1991. Matters to be addressed are the environmental clean-up and the development of better physical planning towards protection of 'green' values. *Integration* means a combination of the financial resources, *flexibility* means that the strict application of rules and regulations may not bring the execution of the project to a halt.

1. *Players in the Role Play*

Various roles in the planning and decision taking process are allocated as follows;

Group 1: Government & Steering Group (civil servants)

Group 1 consists of civil servants; the chairman of the Steering Committee Hollandse IJssel (a full time politician of the provincial government) and three civil servants belonging to the Steering Committee, e.g. a public relations officer, a representative of Dpt. of Water and Environment and a representative of the Department of Physical Planning and Nature Conservation.

Group 2: Moordrecht residents and NGO for citizen support

Group 2 consists of the residents living in Moordrecht; one resident living in Moordrecht, but working elsewhere; one Moordrecht farmer, a company owner/entrepreneur based in Gouda depending transport of his goods be the canal and a representative of the NGO for environmental protection.

Group 3: Concerned & interested citizens from elsewhere in The Netherlands

Group 3 consists of citizens of The Netherlands who are critically following the developments in this case, although they do not have a direct (personal) interest in the case. Their task is to monitor the decision making process and to critically evaluate contributions from both group 1 and group 2.

2. *Resource Persons*

The resource persons will be active in providing clarifications and additional information on the political implications, on the rehabilitation project Hollandse IJssel and other relevant matters. Time table:

11.00 h	Allocation of roles and tasks
11.15 h	Information Phase (talking groupwise resource persons)
11.40 h	Group discussions
12.30 h	Formulation of findings and conclusions
13.30 h (after lunch)	Presentation of findings and conclusion

Rehabilitation of the River Hollandse IJssel

The Role of the Government

Bert van Dijk

Province of Zuid-Holland

MAIN PROBLEMS

- 20 km of river seriously polluted
  1.8 - 5 million m3 of sludge

- 41 sites (seriously) polluted
  0.3 -2.2 million m3 of soil

- costs of cleaning fl. 750 - 1650 million

- 13 government organisations

SOURCES OF POLLUTION

- Inflow of rivers
  (Rijn and Gouwe)

- Discharges bij agricultural, industrial and domestic sources

- Effluent of wastewater treatment plants

- (Il)legal dumping locations

PRINCIPAL OBJECTIVES

- Restauration and maintenance of the quality of:
  * surface and groundwater
  * riverbanks and sediment

- Prevention of impoverishment of the area

- Development of Hollandsche IJssel as part of the "Green Heart"

ADMINISTRATIVE STAGES

July 1987
letter from 6 IJssel local authorities

March 1988
setting up steering committee

May 1989
order for study

June 1990
final report

March 1991
decision in principle
starting document environmental impact assesment

DECISION IN PRINCIPLE

1. Description of problem and general project objectives

2. Development of compartments

   - objectives/functional level
   - opportunities for variation
   - financing the cleaning

3. Dumping location

   - position EIA Hollandsche IJssel
   - relation to other studies
   - locations to be examined

4. Agreement

   - starting points

POLICY ASPECTS

1. Planning developments
   - use value of the area
   - future value of the area

2. Environmental quality
   - is the cleaning sustainable
   - environmental efficiency
     of the measures

3. Time
   - programming the cleaning
   - chances for non governemental
     initiatives and investment

4. Money
   - cost-effectiveness
     of the integrated approach
   - cost allocation

5. Organisation
   - democratic control
   - directed towards project execution

PLANNING DEVELOPMENT

1. LANDSCAPE-STRUCTURAL PLAN ZUIDPLASPOLDER

Relations with sanitation Hollandsche IJssel:

- restriction of the storage site during use
  advantages of (recreation)site after completion

- planning effects of various alternatives
  (location, size, and period of use)

- significance of a clean river for
  overall development of the Zuidplaspolder

2. STUDY THE RIVER AND ITS BANKS

- development proposals for the banks
  45 hectares will be freed for housing,
  recreation or nature
- plans for swimming and fishing facilities

3.LANDALLOTMENTPLAN KRIMPENERWAARD

- towards sustainable agriculture
- enlargement nature reserves

ENVIRONMENTAL IMPACT ASSESMENT HOLLANDSCHE IJSSEL

Three considerations:

* 1 dumping location versus 41 dumping locations

  - control of spread into environment
  - costs of facilities and maintenance

* Comparison between 8 locations in the region

  - risks of spread
  - nature and the landscape
  - nuisance and health

* Comparison with possibilities elsewhere

  - environment
  - costs
  - time to complete

WHY AN INTEGRATED APPROACH

TECHNICAL REASONS

- connections between sub-problems
- partial solutions are not effective
- cost-effectiveness of integrated approach
- cleaning to be coordinated with development

ADMINISTRATIVE REASONS

- increases support for/urgency of seperate measures
- streamlining of decision-making and efforts by all authorities
- wide policy support for difficult decisions
- positive effects on non-governamental initiatives and investment

POLICY AREA AND SCENARIO'S

ENVIRONMENTAL QUALITY

poor | acceptable | very good | exceptional

PLANNING DEVELOPMENT

no opportunities | good opportunities

COSTS

750 million | 1200 million

← POLLICY AREA →

+++++++++++++++++++++++++

SCENARIO'S

present situation | basic | growth + + | major cleaning

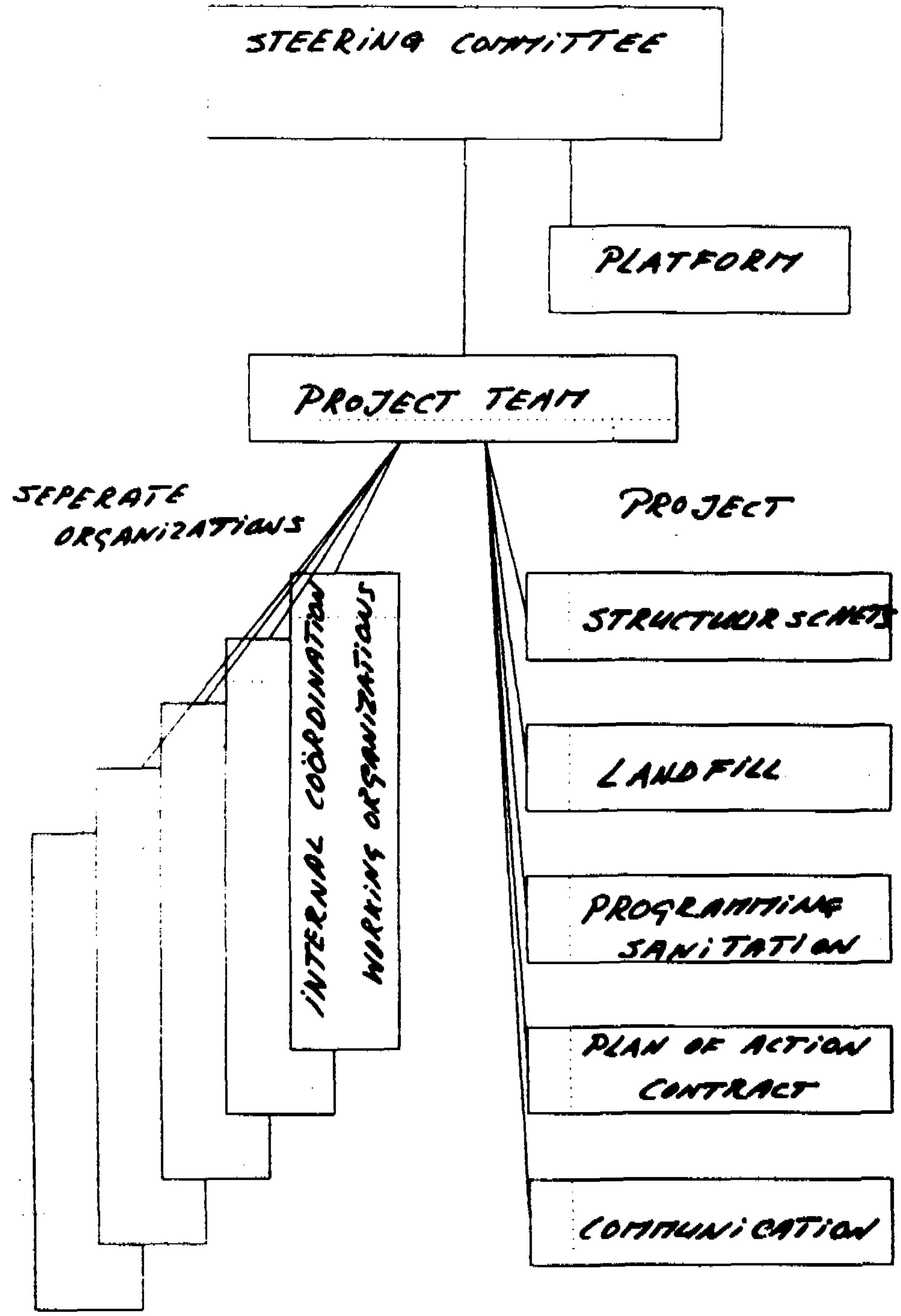
PLANNED ACTIVITIES		
	sep '91 jun'92	further
Planning develop-ment	landscapestuctural plan >+++++++ * ======== * Plan river and banks <++++++ * ======== *	
EIA dumping location	Phase 1 pre-selection <++++++ * ======= *	Phase 2 * end '92 Realisati-on ?/ '95
Organisa-tion	Study >++++++	
Finance	Study >++++++	
Program for sanitation	Study >+++++++ * ======= *	Start sanitation activities '93
Agree-ment	>++ * =======	decision end '92
Commu-nication	* annual report permanent activities steering committee and platform	mailing compag-nies '92

