

NATIONS UNIES
COMMISSION ECONOMIQUE
POUR L'EUROPE

ОБЪЕДИНЕННЫЕ НАЦИИ
ЭКОНОМИЧЕСКАЯ КОМИССИЯ
ДЛЯ ЕВРОПЫ

UNITED NATIONS
ECONOMIC COMMISSION
FOR EUROPE

SEMINAIRE

СЕМИНАР

SEMINAR

CONVENTION ON THE PROTECTION AND
USE OF TRANSBOUNDARY WATERCOURSES
AND INTERNATIONAL LAKES



INTERNATIONAL DECADE FOR NATURAL
DISASTER REDUCTION

WORLD HEALTH ORGANIZATION
REGIONAL OFFICE FOR EUROPE

WORLD METEOROLOGICAL ORGANIZATION

**SEMINAR ON FLOOD PREVENTION
AND PROTECTION**

(Berlin, Germany, 7-8 October 1999)

Distr.
GENERAL

MP.WAT/SEM.2/1999/29

7 July 1999

Original: ENGLISH ONLY

FLOOD PROTECTION CONCEPT FOR THE CITY OF COLOGNE

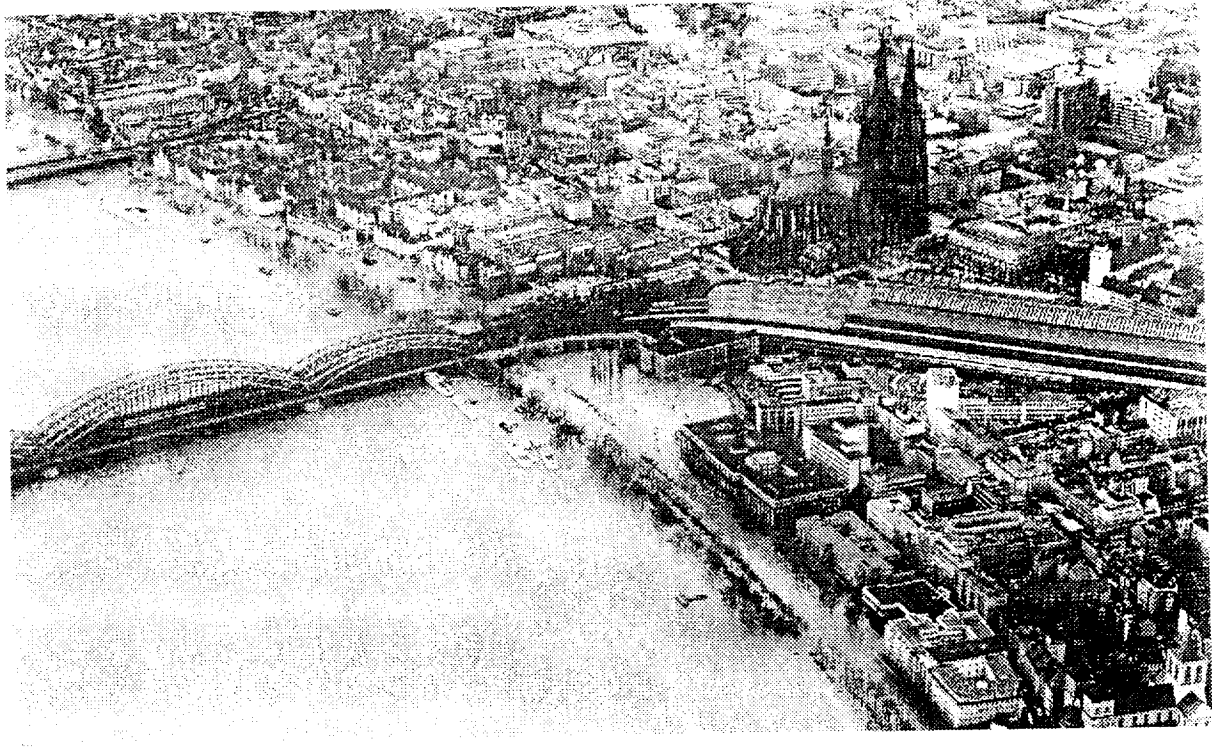
Discussion paper transmitted by the Government of Germany */

(Prepared by Mr. H. OELMANN)

*/ Apart from minor editorial changes, this document has been reproduced in the form in which it was received by the secretariat.

