

Sub-Basin Level Flood Action Plan - The Upper Danube -

As coordinated between Germany and Austria



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1. Introduction

In response to the danger of flooding and in line with its Joint Action Programme, the ICPDR decided in 2000 to establish the long-term Action Programme for Sustainable Flood Prevention in the Danube River Basin. The whole process was accelerated after disastrous floods in 2002 and resulted in adoption of the Action Programme at the ICPDR Ministerial Meeting on 13 December 2004.

The overall goal of the ICPDR Action Programme is to achieve a long term and sustainable approach for managing the risks of floods to protect human life and property, while encouraging conservation and improvement of water related ecosystems. Given the area, the complexity and the internal differences in the Danube River Basin, the Action Programme represents an overall framework, which needs to be specified in further detail for sub-basins. Therefore, the targets of the ICPDR Action Programme include preparation of flood action plans for all sub-basin in the Danube catchment area.

In September 2007 a Directive of the European parliament and of the Council on the assessment and management of flood risks (EFD) was adopted by the European Council. The aim of the Directive is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. The Directive requires Member States to first carry out a preliminary flood risk assessment by 2011 to identify areas at risk of flooding. For such areas they would then need to draw up flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015.

As the ICPDR Action Programme was designed in full coherence with EFD the flood action plans for sub-basins are an important part of implementation of the EFD and they summarize the key actions towards preparation of the flood risk management plans. Therefore, the preparation of the flood action plans for sub-basins can be considered as an interim step in implementation of EFD.

This action plan for the **Upper Danube** sub-basin reviews the current situation in flood protection and sets the targets and the respective measures aiming among others to reduction of damage risks and flood levels, increasing the awareness of flooding and to improvement of flood forecasting. The targets and measures are based on the regulation of land use and spatial planning, increase of retention and detention capacities, technical flood defenses, preventive actions, capacity building, awareness & preparedness raising and prevention and mitigation of water pollution due to floods.

It is foreseen that this planning document will be further refined as appropriate and necessary by the bilateral river commissions.

This report does not include the river Inn where the activities are being coordinated by Austria.

2. Characterisation of Current Situation

2.1 Review and assessment of current Situation

2.1.1 Natural conditions

The Danube originates in the Black Forest and has a length of over 687 kilometres by the time it reaches the German-Austrian border. On the right side are the tributaries Iller, that enters the Danube at Neu-Ulm, the river Lech, that flows into the Danube at Marxheim and the river Isar that enters at Deggendorf, as well as the river Inn in Passau; tributaries on the left are the river Wörnitz in Donauwörth, the Altmühl at Kelheim, and the Naab and Regen that flow into the Danube at Regensburg.

- The Iller is 147 kilometres long, its source is located in the Upper Allgäu where the Breitach, Trettach and Stillach join up at Obersdorf, it then flows through the regions of Allgäu and Upper Swabia and enters the Danube southwest of Neu-Ulm. The Iller has a catchment area of 2152 km².
- The Lech is 264 kilometres long, originates in the Vorarlberg region in Austria and flows through Tyrol and Southern Bavaria where it enters the Danube at Marxheim. The catchment area of the Lech is 3926 km².
- The Isar is 295 kilometres long, originates in the Karwendel mountains (Austria) and enters the Danube at Deggendorf. The Isar has a catchment area of 8370 km².
- The Inn is 517 kilometres long, originates in the Upper Engadine (Switzerland) and flows into the Danube at Passau, the “town of three rivers”. The catchment area of the Inn at Passau is 25700 km².
- The Wörnitz is 130 kilometres long and has its source in the Frankenhöhe Nature Reserve from where it flows through a wide valley between the regions of the Swabian Alb and the Franconian Alb and enters the Danube at Donauwörth.
- The Altmühl is approx. 220 kilometres long and originates to the northeast of Rothenburg ob der Tauber and flows into the Danube at Kehlheim.
- The river Naab is 165 kilometres long and originates to the west of the Oberpfälzer Wald in the Upper Palatinate, to the south of Weiden, and enters the Danube at Regensburg-Mariaort. The catchment area including all headwaters and tributaries is 5225 km².
- The Regen is 185 kilometres long and originates from several spring streams in Zelená Ruda and flows into the Danube at Regensburg

At the border to Austria (discharge gauge Achleiten) the catchment area of the upper Danube has an area of 76,700 km², of which (in rounded figures):

Bavaria accounts for	40,100 km ²
Baden-Württemberg for	8,100 km ²
The river Inn for	26,100 km ² (8,100 of which are in Bavaria)
Austria for	2.400 km ² (upper catchments of rivers Lech, Isar, Loisach)

Some 6,000 km² (15%) of the Danube river basin in Germany are allocated to the alpine and prealpine region.