STATEMENTS

1. Sanitation requires a clear view on:
   - present and future risks of pollution
   - environmental benefits of proposed solutions

2. Sanitation must be coordinated with deveopment
   - nobody likes to spend money for solving only a problem
   - new opportunities for (non-governemental) initiatives can raise extra funds

Project Hollandsche IJssel



ORGANISATION

ADMINISTRATIVE STAGES

JULY 1987

LETTER FROM 6 IJSSEL MUNICIPALITIES

MARCH 1988

SETTING UP STEERING COMMITTEE

JUNE 1990

INTEGRAL STUDY HOLLANDSCHE IJSSEL

MARCH 1991

DECISION IN PRINCIPLE

* STRUCTUURSCHETS
* PROGRAM FOR SANITATION
* CONTROLLED LANDFILL

END 1994

PLAN OF ACTION

* TARGETS

13 AUTHORITIES

6 MUNICIPALITIES

LAND USE PLANNING
SEVERAGE

3 REGIONAL WATER AUTHORITIES

DIKES, REGIONAL WATERSYSTEM
WASTE WATER TREATMENT

1 PROVINCE SOUTH HOLLAND

SANITATION RIVERBANKS
LAND USE PLANNING

3 MINISTERIES

HOUSING AND ENVIRONMENT

RIVER AUTHORITY

RECREATION AND NATURE

Rehabilitation of the River Hollandse IJssel

The Role of Rijkswaterstaat
Technology Options for Rehabilitation

Rob Smits

Rijkswaterstaat

DECISION MAKERS

* WANT TO SOLVE A PROBLEM

* WANT TO SCORE POLITICALLY

* WANT QUICK RESULTS
(before the next election)

* WANT TO KNOW: THE ENVIRONMENTAL GAIN
(compared to costs:financial,political)

* WANT:-CONCRETE CHOICES
-COSTS
-WHEN

TECHNICAL EXPERT

CONCRETE CHOICES (price,time)

* (future) ENVIRONMENTAL QUALITY

* STORAGE OF WASTE PRODUCTS

* SANITATION METHODS

- LACK OF INSTRUMENTS (data, models, knowledge)

- LACK OF NORMS

- WEAKLY DEVELOPED POLICY

- LACK OF TIME/MONEY

MAIN PROBLEMS

* NECESSITY OF SANITATION
(environmental hazards)

* MOMENT OF SANITATION

* DEGREE OF SANITATION
(where do you stop)

* AVAILABILITY OF TECHNIQUES
(sanitation of pollution-sources)

* DETERMINATION AFTER-CARE
(rehabilitation has to be lasting)

* STORAGE OF POLLUTED MATERIAL

* ENVIRONMENTAL GAIN

QUESTION

MOMENT OF SANITATION:

WHEN WILL THE SURFACE WATER BE SUFFICIENTLY CLEAN TO ENSURE A LASTING REHABILITATION

QUESTION

DEGREE OF SANITATION

WHAT IS AN ACCEPTABLE QUALITY OF THE WATER SYSTEM (how deep do you dig?)

RELEVANT ASPECTS

* FUNCTIONS (desired)

* NORMS

* NATIONAL POLICY
(Nat.Pol.Document on Water Management)

* MOMENT OF SANITATION

WATERQUALITY:

* BACKGROUND POLLUTION (New Meuse)