GE.99-32095

The historical and evolving city zone in Cologne has always been threatened by flooding. The floods of previous centuries were characterised by the fact that ice drifts in the Rhine coincided with seasonal meltwater and rain water. As the Rhine has warmed, the ice drift problem no longer exists. However other influences have had a lasting effect on flood development in Cologne. Amongst the sins which we have all committed, the loss of retention areas along the upper Rhine from what was formerly 1.000 km² to around 140 km² is particularly serious.



According to calculations by the Flood Study Group (*Hochwasserstudienkommission*) the development along the upper Rhine between 1955 and 1977 was enough to cause a 40 cm increase in the flow rate to be noticeable in the lower Rhine including Cologne.

Flood peak discharges of varying return periods for development conditions 1955 - 1977								
Return period	Water-level gauge Worms 1)		Water-level gauge Kaub 1)		Water-level gauge Cologne 1)			
	1955 m ³ /s	1977 m ³ /s	1955 m ³ /s	1977 m ³ /s	1955 m ³ /s	1977 m ³ /s	Increase m ³ /s	cm
2	3.420	3.650	4.240	4.320	6.550	6.700	150	13
5	3.590	4.300	5.000	5.150	7.950	8.200	250	18
10	4.350	4.800	5.500	5.800	8.900	9.250	350	23
25	4.850	5.450	6.250	6.650	10.050	10.550	500	30
50	5.250	5.950	6.800	7.300	10.950	11.550	600	34
100	5.700	6.400	7.400	8.000	11.850	12.550	700	36
200	6.000	6.800	8.000	8.800	12.750	13.550	800	39

Although there is a Franco-German agreement from the year 1982, changes for the middle and lower Rhine were not sufficiently thought through, let alone carried out.

It cannot be disputed, that despite extensively planned retention measures in Baden-Württemberg and Rheinland-Palatinate an increase in the flow rate of 15 cm will remain for the lower Rhine. Apart from the fact that in Baden-Württemberg only 80 million m³ of a planned 270 million m³ of retention areas were ever realised, the decisions by the *Land* of Hesse to go no further with planned retention areas on the Rhine will have serious consequences. Moreover, these decisions are incomprehensible, because the flood situations in 1993 and 1994 which are now behind us, should have made clear the joint responsibility of all those living along the Rhine. In this respect the decision by the former Red/Greens Hessian *Land* government, which has yet to be repealed, is beyond understanding.

For this reason the drawing up of an action plan by the International Commission for the Protection of the Rhine against pollution (ICPR) in 1998 was all the more important. The city of Cologne also actively collaborated in this plan through the Flood Emergency Organisation. As part of the action plan the *Länder* too have been placed under an obligation to participate more intensively in water management planning of retention areas and other flood reducing measures. It is hoped that the *Länder* will take this task seriously and will invest in committed flood protection planning.

In 1995 the city of Cologne attempted to set a good example by drawing up a holistic flood protection concept. Plans include: a new framework for planning decisions which even provides for a change in the land use plan, resulting in the exclusion of meadows and flood plains as future settlement land, the provision of retention areas for downstream parties and in combination with this, the construction of a protection against incidents of flooding that occur every 100 or 200 years at a cost of around 500 million DM, as well as improved flood-management and the formulation of disaster models.