2.1.2 Floodplains and flood protection

Efforts have been made to establish flood protection in the Danube river basin for about 150 years. The devastating Whitsun floods of 1999 and the damage caused by the floods in August 2002 and 2005 show that there is need for further action. According to the present level of knowledge, an increase in the incidence of minor and medium-scale flood events must be anticipated additionally for the future as a consequence of climate change (cf. www.kliwa.de).

- Description of Flood Hazard

Baden-Württemberg: By 2011, flood-hazard maps will be developed in Baden-Württemberg in a joint project with municipalities along 12,300 km of water bodies. Two standard descriptions of 10, 50, and 100-year flood events, as well as of one extreme event, will represent floodplains and, in addition, the water depths to be expected. For the Danube, such flood-hazard maps have been provided since 2004 (cf. flood profiles).

- Renaturation of rivers

Bavaria: Besides enhancing the ecological status, renaturation of rivers is aimed to improve flood protection through measures that level out and delay discharge. The Flood-Action-Programme 2020 specifies approximately 1,300 km of rivers and 5,300 hectares of river banks as the target for the Danube river basin. Of these some 400 km of rivers and approx. 700 hectares of river banks have undergone renaturation since 2001. Within the scope of these measures alluvial forests have been planted on over 45 hectares of floodplains.

Baden-Württemberg: The renaturation of rivers is also aimed to delay flood runoff and improve the retention in the plain. Along the Danube itself 12 large renaturation projects have been completed respectively construction work started over the past 10 years. These projects each measure over 300 meters in length and cover a total of 5 river km. Danube restoration work started in the autumn of 2008 over a length of 2.7 km. Further measures to restore the good ecological status acc. WFD are under preparation.

- Reactivation of natural retention areas

Bavaria: Precipitation that is already retained in the catchment area and not directly discharged reduces flood discharge in the river. Besides the renaturation of rivers it is therefore important to also strengthen the retention function of the riparian wetlands. This includes measures such as relocating dykes, for example, the activation of abandoned waterways, natural depressions and other retention areas as well as the new development and temporary flooding of alluvial forests. Since 2001 some 20 km of dykes have been relocated and approximately 3 million m³ of retention space activated.

Baden-Württemberg: In addition to this, the large scale restoration of the Lower Iller (km 22-13), implemented in cooperation with the state of Bavaria, has substantially restored the lost retention volume. The restoration of the Danube over a length of 2.7 km, work commencing in the autumn of 2008, will also restore large retention capacities.

Vorarlberg: Due to the morphological conditions (stretches of gorge, areas of natural deepening of the watercourses), it is almost impossible to create natural flood retention areas in the province of Vorarlberg.

Tyrol: Based on the “Wild River Landscape of the Tyrolean Lech” river development scheme, the reactivation of retention areas on the Lech is currently being accelerated. The 10-year programme in the catchment area of the Lech envisages investments of about € 30 million in measures to rapidly improve retention (of flowing waters). Within the framework of the Leutascher Ache flood protection project, numerous flood protection and river ecology plans have been carried out in reaction to the floods of the past few years. The canalised channel of the stream has been markedly widened and structured along approx. 2.5 river kilometres. The training structures which have been built along certain stretches have been designed so that the stream can overflow them, in order to use the adjoining areas for retention purposes.

- Technical flood protection

Flood protection of cities and municipalities / dyke upgrading programme

Bavaria: Generally, technical defence measures are based on the protection against a 100-year flood event. In view of the progressing climate change, when planning new projects in Bavaria an extra 15 % has been added to the hydrological model of a 100-year discharge, as a precautionary measure. This is to account for a future increase in discharge that cannot, at present, be determined in exact terms.

Since 2001 some 270,000 inhabitants in the Danube basin have been protected against a minimum 100-year flood event. The implemented measures protect some 25,000 hectares of developed land against flooding. The targets set in the Flood-Action-Programme 2020 have therefore already been reached.

The kilometre-long dykes along water bodies of the first and second order (larger rivers under the river management of the State of Bavaria) effectively help protect our populated areas. In order to secure their function in the long term, these rivers must be regularly monitored and professionally managed. A survey carried out rates some 350 km of dykes in the Danube river basin as being in need of restoration. Since 2001 some 290 km of these dykes have been restored. Priority must continue to be awarded to the restoration of dykes in the coming years as well.

Within the framework of technical flood defence measures some 40 km of flood walls and 4 km of mobile floodgates have been newly built or completed since 2001.