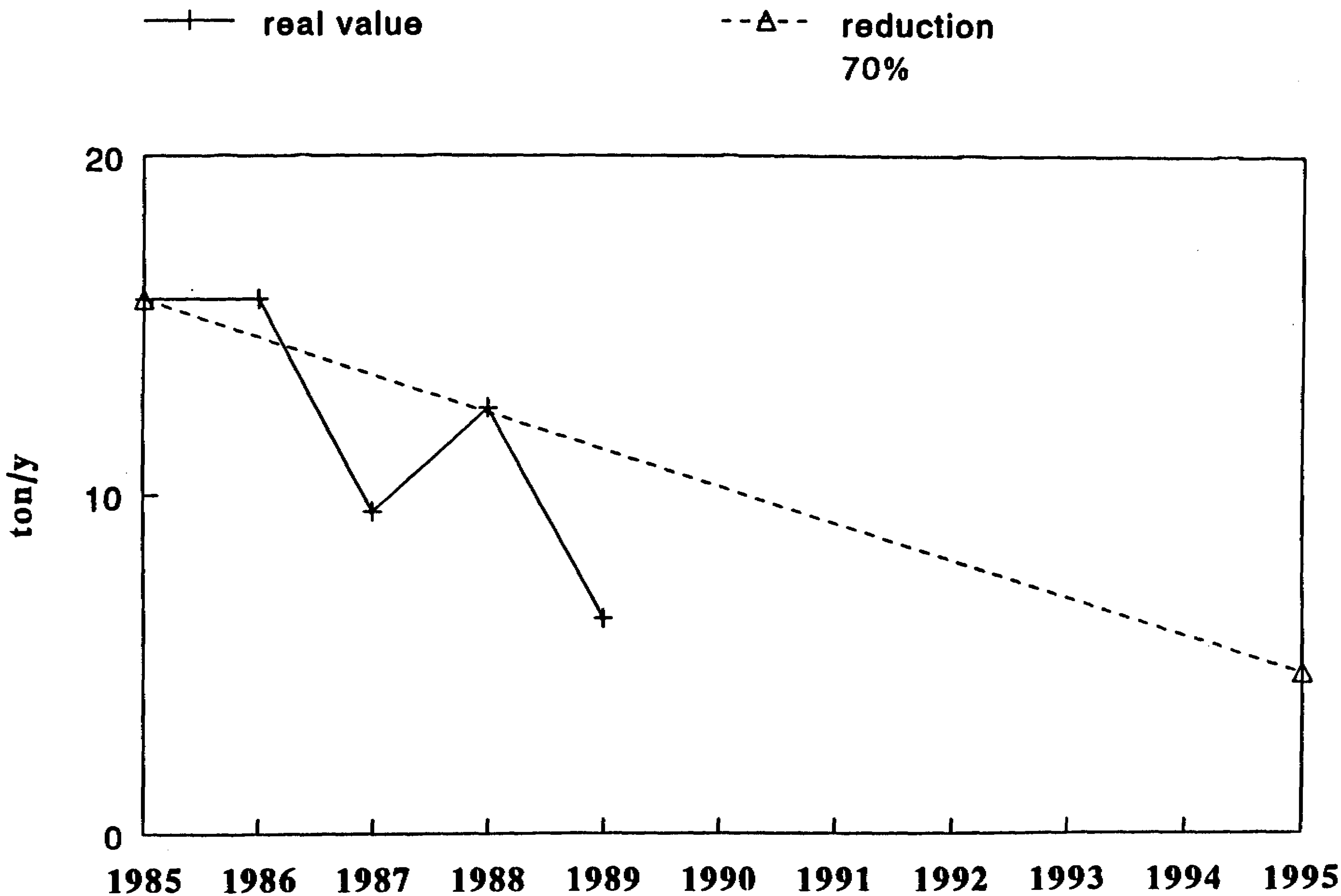
* INDUSTRIAL WASTE WATER

* DOMESTIC WASTE-WATER TREATMENT PLANTS

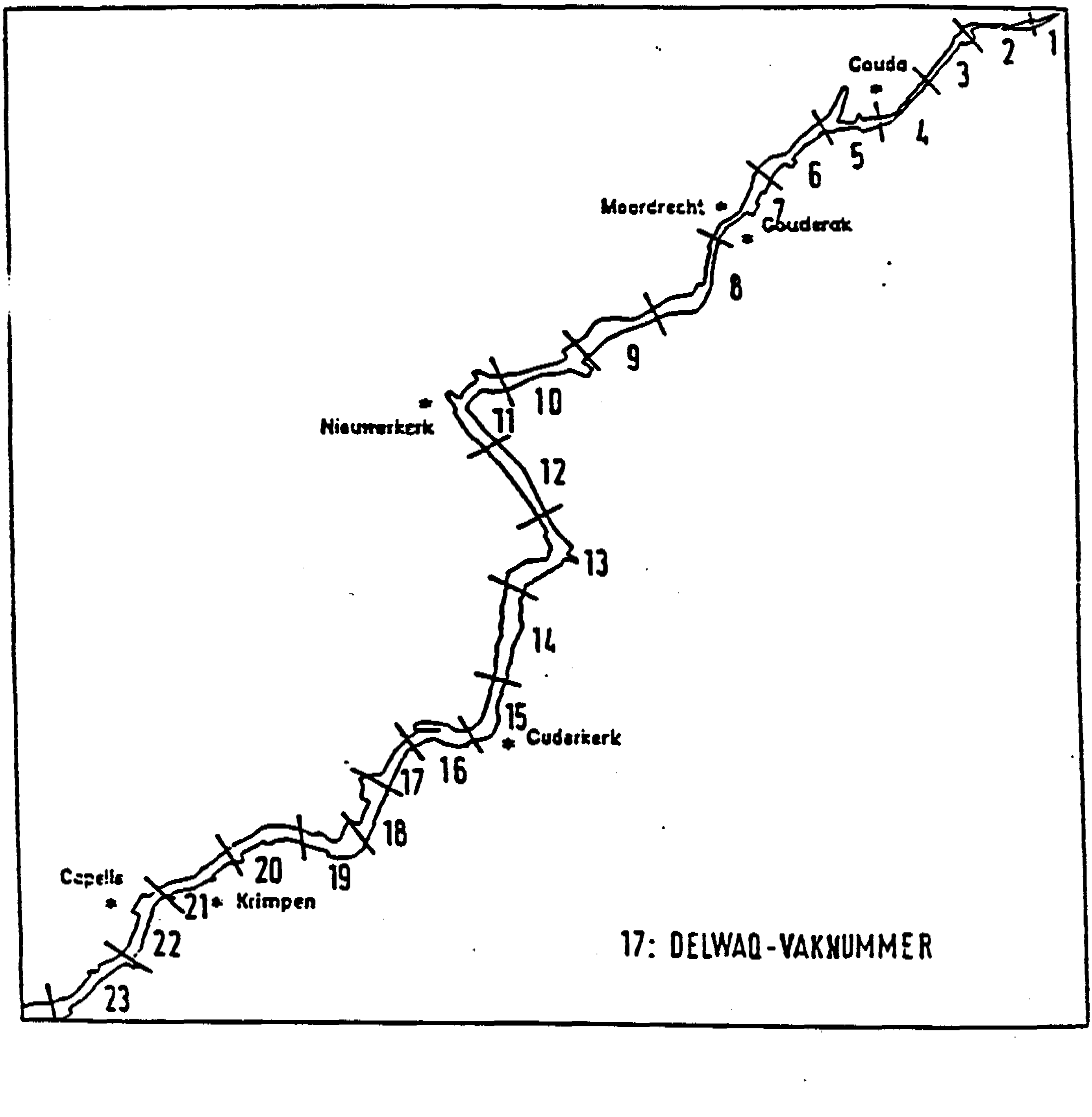
* RIVER GOUWE

* POLDERS

Total Cadmium-vracht te Lobith
28 daagse verzamelmonsters

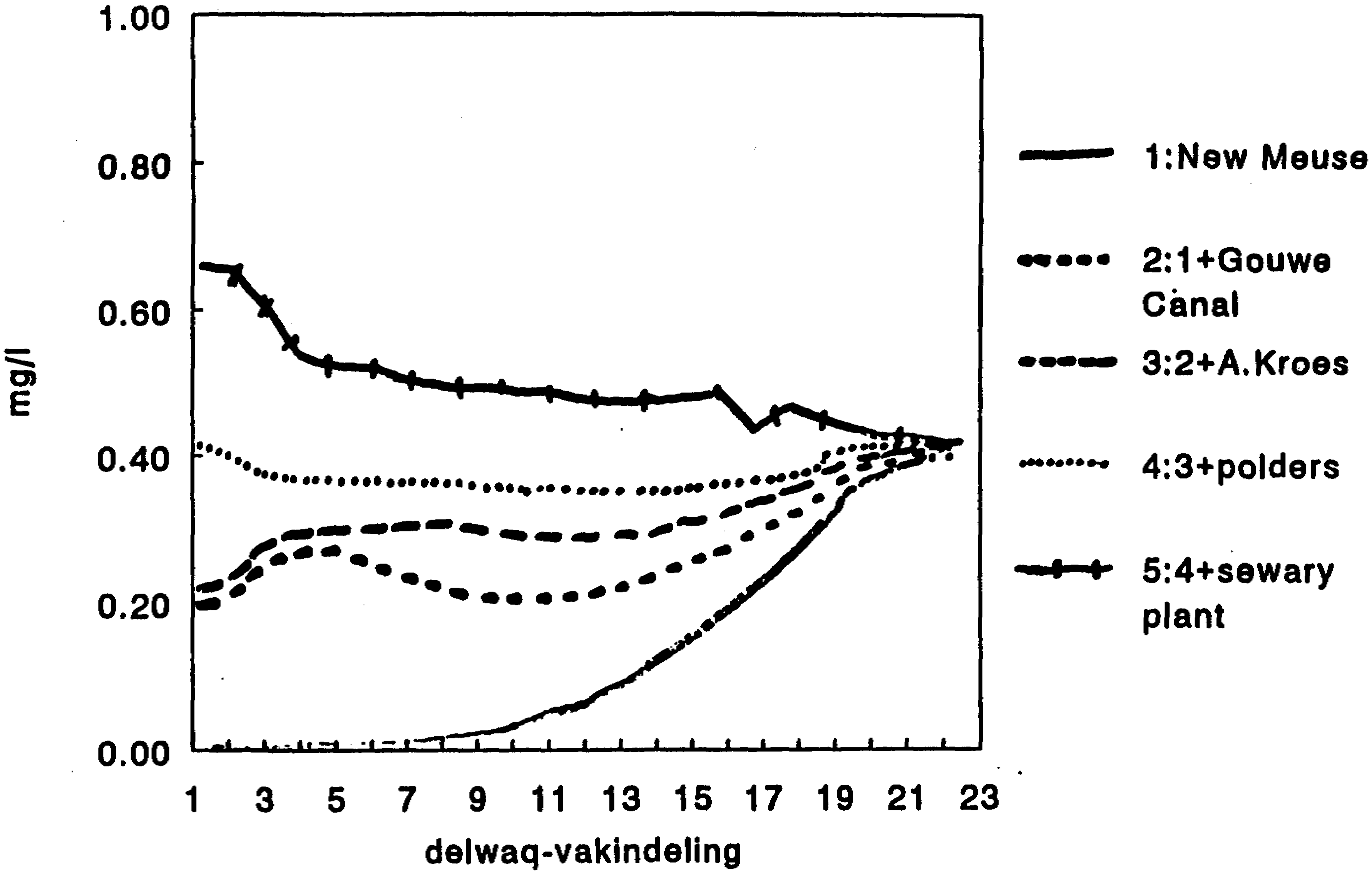


DELWAQ-VAKINDELING HOLLANDSCHE IJSSEL



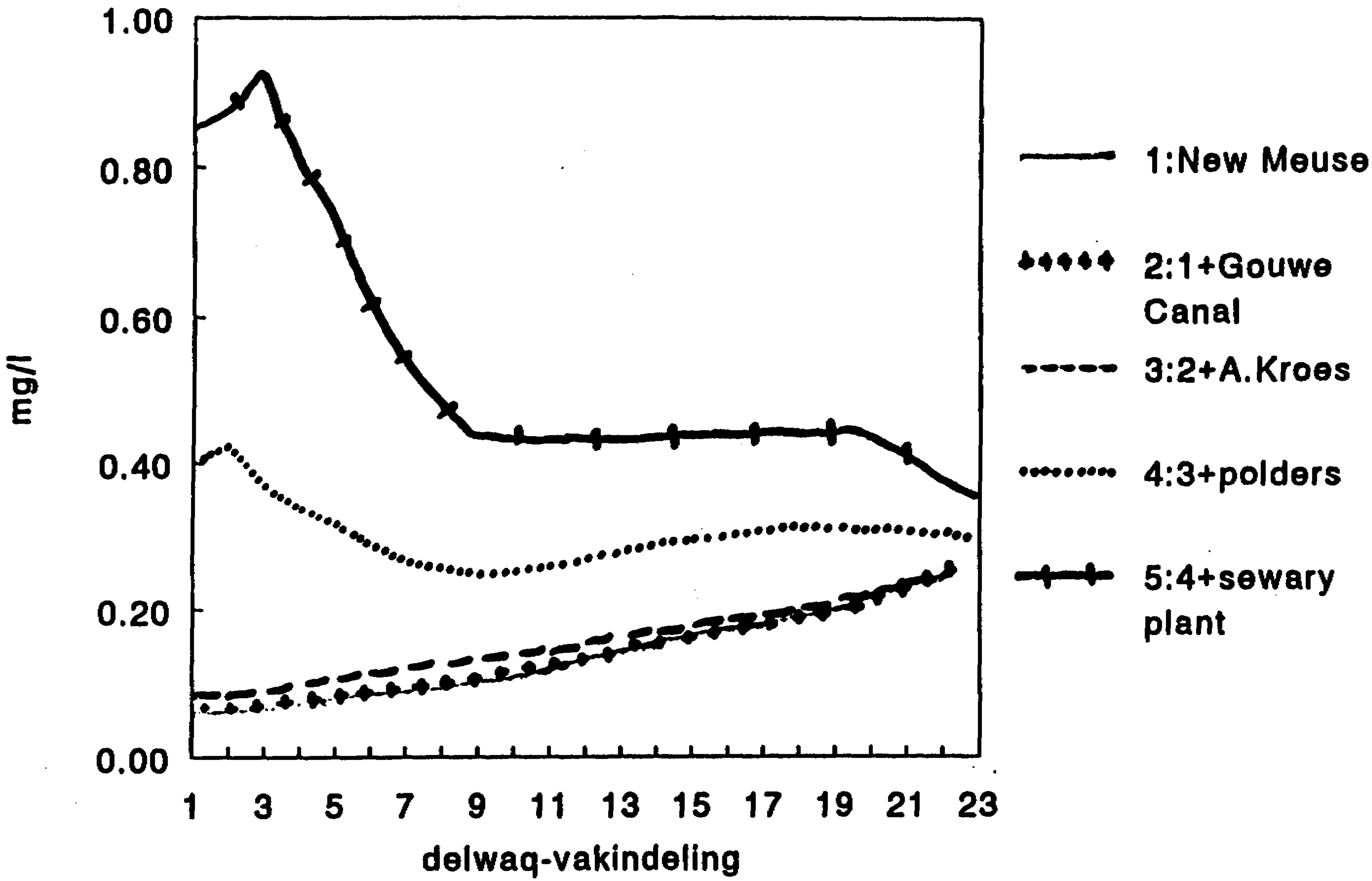