The greatest unknown in the development of all scenarios is posed by a possible climate change. Nobody disputes that there are anthropogenic influences on the climate. Precipitation frequency and temperature tables used to be the basis for assessment according to historical documents, which included statistical water management fundamentals and tables of rainfall frequency. What is scientifically highly controversial however, is whether or to what extent frequent precipitation and higher temperatures in the flood prone season will lead to fundamental changes in development. Understandable arguments should urge caution and guardedness here and will require a review of the flood protection concept with respect to future developments in the flood situation.

However nobody can dispute the remaining anthropogenic causes of flooding. Of the many adverse developments, which we are all responsible for, such as the development of water bodies, exaggerated land sealing, badly organised land consolidation, agricultural use and damage to forests, the development of the upper Rhine should be particularly stressed.

The responsibility with regard to downstream parties to push ahead with flood protection in accordance with the polluter-pays principle, calls for development planning in the whole Rhine river basin which corrects the mistakes of the past and rules out new adverse developments. With respect to this, Cologne must set a good example, in order to plausibly be able to demand things of others.

Therefore a range of concrete suggestions for precautionary flood protection have been made. Alongside the creation of additional retention areas by relocating dykes in Köln-Porz-Langel and in Worringen, the district council has decided on a basis for action for keeping the flood plains clear, for breaking up sealed areas and for rain water seepage, for restoring rivers to their original courses and for other measures to reduce the flow rate.

At present plan approval procedures are being carried out for 17 plan approval zones along a 60 km stretch of the Rhine (two stretches of 30 km along the left and right sides of the Rhine). The major aim of this is to give the Rhine more space even in Cologne. Every existing square metre which has hitherto been used for agricultural purposes and is not a large settlement area will be tested to see whether it can be reclaimed as additional flood plains. In this way it is concretely planned, to make 10 million m³ of additional retention volume available for flood flow in Cologne alone. Though these developments are being intensely debated, we can already see from this that the people of Cologne are aware of the joint responsibility of all those who live alongside the Rhine.

The city of Cologne also sees that only if additional flood plains are provided, is there a justification for relatively moderate flood protection structures.

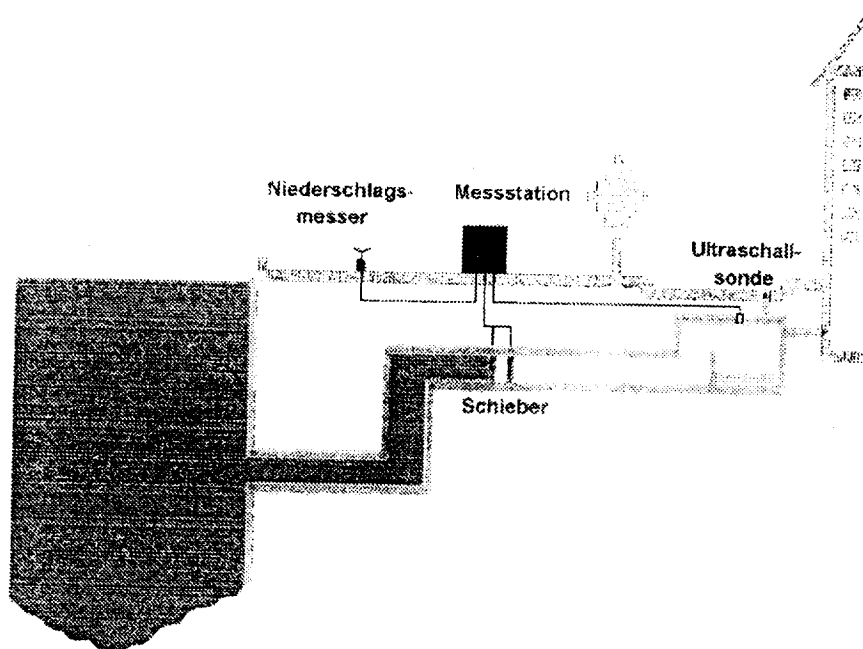
For Cologne, the review of the last incidents of flooding with damage amounting to hundreds of millions led to the conclusion that better flood protection is required for the city irrespective of developments in the Rhine river basin as a whole, in particular since the planned retention areas are far greater than the residential areas to be protected, as far as volume goes.