Baden-Württemberg: With the flood-protection measures taken on the Danube in Ulm, the flood-protection level for the Donautal industrial estate has been enhanced to include a 200-year flood event. Other local flood-protection measures – such as, for instance, Riedlingen – are currently in their planning stages.

Vorarlberg: The village area of Lech has been made flood-proof by means of flood walls (1.4 km) built on both sides of the bank. In addition, the Forest Engineering Service in Torrent and Avalanche Control has implemented flood protection measures in the area of the villages of Zürs and Lech, as well as bed load retention measures on the Zürsbach stream. Above and below the village of Lech, selective protective measures have been carried out to secure the course of the river.

Tyrol: There has been extensive flood protection construction work in the catchment areas of the Isar and Lech. The areas of settlement on the Isar, as well as its tributaries (e.g.: Leutascher Ache), are protected against a flood statistically occurring every 100 years. The main focus of attention here is the maintenance of the protective structures.

- Flood reservoirs / Flood retention basins

Bavaria: 12 state-owned reservoirs with a flood capacity of approx. 150 million m³ decisively contribute towards reducing flood discharge in the Danube river basin. Three of these reservoirs also help to counteract low water levels with a volume of approx. 56 million m³.

Over recent years, technical measures or adapted control strategies have increased the retention capacity of the reservoirs. At the Sylvenstein reservoir on the river Isar, for example, which is the largest state-owned reservoir in the Danube catchment area, an increase in the flood retention capacity was made possible by raising the height of the dam by 3 m and reducing the permanent storage volume by 28 million m³. This, however, involved a reduction in the available capacity for topping up low water levels of approx. 8 million m³.

Baden-Württemberg: Within the Integrated Danube Programme the flood retention basin Wolterdingen has been under construction since 2006 and will be completed in 2011

Vorarlberg: In the Vorarlberg section of the Danube sub-basin of the Upper Danube, there are no storage-type and retention plants that are worth mentioning with regard to flood protection. It is almost impossible to construct retention basins in Vorarlberg, due to the morphology.

Tyrol: In the province of Tyrol, there are a series of valley dams and reservoirs which are utilised for the production of hydroelectricity. In the event of flooding, these storage-type plants can contribute to flood protection through retaining the precipitation in the catchment area. In the catchment area of the Upper Danube, Lakes Plansee and Achensee are of particular importance in this respect.

As well as the two large reservoirs, there are a couple of smaller retention basins for the local protection of the villages. However, mainly due to morphological conditions, no large-scale flood retention plants have been or will be built within the Austrian sub-basin of the Upper Danube.

- **Flood polders – controlled retention**

Bavaria: The selective flooding of retention areas can effectively dampen flood peaks and avoid damage. This also makes it possible to compensate retention area loss as a consequence of other technical measures, such as raising the height of existing dykes.

5 controlled flood polders with a total capacity of around 37 million m³ are planned in the Danube catchment area. Of these polders 1 has already been built, the others are currently in the planning or approval stage.

Baden-Württemberg: Along the Danube in Baden-Württemberg a controlled flood polder with a capacity of approx. 100,000 m³ has been built.

- **Flood control along torrents / protection against alpine natural hazards**

Bavaria: In the Bavarian Alps region approximately 29,000 inhabitants and 2000 hectares of developed land have been protected against floods and mud flow since 2001. To achieve this, reinforcement work has have been carried out along torrents over a length of more then 65 kilometres.

Vorarlberg: According to the 2007 Annual Report of the Forest Engineering Service in Torrent and Avalanche Control (WLV), about 16.5 million euros were invested in protection against torrents, avalanches and rockfall, as well as landslides, in Vorarlberg in 2007.

According to the Forest Engineering Service in Torrent and Avalanche Control (2007), there are 1,369 torrent catchment areas lying within its sphere of competence in the province of Vorarlberg. About 719 of these hazard or catchment areas have already undergone protective measures. The work of maintaining and renovating existing protective structures is therefore markedly gaining importance in the field of action of Torrent and Avalanche Control.

(Anmerkung: Kürzung wurde aus Gründen der Ausgewogenheit vorgenommen.)

Tyrol: According to the Tyrolean Section of the Forest Engineering Service in Torrent and Avalanche Control (2007), from 1999 to 2006 306 million euros were spent on protecting living space in Tyrol. About 40 % of these funds were invested in avalanche control, a further 50 % in torrent control and about 10 % in protection from rockfall and area management measures. Thus, within the sphere of competence of the Tyrolean Section of Torrent and Avalanche Control alone, about 150 million euros were invested from 1999 to 2006 in flood control construction and, subsequently, in protection from floods and natural hazards. In all, approx. 25 million euros are invested annually in protection from hazards arising through torrents in Tyrol.