Water quality Dutch IJssel

Total P - january - wet year



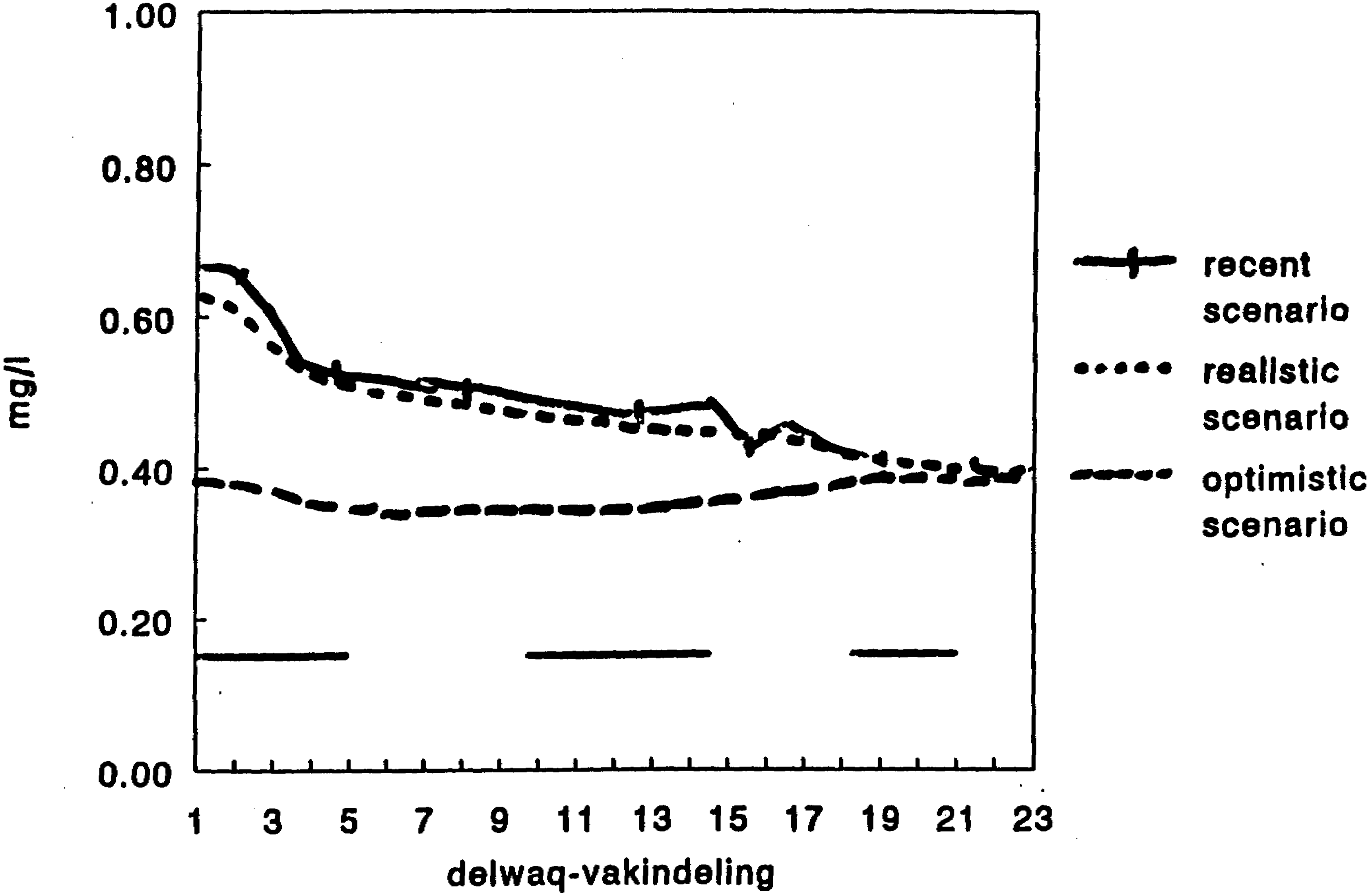
Water qua'ity D ch IJssel

Total P - july - wet year



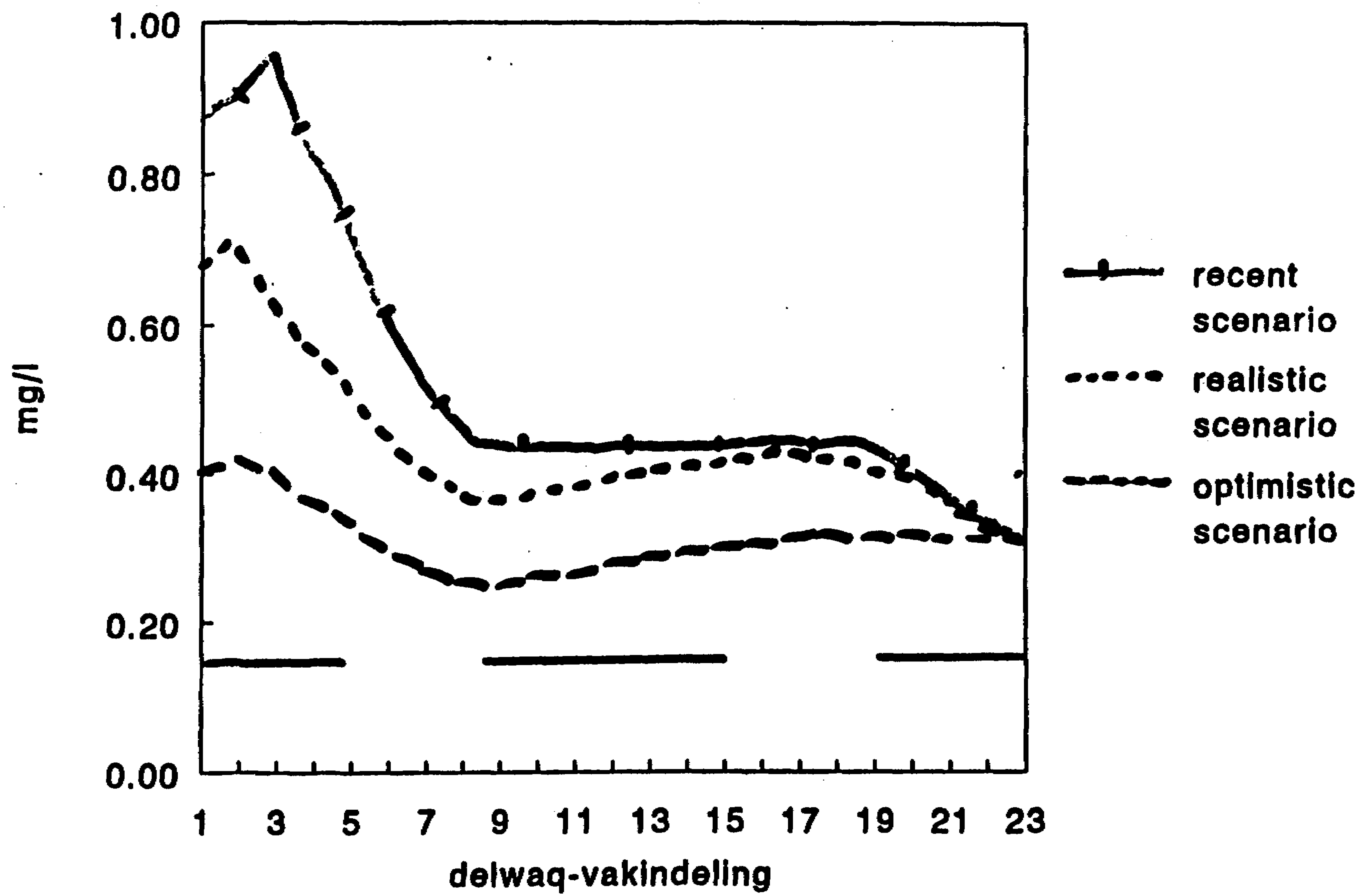
Water quality Dutch IJssel

Total P - january - wet year



• Water qua'·ty Dutch IJss •

Total P - july - wet year



STATEMENT

TO NORMS:

WHEN NORMS ARE LACKING, THE TECHNICAL EXPERT WILL HAVE TO PROVIDE THE SOLUTION

STATEMENT

ON MOMENT:

"DON'T MOP THE FLOOR WHILE THE TAP IS RUNNING" MEANS: NO MOPPING AT ALL !

STATEMENT

ON SANITATION OF RIVERBOTTOMS

IN SEDIMENTATION AREA'S:TIME SOLVES ALL PROBLEMS
(just sitting by the river will solve your problem too)

QUESTION

ON STORAGE

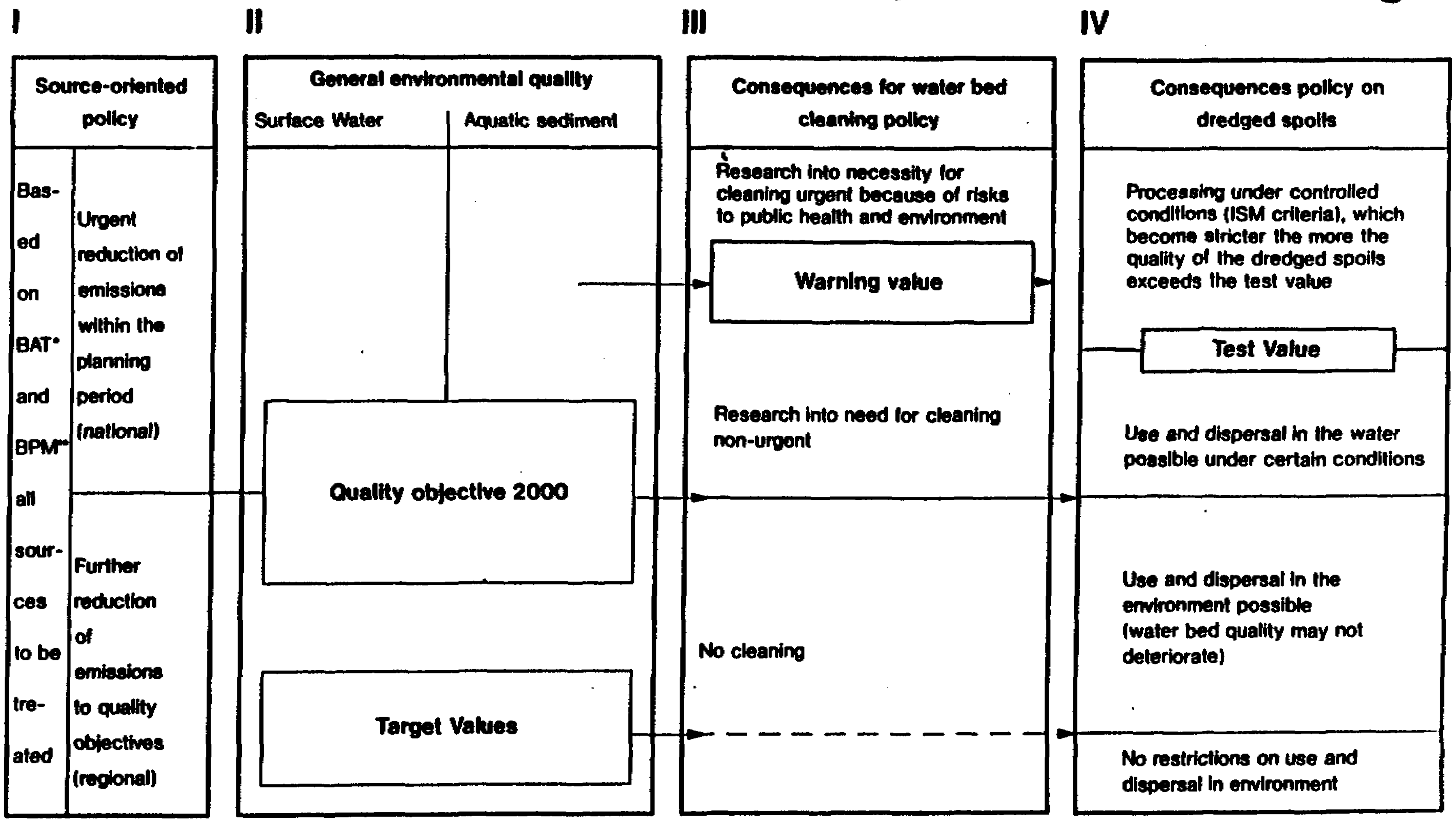
HOW DO YOU STORE THIS TYPE OF MATERIAL FOR THE NEXT 100.000 YEARS (or more)?

STATEMENT

TO STORAGE:

GEO-MEMBRANES: folies or follies?

CONTROLLED LEAKAGE:the best there is !



* Best available technology
** Best practicable means

Figure 18

Relationship between general environmental quality, the warning value and test value for aquatic sediment

General environmental quality standards (quality objective 2000)

General environmental quality (quality objective 2000), test values and warning values for fresh surface water and sediment

water = total content in water (in µg/l, unless stated otherwise)

sediment = content in sediment in water bed (in mg/kg), converted to standard sediment (10% organic matter and 25% lutum); for standard suspended matter (20% organic matter and 40% lutum) the values for heavy metals and organic matter resp. lie a factor of 1.5 and 2 higher than for the sediment.

Parameters	New						Old			
	M-list		I-list		provisional test value sediment	provisional warning value sediment	basic quality		provisional test value sediment	provisional warning value sediment
	water	sediment	water	sediment			water	sediment		
General parameters										
colour, odour, foam, solid waste, turbidity	the water may not look or smell polluted						idem			
temperature (°C)	25						25			
oxygen (m/l)	5						5			
however:										
- normalized streams/dammed streams/canals/pools/peat hollows	4						4			
- urban waters/ditches	3						3			
acidity (n, pH)	>6.5 <9.0						>6.5 <9.0			
visibility (s, n, metres)	0.4						0.5			
Nutrients and eutroph. parameters										
total phosphate (y, s, n, mg P/l)	0.15						0.15			
total nitrogen (s, n, mg N/l) (Kj-N + NO_3 + NO_2)	2.2									
chlorophyll-a (n, s, µg/l)	100						100			
ammonia (mg N/l)	0.02						0.02			
[illegible]trate + nitrite (n, mg N/l)							10			
Salts										
chloride (n, mg, Cl/l)	200						200			
fluoride (mg F/l)			1.5							
bromide (mg/Br/l)			8							
sulphate (mg SO_4/l)	100						100			
Radioactivity parameters										
(Bq/l, 1Bq = 27 pCi)										
total α-activity (y)			0.1				0.1			
remaining ß-activity (y)			1.0				1.0			
tritium-activity (y)			200				200			
Biological parameter										
thermotolerant coliform (median, MPN/ml)	20						20			
biological assessment system*			specify per water system*							

y = yearly average
n = natural deviation permitted
s = summer average value for eutrophication-sensitive, stagnant water, April tot September, inclusive
* = this specification can be done for stagnant waters according to a system based on Caspers and Karbe, and for running waters according to a system recently developed on behalf of the STORA

General environmental quality (quality objective 2000), test values and warning values for fresh surface water and sediment

water = total content in water (in µg/l, unless stated otherwise)

sediment = content in sediment in water bed (in mg/kg), converted to standard sediment (10% organic matter and 25% lutum); for standard suspended matter (20% organic matter and 40% lutum) the values for heavy metals and organic matter resp. lie a factor of 1.5 and 2 higher than for the sediment.