For future flood protection structures, reference water levels of 11,30 m for a 100 year incident and 11,90 m for a 200 year incident will serve as a basis for assessment.

The recommendations of North-Rhine-Westphalia and regional administration in Cologne were taken into account during considerations. They recommended that future flood protection be based on a 200 year incident plus the required additional margins. This goal was only achieved in parts of the city in which there are structures which pose a serious environmental hazard, where existing dykes need to be redeveloped or changed or where urban development or technical considerations are not an obstacle.

When planning, the local location of flood protection structures has to be taken into consideration. For aesthetic reasons it is not always possible to erect solid walls at the reference water level. Instead, mobile works consisting of many sections will have to be used. On the one hand, the people living there cannot be expected to live behind 2 - 3m high walls. On the other hand it must also be considered that the maintenance and construction of mobile components are time consuming and require many workers, and regarding the constructions themselves a maximum height limit of 2 m will have to be observed.

Rhine Flood Water Gate Valve Closed



Niederschlagsmesser - precipitation gauge
 Messstation - gaging station
 Ultraschallsonde - ultrasonic probe
 Schieber - gate valve

A level of protection which meets the 100 year reference water level is being determined for the whole city zone. These protection levels cannot however be achieved in Porz-Zündorf as well as in the old part of Cologne between the Deutzer and Hohenzollern bridges, as a result of major technical difficulties.

In all considerations for increasing flood protection measures however, it must be assumed that the risks and dangers in low-lying areas will increase. Up until now for instance, the Rodenkircher meadows district was flooded at a fairly slow rate. In future however, the district will become flooded without warning by a sudden rush of flood water and end up under 2,5 metres of water for a short period. Appropriate safety measures will have to be taken.

Municipal drainage measures need to be adjusted, but plans for this are proving to be particularly difficult and costly, as protection against flood-induced backflow in the sewer system has to be provided as well as trouble-free sewage disposal and treatment when the Rhine is at its highest levels.

The plans implemented on this basis were approved by North-Rhine-Westphalia's *Land* government and Cologne's regional administration.

The planned construction works will give rise to the following costs:

Constructive flood protection 150 million DM

Municipal drainage 350 million DM

With the construction of retention areas this amount will climb to more than 500 million DM. All plans were commissioned in 1996.

After talks with the *Land* Ministry of Environment, Regional Planning and Agriculture, only constructive flood protection measures are eligible for a subsidy. A financial contribution of around 60 % can be expected for this.

In the face of these massive sums of money it has been decided to implement the plans as part of a 10 year programme.

The necessary funds for municipal drainage amount to 350 million DM. Just as with the implementation of the *Waste Water Concept 2000*, the 10 year programme would place a burden on the waste water charge budget and would require Cologne's citizens - as part of a joint responsibility - to pay higher water charges. In planning a 10 year programme at least 35 million DM would have to be financed yearly from the waste water charge budget. The increase in charges resulting from this programme would amount to around 3 Pfennigs per cubic metre per year, or for a 4 person household around 5 DM per year. Given the fact that due to the investments which have already been made between 1987 and 1994 the waste water charges will only increase by a relatively small amount (if at all) in the coming years (in 1998 they were reduced by up to 7 %), the investments in flood protection on the scale to which they have been planned would seem acceptable in the interests of those living in Cologne.

It will not be possible to implement the necessary measures all at the same time and therefore priorities will have to be decided. These priorities should however be viewed with caution, as the order can be completely changed by external circumstances. For virtually all of the plans it is necessary to meet the requirements of construction law, e.g. plan approval procedures, and this can take a long time due to possible objections and discussions. This could result in changes over the course of 10 years.