2.1.3 Characterisation of land uses and known risks

The Danube is Germany's third longest river. Major cities situated on the Danube are Tuttlingen, Ulm, Neu-Ulm, Neuburg an der Donau, Ingolstadt, Regensburg, Straubing and Passau.

In this natural environment agricultural farming still plays a major role, although the agricultural land use decreases from North West to South East, as it does also in the prealpine hills and moorlands. Agricultural land use is therefore dominant in the undulating hill country with more grassland farming in the foothills of the Alps.

In spite of the many and sometimes extensive human interventions, there are several sections of the Danube that still boast an extremely rich species diversity, this being due first and foremost to the declaration of several particularly sensitive habitats as protected areas.

- Identifying and defining floodplains in Bavaria

Bavaria: To avoid future damage potential the most effective preventive measure is to define and keep clear areas endangered by flooding.

The identification of floodplains is planned along approx. 5,100 river km of the major rivers in the Danube river basin, of which approx. 3,000 river km (approx. 60%) have already been assessed. These analyses will be completed by the end of 2010. The calculation will be carried out using digital terrain models with high resolution laserscan data as well as hydraulic 2D models. The calculations base on a 100-year flood event. The floodplains will be defined in a legally binding manner by the competent administrative district authorities. This will restrict a more extensive use of these areas, e.g. for building purposes. Moreover, other changes shall also only be permitted if these do not impair the runoff and the retention properties. Restrictions to agricultural use can also be enforced if, for example, maize planting should hinder the discharge. The same applies to farming of the alluvial forest. A corresponding ordinance was issued recently on the Danube, in the region of Deggendorf.

Baden-Württemberg: The floodplains along all major rivers of the Danube river basin were legally secured years ago. The preparation of **flood hazard maps** for the whole of Baden-Württemberg has been in progress since 2005. Areas affected by flood events occurring statistically every 100 years (HQ_{100} floods) are calculated for all rivers where the catchment area is greater than 10 km² (where settlements are concerned the floodplains are also defined for smaller catchments). The floodplains are defined in a legally binding manner upon publication thereof.

Vorarlberg / Tyrol: In Austria, hazard zone maps are drawn up either by the Federal Hydraulic Engineering Administration or the Forest Engineering Service in Torrent and Avalanche Control, depending on their respective spheres of authority. The hazard zone maps are technical plans which show not only those zones at risk from natural disasters, but also areas which must be kept clear for protective measures or a special kind of area management. Hazard zone maps must show the type and extent of the hazards at the onset of the design event (flood discharge occurring statistically every 100 years), while taking into account the bed load and driftwood carried in the discharge. Furthermore, they must also show the hazard zone in the event that the design event is overstepped up to HQ_{300} , as well as the resulting failure of protective hydraulic engineering systems. Basically, in the catchment area of the “Upper Danube”, hazard zones in the relevant areas of settlement and infrastructure are identified, both in the province of Tyrol and in the province of Vorarlberg.

- Definition of priority areas in the regional planning

Bavaria: The new Bavarian State Development Programme came into force on April 1, 2003 and defined in binding manner priority areas for securing flood discharge and flood retention in regional plans. In the Danube river basin most of these areas have already been protected as reserve/priority areas in the regional planning. Formally, the protection of reserve areas is somewhat weaker than that of priority areas, the set goals, however, are mostly the same. In the glossary to the regional plan these terms have the same meaning.

Baden-Württemberg: The defined floodplains have been/are being taken up in the regional plans as priority areas.

Vorarlberg: Legal regulations relating to natural hazards are stipulated in Vorarlberg's spatial planning law. Areas that are unsuitable due to natural conditions (flooding and the like) may not be designated as building areas. However, opportunity is granted to create the preconditions for designation as building land through implementing suitable measures to protect against hazards, provided these are technically possible and economically justifiable.

Tyrol: Tyrol's spatial planning law stipulates the following with regard to natural hazards: local spatial planning stipulates that those areas and pieces of land which are at risk from natural disasters must be clearly shown on the land utilisation plan. The aim is to as far as possible eliminate the hazard situation on the basis of existing hazard zone maps. Building is only permitted on plots of land where a risk exists (among others, flooding) provided sufficient precautions to protect against natural hazards are taken. In assessing a hazard situation, the existing hazard zone maps must be taken into consideration.

2.1.4 Flood forecasting and warning

Bavaria: Qualitative improvement in flood forecasting methods prolongs the time between the beginning of flood event and critical flood levels. This time can be used to reduce damage.