Parameters	New						Old			
	M-list		I-list		provisional test value sediment	provisional warning value sediment	basic quality		provisional test value sediment	provisional warning value sediment
	water	sediment	water	sediment			water	sediment		
Metals										
cadmium	0.2	2			7.5	30	2.5	0.8	7.5	30
mercury	0.03	0.5			1.6	15	0.5	0.3	1.6	15
copper	3	35			90	400	50	36	90	400
nickel	10	35			45	200	50	35	45	100
lead	25	530			530	1000	50	85	160	700
zinc	30	480			1000	2500	200	140	1000	2500
chrome	25	480			480	1000	50	100	155	600
arsenic			15	85	85	150	50	29	45	100
EOX					7.0	20.0	5	5.5 (med.)	7.0	20.0
AOX						(med.)	40			
sum MA's							2 (med.)			
PAHs										
benzo(a)anthracene				0.05	0.8	3		0.2	0.8	3
benzo(ghi)perylene		0.05			0.8	3		0.2	0.8	3
benzo(a)pyrene		0.05			0.8	3		0.2	0.8	3
phenantrene				0.05	0.8	3		0.2	0.8	3
indeno(123cd)pyrene		0.05			0.8	3		0.2	0.8	3
[illegible]ene				0.05	0.8	3		0.2	0.8	3
dibenzo(ah)anthracene				0.05	0.8	3		0.2	0.8	3
anthracene				0.05	0.8	3		0.2	0.8	3
benzo(b)fluoranthene		0.2			0.8	3		0.6	0.8	3
benzo(k)fluoranthene		0.2			0.8	3		0.6	0.8	3
chrysene				0.05	0.8	3		0.2	0.8	3
fluoranthene	0.07	0.3			2.0	7		1.2	2.0	7
sum PAHs (6 of Borneff)		0.6			4.5	17	0.1 (med.)	2.3	4.6	17
Volatile haloginated hydrocarbons										
VOX	5						5 (med.)			
1,3-dichloropropene			1							
trichloroethene			2							
hexachloroethane			1							
Chlorobenzenes										
dichlorobenzenes			2							
trichlorobenzenes			0.4	0.3						
tetrachlorobenzenes			0.2	0.3						
pentachlorobenzene			0.3	0.3	0.3	0.5		0.003	0.02	0.5
hexachlorobenzene		0.004			0.02	0.5	0.01 (med.)	0.003	0.02	0.5

General environmental quality (quality objective 2000), test values and warning values for fresh surface water and sediment

water = total content in water (in µg/l, unless stated otherwise)

sediment = content in sediment in water bed (in mg/kg), converted to standard sediment (10% organic matter and 25% lutum); for standard suspended matter (20% organic matter and 40% lutum) the values for heavy metals and organic matter resp. lie a factor of 1.5 and 2 higher than for the sediment

Parameters	New						Old			
	M-list		I-list		provisional test value sediment	provisional warning value sediment	basic quality		provisional test value sediment	provisional warning value sediment
	water	sediment	water	sediment			water	sediment		
PCBs										
Pcb 28		0.004			0.03	0.1		0.004	0.03	0.1
PCB 52		0.004			0.03	0.1		0.004	0.03	0.1
PCB 101		0.004			0.03	0.1		0.004	0.03	0.1
PCB 118		0.004			0.03	0.1				
PCB 138		0.004			0.03	0.1		0.004	0.03	0.1
PCB 180		0.004			0.03	0.1		0.004	0.03	0.1
PCB 180		0.004			0.03	0.1		0.004	0.03	0.1
sum of PCBs(7)					0.2	0.4	0.007 (med.)	0.02	0.2	0.4
Organochloro-pesticides										
aldrin + dieldrin				0.04	0.04	0.5	0.01 (med.)	0.003	0.02	0.5
endrin				0.04	0.04	0.5	0.01 (med.)	0.003	0.02	0.5
DDT + derivatives				0.01	0.02	0.5	0.01	0.003	0.02	0.5
(-endosulphane + -sulphate	0.01	0.01			0.02	0.5	0.01 (med.)	0.003	0.02	0.5
α-HCH					0.02	0.5	0.01	0.003	0.02	0.5
β-HCH					0.02	0.5		0.003	0.02	0.5
γ-HCH	0.01	0.001			0.02	0.5	0.01- (med.)	0.003	0.02	0.5
heptachlor + epoxide				0.02	0.02	0.5	0.01 (med.)	0.003	0.02	0.5
chlorodane			0.12	0.02				0.003	0.02	0.5
hexachlorobutadiene				0.02	0.02	0.5		0.003	0.02	0.5
total-pesticides					0.10	2.5	0.02 (med.)	0.02	0.10	2.5
anionic detergents							100 (med.)			
non-ionic and cationic detergents							100 (med.)			
Chlorinated phenols										
dichlorophenols			0.08							
pentachlorophenol	0.05	0.02					0.05 (med.)			
Steam-distillable phenols							5 (med.)			
Chloroanilines										
total anilines							1 (med.)			

General environmental quality (quality objective 2000), test values and warning values for fresh surface water and sediment

water = total content in water (in µg/l, unless stated otherwise)

sediment = content in sediment in water bed (in mg/kg), converted to standard sediment (10% organic matter and 25% lutum); for standard suspended matter (20% organic matter and 40% lutum) the values for heavy metals and organic matter resp. lie a factor of 1.5 and 2 higher than for the sediment

Parameters	New						Old			
	M-list		I-list		provisional test value sediment	provisional warning value sediment	basic quality		provisional test value sediment	provisional warning value sediment
	water	sediment	water	sediment			water	sediment		
Organophosphorus pesticides										
Cholinesterase inhibition	0.5						0.5 (med.)			
DDVP			0.002							
Triazophos			0.03							
Azinphos-methyl			0.02							
Azinphos-ethyl			0.05							
Demeton			0.4							
Fenitrothion			0.05							
Methyl Parathion			0.2							
Ethyl Parathion			0.02							
Disulfoton			1.5							
Trichlorfon			0.005							
Cumaphos			0.002							
Diazinon			0.03							
Fenthion			0.02							
Phoxim			0.2							
Malathion			0.03							
Mevinphos			0.005							
Pyrazophos			0.003							
Oxydemeton-methyl			0.1							
Organo-tin compounds										
tributyl-tin compounds			0.01	1.5	(µg/kg)					
triphenyl-tin compounds			0.01	1.0	(µg/kg)					
Remaining non-halogenated compounds										
Phenol herbicides										
Dinoseb (DNBP)			0.02							
DNOC			0.3							
Carbamates										
Aldicarb			0.5							
Oxamyl			0.5							
Carbendazim			0.03							
Dithiocarbamates										
Maneb			1.0							
Thiram			0.02							
Zineb			0.6							
metham-sodium			0.01							
phenol			2							
petroleum hydrocabons		1000			3000	5000		500	3000	5000
aniline			2							
nitrilotriaceticacid			200							

* Supplementary specification because combination toxicity $\sum_i \frac{\text{measured content of substance}}{\text{general environmental quality standard (quality objective 2000)}} \leq 1$ is not taken into account

General environmental quality (quality objective 2000), test values and warning values for fresh surface water and sediment