Priorities were decided according to possible damage. A report about possible damage in 16 plan approval sectors was drawn up. Plan approval procedures and subsequent construction measures take precedence in those areas where potential environmental and property damage are the greatest in a disaster.

Further chapters of the flood protection concept are about flood management and disaster prevention. In this context organisational developments are being further optimised on the basis of our experiences during the 1995 flood. In addition to this, planned new reference water levels and the higher, and in particular, mobile, protection structures call for completely different and more demanding logistics. The flood regulations will have to be revised to take account of this. Here we should particularly emphasise the increased participation of the

technical administrative staff in flood services, cooperation with local pressure groups and the creation of an independently managed "flood protection" unit with coordinating functions within the municipal drainage department, which guarantees that the flood regulations are adhered to even during low water-level periods.

Looking ahead.

Having been through both incidents of flooding in 1993 and 1995 and the problems that it caused for those concerned, it is known, that in a town like Cologne every additional cubic metre of flood water means that the dykes become increasingly sodden, and that every centimetre that the water depth gauge rises in Cologne means more cellars, ground floors and upper floors will be flooded by the Rhine. Furthermore, having prepared the evacuation of well over 100 000 people and knowing, that during the floods in 1995 a disaster with damage running into thousands of millions in Cologne alone would have occurred, if the weather forecasts had been accurate, one can only express total disbelief at discussions regarding competence, responsibilities and financial involvement.

A joint Federal-*Länder* working party of the *Federal Wasser- und Schifffahrtsverwaltung* (Administration responsible for waterways) together with the water resources administration bodies from Baden-Württemberg, Hesse and Rhineland-Palatinate calculated in December 1995, that a flood disaster in the low-lying areas of the upper Rhine between Iffezheim and Bingen would cause maximum property damage of around 25,4 thousand million marks. For Cologne alone this would amount to more than 7 thousand million DM. It is to be feared that in cases of extreme flooding, property damage could be as much as 100 thousand million DM in total.

Of course flood disasters cannot be prevented. They are naturally occurring incidents against which there is no absolute protection. In the face of the adverse developments in the whole of the Rhine river basin however, changes on a large scale are urgently needed and possible, in order to minimise the risk of damage which arises from many minor and larger incidents of flooding.

Imagine if there were to be a 200 year flooding incident in the coming years, that led to personal injuries and property damage on a scale of several thousand million DM. It doesn't bear thinking about the accusations, protests and court cases that could be expected with arguments over denial of assistance. These would be aimed at those people dealing with the plans for retention areas, who currently are only hesitantly pushing them forward, not doing anything at all, or have discontinued them for financial reasons. The cities as well as the numerous pressure groups that would have been formed in the meantime would never let the issue drop.

But there are clearly many people who do not recognise the seriousness of the situation. Also it is for the most part only during a serious natural occurrence that demands gain a hearing and people urge for new strategies.

It is now high time to launch the implementation of the Franco-German Treaty, which agreed on a restoration of flood protection as it was before 1955. The Federal Government would have to remind all the *Länder* including North-Rhine-Westphalia of their duty, if they

themselves are not capable of agreeing on arrangements relating to financial and planning matters. In respect to this we should be urging for an optimisation of flood management as well as countering the increase in the flow rate as far as the lower Rhine. It must also be stated in public that the legal apparatus for constructing flood-reducing installations is not sufficient.

Legal procedures would have to be accelerated. In case the *Länder* are not capable of coming to an agreement within the framework of their possibilities, the Federal Government should be provided with the coordination and directing powers necessary for flood protection

The Flood Emergency Organisation for its part, will have to be more effective. It is to be hoped that the pressure to act exerted by towns from Mainz to Nijmegen will lead the Federal Government and *Länder* as well as the International Commission for the Protection of the Rhine against Pollution to develop more commitment to flood protection. A joint responsibility for all those living along the Rhine must come about, whereby egotism is put aside and responsibility for others is considered and accepted.