Baden-Württemberg: The flood forecast centre (HVZ) of the LUBW operates numerous level-monitoring stations in the Danube catchment area as well, publicising flood forecasts for selected stations during supra-regional flood events. In the meantime, flood early-warning systems have also been set up for small catchment areas. The probability of a flood event is classified as "small" (< HQ2), "medium" (> HQ2), "high" (=HQ10), or "very high" (= HQ50).

- Gauging equipment

Bavaria: Within the framework of a revision of the hydrological gauging system the equipment at the some 300 hydrological gauging stations in the Danube catchment area has been substantially improved in terms of data availability and fail-safe measurements. In the flood early warning system nearly all gauges have redundant data and a second remote data transfer device, i.e. the detection, storage and transmission of the water level is carried out using two independent systems.

In **Baden-Württemberg** water level gauging systems have been further automated over recent years and equipped with remote data transfer systems. All major gauging stations are equipped with redundant measuring equipment.

- Precipitation monitoring network

Bavaria: Over recent years the Bavarian Water Management Authority has built up and commissioned an automatic precipitation monitoring network in cooperation with the German Meteorological Service (DWD), designed,. In the area of the upper Danube there are now 61 own and a further 101 DWD stations operating in the online system. All precipitation monitoring stations are fitted out with equipment of the same standard. They deliver high resolution data and are monitored by operators in order to obtain additional meteorological information (e.g. on snow coverage) and to ensure the quality of the measurements. Other data are acquired from different monitoring networks. The precipitation is a particularly important input variable for forecast models. In areas without radar coverage and in special hydrological cases this monitoring network is being further intensified.

Baden-Württemberg operates a precipitation monitoring network together with the DWD.

- **Snow monitoring network**

Bavaria: All 61 precipitation monitoring stations of the Bavarian Water Management Authority have been fitted with snow sensors. Manual measurement of the height and water content of the snow layer is carried out by operators once a day, the data are transferred online for the calibration of snow forecast models and are also published on the internet. Two automatic snow monitoring stations are also in operation.

Baden-Württemberg has access to snow monitoring stations based on a cooperation with the DWD.

- **Forecast models**

Bavaria: Forecast models have been developed for the different sub-catchments of the Upper Danube. They provide an area-wide coverage of the Danube river basin in Bavaria (1-D precipitation runoff models, 1D wave discharge model for the navigable area of the Danube). Using these models operational, gauge-based water level and discharge forecasts are calculated and published (several time a day in flood events). In 2007 the range of uncertainty of published flood forecasts was introduced. The bandwidth of the available precipitation forecasts has expanded over the years (precipitation forecasts of different providers, ensemble forecasts). Improved hydrodynamic models and also hydrological models are currently being tested.

Baden-Württemberg has for years had advanced forecasting models that have proved their worth many times. There is also a hydrological model for the Danube.

- **Flood warning system in Bavaria (HND) / Flood forecast centre BW (HVZ)**

Bavaria: The flood warning system is a key element in risk management. Due to early warning systems the public and municipalities can quickly take preventive action.

The water management state offices are appropriately warned in advance, they receive gauge-based flood forecasts and a host of additional information for assessing the situation. For this purpose and in order to inform the public a comprehensive intranet and internet service has been set up for the flood early warning system (including up-to-date analyses on precipitation, water level and discharge as well as a variety of forecasts, information and warnings for specific counties). In addition, the safety and availability of the internet service has been substantially enhanced (redundant data transfer, server and database backups). In the higher, alpine catchments flood forecasting is especially difficult. On the one hand, the time for an early warning is relatively short and in the range of just a few hours. On the other hand, there is substantial uncertainty in meteorological forecasts concerning the spatial and time distribution of the precipitation.

The flood forecast centre in **Baden-Württemberg** (HVZ) has been delivering flood forecasts for preselected gauges for years and is improving its instruments on an ongoing basis. For better understanding of this information the historical flood levels are also given alongside the current level. In this way, people can find out whether the forecast flood will be more serious than others.

There are also provided gauge-based flood hazard maps. These maps show the areas that will be flooded with a forecast flood discharge (e.g. a flood event of HQ₂₀, HQ₅₀, HQ₁₀₀). This information enables residents to assess better the hazard they are exposed to.

Vorarlberg: No flood forecasting models for streams in the Danube sub-basin are available. Due to its geographic position, with the still very small catchment areas, a forecasting model would not be effective here. Advance warning of the public is done based on forecasts of torrential rain.

Tyrol: On the Tyrolean section of the Lech, an occurrence-based hydrological model, which extends over the catchment area of the Lech all the way to the border of the province, has been in trial operation since 2007. As in Vorarlberg, a rapid rise of the flood wave can occur due to the smallness of the catchment area. Suitable measures are therefore implemented, based on the weather warnings. Potential retention space can be created by means of lowering the level of Lake Plansee in good time beforehand.