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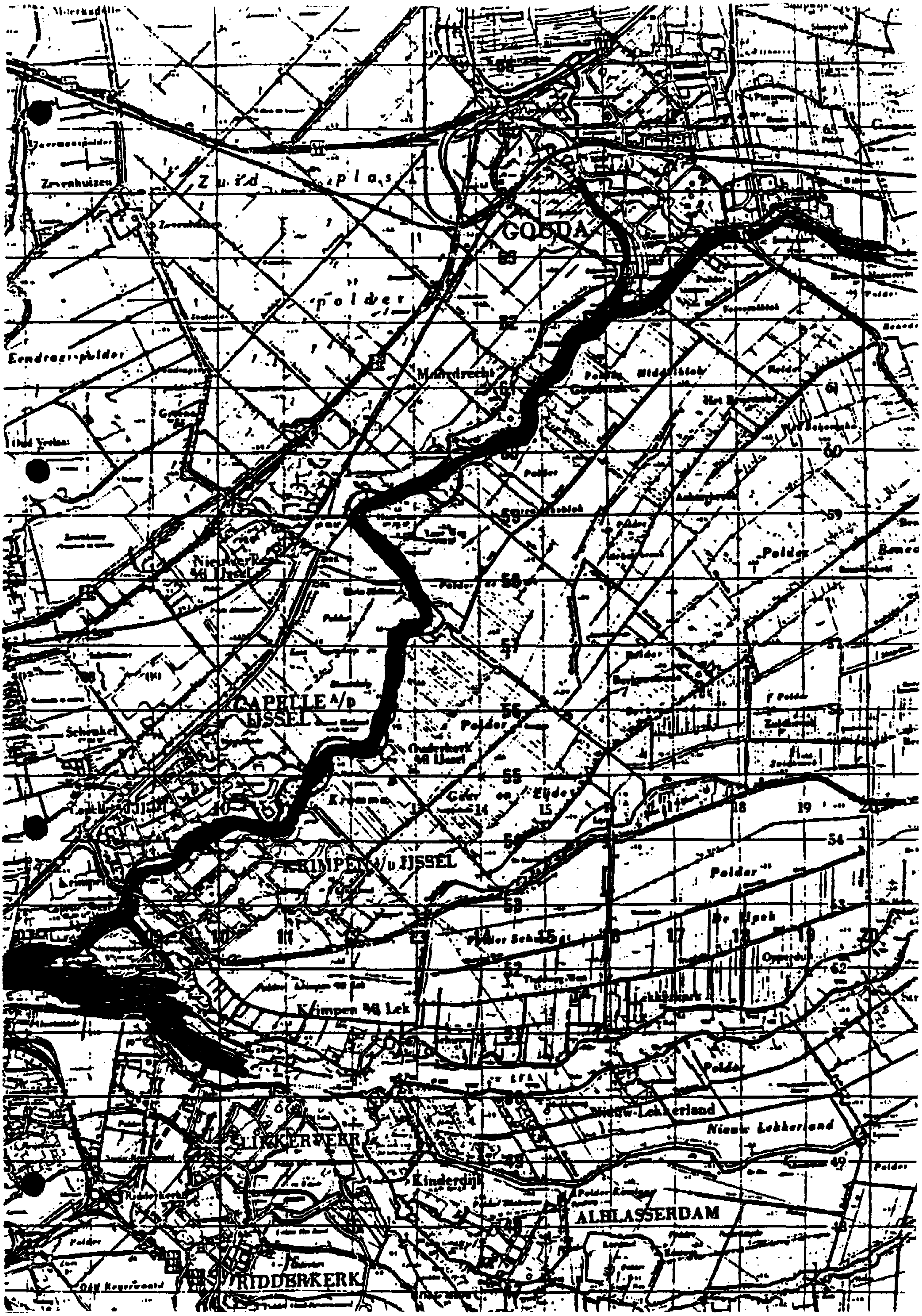
Parameters	New						Old			
	M-list		I-list		provisional test value sediment	provisional warning value sediment	basic quality		provisional test value sediment	provisional warning value sediment
	water	sediment	water	sediment			water	sediment		
Remaining halogenated compounds										
Chlorophenoxy carboxytic acids (herbicides)										
2.4-d			11							
mcpa			0.2							
mecoprop			0.1							
Triazines										
atrazine			0.1							
[illegible]ne			0.4							
[illegible]ed [illegible]natics										
[illegible]			0.2							
Quintozene			0.4							
Pyrethroid pesticedes										
Cypermethrin				0.6						
Delatmethrin				0.4						
Permethrin				0.8						
Bifenthrin				1.6						
Anilides										
Propachlor			0.1							
Aromatic chloro-amines										
Linuron			0.1							
3.3-dichlorobenzidine			0.2							
Carboximides										
Captafol			0.2							
Captan			0.3							

* Supplementary specification because combination toxicity $\sum_i \frac{\text{measured content of substance}}{\text{general environmental quality standard (quality objective 2000)}} \leq 1$ is not taken into account


Zevenhuizen
Zuid plas polder
Eendragtspolder
GOUDA
Moordrecht
CAPELLE A/D IJSSEL
Ouderkerk a/d IJssel
KRIMPEN A/D IJSSEL
Krimpen a/d Lek
Nieuw Lekkerland
Kinderdijk
ALBLASSERDAM
RIDDERKERK

Rehabilitation of the River Hollandse IJssel

The Role of a NGO
Popular Resistance to 'Backyard Disposal'

Anita van der Pelt

Foundation for Nature & Environment
Nederland Gifvrij

POPULAR RESISTANCE TO BACKYARD DISPOSAL

Ir. A. van Pelt in cooperation with
drs. J.W. Biekart

Ladies and gentlemen,

I will try to give you an impression of the backgrounds and the value of popular resistance to backyard disposal, and to environmental policy in general. This is difficult, because almost every environmental professional, if government official, scientist or consultant, inclines to approach environmental problems in a technical manner, and even inclines to joke other approaches. A technical approach, however, can only be a part of the whole picture and therefore I want to ask you to try to leave a possibly technical attitude and put your mind open for another side of the problem.

Imagine that you live in a small town on a river. Nowadays the town has several tens of thousands of inhabitants, but you remember the times, forty, fifty years ago, when it was a village, beautifully situated on the winding river, amidst the green meadows, the cows and the farmhouses. You used to swim in the river with your brother on the hot days of spring and summer. Your father went fishing as often as he could. He used to bring home some fresh fish for dinner. The town had some minor industry, most of it situated along the banks of the river; small shipyards and things like that. The farmlands around the town were polderlands, often somewhat swampy in some places, but many flowers grew there and birds were abundant.

Nowadays the river and the town look much different. The town has grown considerably and with it also the industry has expanded. On the horizon the advancing outskirts of the nearby towns have become visible. The river is not used any more for anything else than shipping. No one dares to swim or fish in its waters. The banks are very dirty with black slimy sediments. People have become very much aware of the pollution, only some general effects of which can be seen. But they remember only to well that in 1982 in the neighbouring town, directly situated on the riverbanks, a former pesticide dump of Shell chemical industries was discovered under newly built houses (a very interesting sanitation case as well, by the way). Groundwater proved to be heavily polluted and was spreading gradually to other places, and also the river was contaminated with very toxic pesticides. The houses were removed eventually. In the Netherlands in that period it was one of the major cases of soil pollution discovered, but it proved to be only one of an uncountable number. The river and its banks give you a feeling of dirt, blackness, potentially dangerous for your health. The pollution forms a slight psychological pressure for you; a continuous awareness of the situation is felt. Luckily there are still the grasslands around the town, which have been altered, but are still green and quiet.

With this little sketch I have tried to let your imagination work a little and to get you a feeling for the living atmosphere of the inhabitants of towns along the Dutch IJssel. The general opinion about the Dutch IJssel project can thus be better understood. Of course, initially the inhabitants were very positive about the project, because they thought their river would become really clean again. For them, it is a large disappointment that:

1. the river will not be cleaned up completely, but only partly and up to a certain degree;
2. the heavily polluted sediments and soils will be stored in the only 'unspoilt' area which remains in their surroundings, the Zuidplas-polder, and will not be cleaned.

I think the first aspect stands out very clearly. The principle decision of the Steering Committee is clearly on this point, a complete clean up is not considered feasible. This holds for several of the riverbanks, for the quality of sediment and for the quality of water, none of which will have a negligible environmental risk level after sanitation and nothing is said about future efforts to reach this level. Isn't it logical that eyebrows are raised when this becomes clear? Why spending so much money if it is nog guaranteed that the river will become clean again, and that the functions of the river will be completely restored, if necessary even later than proposed now. This half-hearted choice introduces clear doubts about the project.

The second aspect introduces even further doubt. What is to be gained if the polluted soils and sediments are not cleaned, but stored in huge depot? A depot which will spoil the remaining quiet and beautiful area in your neighbourhood. A depot which will always be visible, which will cause noise and odour nuisance, and where leaking risks are said to be nil on the contrary. Is it not obvious that fears come up that this toxic material will threaten your health and especially that of your children? That it will intoxicate your vegetable garden and that it will reduce the value of your house? And for what reason? Is it not obvious that people resist and that they say that the soils and sediments should be cleaned, that the micro pollutants should be destroyed. If that is too expensive, hold Shell and those polluting industries responsible for the cleaning, bearing in mind the pesticide dump of Gouderak. Sue them or dump the polluted soil on their premises in Rotterdam. But do not dump the material in my backyard. Not because I am selfish, but because it is not by responsibility to have my environment further spoilt by mistakes of others. It is not so much the statement 'not in my backyard', as well as 'not in any backyard', expect maybe the polluter's backyard.

Here I come to a very important point that I should like to bring forward. In my point of view people living in the Dutch IJssel region think about this environmental problem on an abstract level much more logically, or maybe consistently, than environmental experts. This is not an amazing statement, because the inhabitants are allowed to neglect all sorts of connected, short term problems, of which money, employment and cost effectiveness are major topics. Because the inhabitants are not hindered by the omnipresent short and middle term interests to which the government wishes and chooses to adapt. They are able to see the great value of long term interests, the future environmental quality, in connection with which we now often use the term sustainable development. Or, put in another way, the inhabitants are confronted with the absurdity of present day decision making.

Government officials, policy makers, decision makers, technicians and scientists too often speak another language than people who are directly confronted with an environmental problem in their common environment. In the eighties, a large amount of research was done on the topic of public participation in governmental decisions, concerning the daily environment. In particular many soil sanitation projects made it very clear how large the tension between both these languages may be, but also how valuable public participation is, both in reaching better environmental results and in getting far less difficulties in decision making. Though at this moment the national government has recommended public participation in soil sanitation projects more than ten years ago. In the past many local authorities and county councils made a lot of mistakes in these matters, and they are still making these mistakes, although things are changing. Authorities which act wholeheartedly according to the recommendations, are usually rewarded with a good relationship with the inhabitants of the quarters of towns concerned, and have a more positive attention in the media, whereas secretive authorities are involved in for years on end struggles and distrust of residents' groups, huge and negative press attention and finally bad environmental results which solved nothing. The practise of environmental policy making over more than ten years has proved the value and necessity of public participation.