2.1.5 Institutional and legal framework

Bavaria: After the Whitsun floods of 1999 the Bavarian cabinet adopted the Flood-Action-Programme 2020 for sustainable flood control in Bavaria, and the implementation of this mechanism has been most successful thanks to the strong technical commitment and the allocation of substantial budgetary resources. The programme plans an investment of 2.3 billion EUR by the year 2020, of which some 1.3 billion EUR will go to the Danube catchment area. This will make it possible to:

- effectively reduce the existing damage potential,
- avoid future damage potential in a sustainable manner and
- establish adequate flood defence systems for buildings and infrastructure installations.

To this end, the Flood-Action-Programme 2020 pursues an integrated, future-proof flood control strategy comprising the three fields of action:

- natural retention,
- technical flood protection and
- preventive flood control.

The legal framework for flood control has changed over recent years. On 23.10.2007 the European Directive on the Assessment and Management of Flood Risks was issued by the European Parliament and the Council (EFD).

The Floods Directive is designed to create a framework for the assessment and management of flood risks and is aimed to limit damaging effects on human health, the environment, infrastructure, cultural inheritance and business activities. Implementation of the EFD is to take place in 3 stages:

- Preliminary flood risk assessments,
- Preparation of flood hazard maps and flood risk maps and
- Flood risk management plans.

In Bavaria work has already commenced on preparing preliminary flood risk assessments.

Baden-Württemberg: Over the past years substantial progress has been made for the purposes of the Floods Directive:

In 1992 the state government adopted the Integrated Danube Programme IDP that awards equal priority to providing flood protection and to the renaturation of the Danube and its source rivers Brigach and Breg (an extension of the IDP to cover the entire catchment area is planned in the medium term).

The flood control strategy is based on three partitions, according to LAWA recommendations:

- Floodplain management
- Technical flood defence systems
- Preventive flood control.

As a basis for floodplain management and technical flood defence systems a risk analysis by the Danube was prepared using state-of-the-art methods, that identifies the flooded areas, the flood damage occurring in these areas after a design flood of up to HQ_{1000} . This led to so-called flood profiles. They show the flooded areas and the water depths in the event of HQ_{100} flood events and indicate the potential property damage for flood events of different return periods (HQ_{20} , HQ_{50} , HQ_{100} and HQ_{1000}). On the basis of these studies a concept was drawn up on how to reach a protection of the developed areas along the Danube in the event of a HQ_{100} flood with minimised costs. This concept planned the construction of a flood retention basin with a

capacity of 4.7 million m³ at Donaueschingen-Wolterdingen and additional local flood defence measures in the form of dykes, flood walls and mobile floodgates at settlements. The retention basin has been under construction since 2006, most of the local flood defence systems have been completed. The remaining measures have, in general, been planned and approved.

For the Danube as well as for the rivers Brigach and Breg the expected average annual damage was calculated by determination of the occurring flood damage for different return periods and accounting for its probability. This calculation was carried out for each municipality individually. The result was then pooled. This gave an expected average annual damage prior to and after the implementation of the flood control measures.

These flood profiles are to be revised by the end of 2010 within the framework of the preparation of flood hazard maps throughout the state. For implementation of the EU Water Framework Directive the available results will be adjusted and supplemented according to the criteria for the assessment of the flood risk, for the preparation of flood risk maps and for the development of flood risk management plans.

Vorarlberg: In the sub-basin of the Upper Danube in Vorarlberg, no special strategic objective targets are currently stipulated by the Hydraulic Engineering Administration. Here, the main focus of attention on both the Breitach and the Lech is the maintenance of the existing protective structures and installations, which already correspond to the desired degree of construction.

In 2008, about 45 million euros were spent on flood protection in the province of Vorarlberg, of which approx. 30 million euros were spent within the sphere of the Hydraulic Engineering Administration and approx. 17.5 million euros within the sphere of the Torrent and Avalanche Control. The Action Programme of the Hydraulic Engineering Administration includes plans to invest about 200 million euros from 2006 to 2015. However, due to the large volume of construction work carried out on the existing protective installations, as well as the morphological conditions in the catchment area of the Upper Danube, only a fraction of these financial resources were channelled into measures on these rivers.

Tyrol: In the Tyrolean catchment area of the Lech, the authorities are making efforts to achieve a combined approach to flood protection. As well as targeted flood protection measures in the areas of settlement (flood protection dams, widening measures), the main endeavour here is to preserve, and - when possible - even reactivate, retention spaces and areas for the retention of standing and flowing waters. Measures for widening and enhancing the retention of flowing waters are stipulated in the "Wild River Landscape of the Tyrolean Lech" river development scheme. The 10-year programme of the Federal Hydraulic Engineering Administration envisages flood protection investments mainly in the area of settlement within the Lech catchment area over the next few years. Local protective measures, combined with widening measures and the enhancement of the retention of flowing waters, are being implemented. In the 10-year programme, an investment sum of about 30 million euros is estimated for these measures. A further strategic focus of flood protection on the Lech is the maintenance of the protective installations.

2.1.6 Recent awareness of flooding

- Hazard control and disaster protection

Bavaria: Effective hazard control activities within the scope of disaster protection can save lives and substantially reduce damage. This task is therefore of major importance.

The municipalities are the bodies responsible for hazard control in the event of floods. Operations are carried out by the fire and rescue service and the technical relief agency (Technisches Hilfswerk). In the event of major incidents the administrative district office can declare a state of emergency. Deployment is then taken over by the administrative district office. Experts of the water management state offices are on stand-by to give their advice.

The fire and rescue service carries out regular training sessions and exercises for flood operations. They are supported by water management experts. To this end, there is also a brochure on dyke defence, describing different possible action and how this is to be implemented. The brochure is provided for download on the internet under: www.lfu.bayern.de/wasser/fachinformationen/hinweise_deichverteidigung_deichsicherung/index.htm

Baden-Württemberg: As part of the NOAH EU project, a flood information and warning system (FLIWAS) was developed jointly with the City of Cologne and partners from the Netherlands (cf. www.fliwas.com). The purpose of FLIWAS is to provide the authorities and agencies in charge of flood prevention, hazard avoidance, and disaster control with the hydrological and water-engineering information necessary for preparing and implementing flood-defence measures, as well as with a possibility to file within the system alert and operations plans, and to process the same in such manner that in the event of a flood, all relevant information can be provided in an orderly fashion. FLIWAS is currently being implemented state-wide in Baden-Württemberg and on the Danube as well.

Vorarlberg: In Vorarlberg, the Regional Warning Centre coordinates the crisis management of the local operational command. At the regional level, the individual district operational commands coordinate their work amongst themselves and with the superordinate operational command.

If precipitation threshold levels are exceeded, the Central Institute for Meteorology and Geodynamics (ZAMG) passes the information on to the Hydrographic Service in Vorarlberg. If the water-level markers are overstepped, the Regional Warning Centre will be informed and keeps further developments under observation.

Tyrol: In Tyrol, the Department for Civil Defence and Disaster Control is responsible for all tasks in the area of civil defence and disaster control. In case of emergency, it determines how the respective operations should be managed and supports the authorities in controlling the disaster. The province of Tyrol has set up its own flood alarm plan, which provides for cross-border cooperation with the Free State of Bavaria.

The flood warning system is based on close cooperation between Hydrography and the Central Institute for Meteorology and Geodynamics (ZAMG). The Hydrographic Services function as a hub for all information and data. Based on this, flood warnings will, if necessary, be issued for the regions concerned. The water levels in the province of Tyrol are available to interested members of the public on the internet, and are constantly updated in the event of disaster. The Tyrolean Disaster Management Law and the Disaster Control Plan Regulation stipulate that the municipalities and districts should set up disaster control and emergency plans. Based on this, an instrument for assessing risk including disaster management has been developed as a pilot in the district of Reutte through the cooperation of authorities (province, district, municipality), alp-S - Centre for Natural Hazards and Risk Management and the University of Innsbruck.

- Partnerships

Bavaria: Partnerships have been set up by state offices for water management in areas that are not affected by floods to support those state offices affected with staff and equipment in the event of prolonged floods.

Baden-Württemberg: In Baden-Württemberg the Danube partnership was founded in the Danube catchment area in the year 2005. It includes all municipalities along the Danube in Baden-Württemberg as well as those situated on the source rivers Brigach und Breg. Its task is to improve flood protection and preventive flood control by exchanging information and experience, by giving each other support and in preparing for floods. For this purpose the

municipalities meet once a year under the moderation of the regional administrative authority Tübingen (water management authority).

- Flood conferences and project groups

Bavaria: The 2002 flood caused substantial damage along the rivers Naab and Regen, 2 northern tributaries of the Danube. A project group was then set up with the participation of the water management authorities, the administrative district offices and municipalities and the disaster protection task forces. Representatives of nature conservation and farming organisations were also included. Options for optimising activities in future flood events were established based on an analysis of the flood occurrence. A major topic was also providing information for the public in the form of flyers, brochures and internet services. This was to create greater public awareness and acceptance of flood risks and simultaneously strengthen the idea of citizens taking individual precautions.