There is a number of very important requirements in order to establish a successful public participation. These are:
1. Full and active frankness in information; no withholding reports, documents etcetera.
2. An information post where inhabitants can get the latest information at regular times. A regular news bulletin distributed throughout the region, also when it will still take some time to make the next step in the procedure, works well too.
3. Subsidize the consulting of an independent expert by the group of inhabitants;
4. When organizing a meeting for the public, be sure that the decision makers are present too, in order to make clear that the public is taken seriously.

5. Give the public the possibility to participate in a working or project group of officials and/or decision makers, so they will be able to follow the procedure closely.
6. There should be the possibility that the inhabitants can appeal against the final sanitation decision at a judicial institution.

You see that a lot of action of the government is required in order to be successful here, though in terms of time and money it usually only takes a small part of the project efforts. The organisation I work for, The Netherlands Toxic free, specialised in actions against soil pollution, has two tasks. The first task is to support residents and environmental groups in their struggle for a healthy and clean soil. We give information on aspects concerning health risks and risks for the environment and possible solutions for soil sanitation. We explain how the legislation is organised in the Netherlands, what rights citizens have, how to organise themselves. We stimulate their participation in the decision making process in order to represent their interests, and advise them in the sort of actions they can proceed.
The second task is influencing the governmental policy. One could say that we represent the voice of nature. We do so by informing politicians and decision makers, commenting new legislation of the government and presenting alternatives. Furthermore we monitor the implementation of the legislation. If we notice mismanagement or a bad implementation we ring the alarm bell.

Concluding my contribution to this morning's programme, I should like to stress that almost every decision maker, consultant and official is usually reluctant towards public participation. The reluctance is caused by fundamental differences in communication patterns between the two groups, which can be called either objective versus subjective, or more overdrawn, technocratic versus idealistic, causing mutual irritation and even strong distrust. My opinion is that one cannot do without the other, and both deserve equal respect in environmental sanitation decisions. These decisions are not solutions to purely technical problems, but have a considerable political side.

Bearing this in mind, I should like to finish with two statements:
1. A mere technical scientific approach to environmental sanitation implies a negative attitude towards public participation and will even consider it undesirable at all moments of the decision process.
2. Public participation in environmental sanitation projects is a prerequisite in a democratic society for a continuing increase in the quality of environmental policy.

Rehabilitation of the River Hollandse IJssel

The Role of Local Residents Organised in Pressure Group

Arjen van der Mark

Moordrecht Environmental Association

MOORDRECHTSE MILIEUVERENIGING DE ZUIDPLASPOLDER

(MMVZ)

environmental society the ZUIDPLASPOLDER of MOORDRECHT

ACTIVITIES OF MMVZ

- enlisting of members
- raise money to hire lawyers and finance activities
- give lectures on techniques to clean up polluted soil and sludge
- giving intervieuws to the press (local newspapers, radio and television)
- lobby with the local politicians
- hand out of information (SLUDGE-PAPERS I AND II)
- placement of protestsigns along main roads
- representation on local fairs

<u>SOLVE</u> THE PROBLEM, NOT <u>SHIFT</u> IT

(sanitation-, separation- and immobilisation-techniques)

IN THE MEDIA THE MMVZ WAS ONE STEP AHEAD OF THE STUURGROEP ALL THE TIME

THE ACTIVITIES OF THE MMVZ RESULTED IN MORE OPPOSITION AND RESISTANCE THAN THE STUURGROEP COULD HANDLE

MOORDRECHT

CITY-COUNCIL - MAYOR + ALDERMEN (REPRESENTING POLITICAL PARTIES)

CITIZENS - APPROX. 7000

PROJECTTEAM HOLLANDSCHE IJSSEL

\\/ information and plans

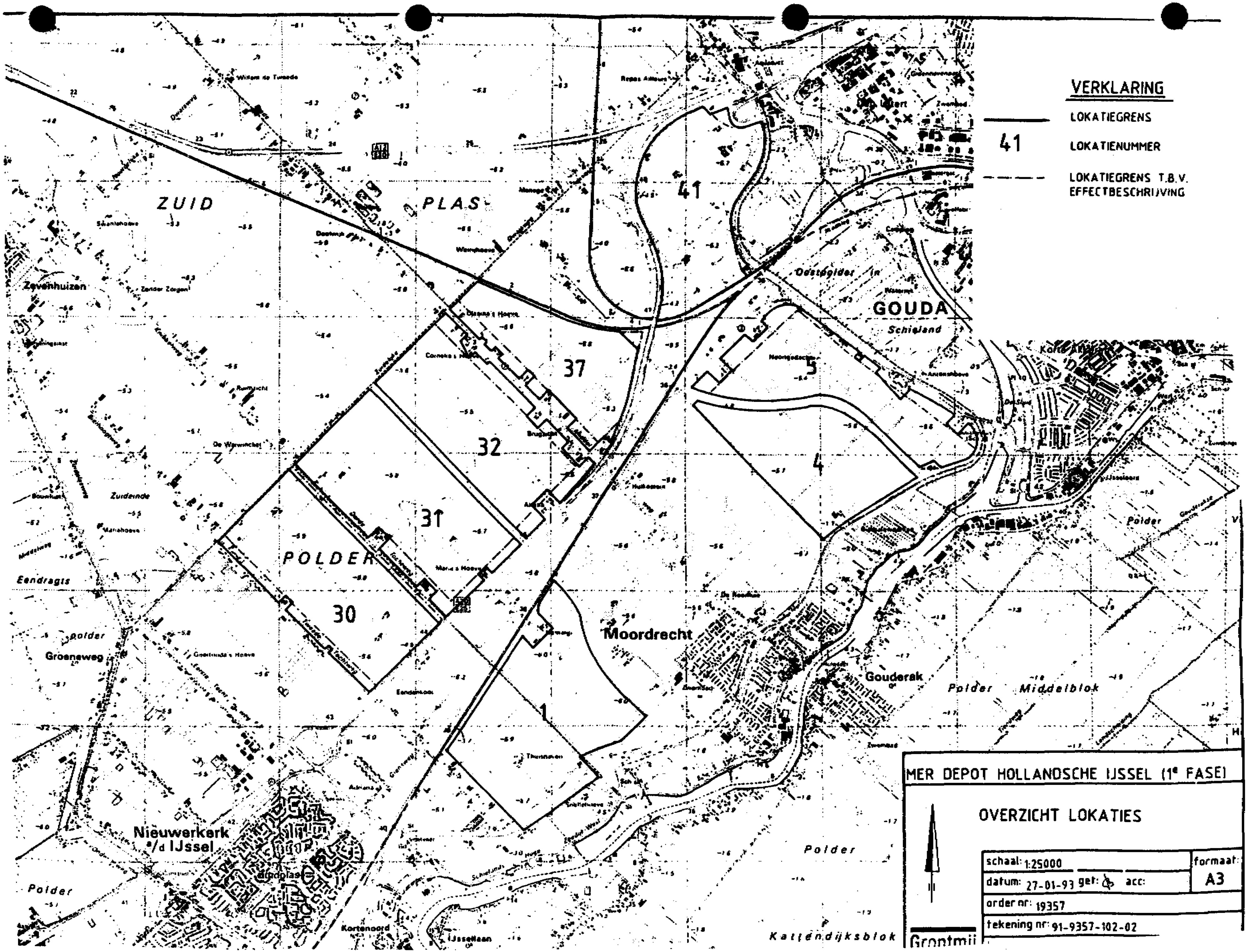
PLATFORM HOLLANDSCHE IJSSEL

representatives of:

stuurgroep
deptment of ways and waterworks
polderboard
chamber of commerce
society of shipowners
society of fishermen
agricultural society
citizens of Nieuwerkerk
citizens of Moordrecht (MMVZ)

\\/ information and plans
+ comments of platform

STUURGROEP HOLLANDSCHE IJSSEL


VERKLARING
LOKATIEGRENS
41 LOKATIENUMMER
LOKATIEGRENS T.B.V. EFFECTBESCHRIJVING
ZUID PLAS
POLDER
Zevenhuizen
GOUDA
Schieland
Moordrecht
Gouderak
Polder Middelblok
Nieuwerkerk a/d IJssel
Groeneweg
Eendragts
Polder
Kattendijksblok
41
37
32
31
30
5
4
1
MER DEPOT HOLLANDSCHE IJSSEL (1e FASE)
OVERZICHT LOKATIES
schaal: 1:25000
datum: 27-01-93
get:
acc:
formaat: A3
order nr: 19357
tekening nr: 91-9357-102-02
Grontmij