After the 2005 floods there were 2 flood conferences held for the catchments of the rivers Iller and Isar. Besides being attended by water management experts there were also representatives of the municipalities and the disaster protection task forces. The tasks at the conferences were to analyse the flood occurrences and most importantly to reveal deficits and ways to optimise the course of action in the event of a flood.

- Information service for flood-endangered areas

Bavaria: To further increase public awareness for flood hazards the Bavarian Environment Agency (LfU) has set up an information service for flood-endangered areas in Bavaria (IÜG) in cooperation with the Bavarian Administration for Surveying and Mapping. This service gives everyone access to information on the defined flood-endangered areas on the internet under www.iug.bayern.de. The new information acquired through the project “Identification and definition of floodplains in Bavaria” will be used to update the maps every six months. For implementing the EFD these maps will have to be supplemented accordingly.

Baden-Württemberg: In Baden-Württemberg, floodplains have been identified on all water bodies by law, and are shown in flood-hazard maps. Information about floodplains on the Danube can be accessed on the Internet homepage of the District Government in Tübingen.

Austria: With its “Flood Risk Zoning Austria – HORA” project, the Federal Ministry of Agriculture, Forestry, Environment and Water Management and the Association of Austrian Insurance Companies started a nationwide risk zoning system for natural disasters, particularly for floods. As well as promoting risk awareness, the aim of this measure is to highlight the limits of active protective measures and the need for the sensible utilisation of areas at risk of flooding. Valuable information on the current flood risk, based on digital hazard maps, can be accessed by every citizen via the internet. In addition, these risk maps also offer each Austrian citizen the basic possibility of assessing risk.

In 2004, the Federal Ministry of Agriculture, Forestry, Environment and Water Management launched “Generation Blue”, - www.generationblue.at - a youth internet platform. The aim of this internet platform is to introduce young people to the subject, to awaken their enthusiasm, and to inform and sensitise them concerning water. To achieve this aim, the website has been designed to appeal to young people, offering many possibilities of learning something on the subject through games.

Torrent and Avalanche Control makes children aware of the problem of natural hazards through the character “Bertie Beaver” - www.biberberti.lebensministerium.at. Presented in the form of school projects, the aim is for children to learn through play how to handle natural hazards correctly, as well as how to behave in case of emergency.

The Environmental Education Forum is an initiative launched jointly by the Federal Ministry of Agriculture, Forestry, Environment and Water Management and the Federal Ministry for Education, Arts and Culture -www.umweltbildung.at. This portal offers a large number of environmental education opportunities in a variety of special fields. The target group encompasses disseminators in schools, institutions offering further training for teachers, extracurricular youth educational organisations and also adult education. Valuable information, documents and publications on a wide variety of different special fields, including flood protection, can be accessed on the homepage.

The largest flood research project of the European Union fulfils the requirements of the Water Framework Directive with regard to cross-border coordination between countries sharing common river basins. On the Floodsite homepage - www.floodsite.net -, those interested can access a variety of information, publications and newsletters, though to do this one must have a command of the English language and a certain amount of technical knowledge.

- Alpine natural hazard information service

Bavaria: The Alpine natural hazard information service (IAN) provides comprehensive information relating to these natural hazards in the Bavarian Alps region. It is an interactive geographic information system (GIS) that gives all parties involved, experts, municipalities, planners or interested citizens, a simple and fast overview of the hazard situation in a specific area. The mapping service can be called up under www.wasser.bayern.de.

- Citizens must take own precautions

There was a drastic increase in damage caused by flooding during the nineties of the last century. Damage inflicted by extensive floods over the past decades cost over 11 billion EUR in Germany alone.

Absolute flood protection is not possible. It is therefore essential that citizens take appropriate precautions (suitable construction measures, behaviour and risk coverage). Taking such action can limit or even avoid flood damage. There is, however, still a considerable amount of residual risk. Every individual in flood endangered areas should take precautionary action e.g. in the form of provisions or insurance coverage.

Citizens can find further information around these measures in flyers, brochures or on the internet under www.wasser.bayern.de.

- Optimising cooperation in integral flood control

The **International Commission for the Protection of the Danube River**, which is based in Vienna, was founded in 1994 to actively promote cooperation concerning protection and contractual utilisation in the Danube river basin. Due to the severe floods and the as yet hardly assessable consequences of climate change, in 2004 it was decided to launch a long-term Action Programme for sustainable flood protection in the Danube river basin. One of the aims of the Action Programme is its declared objective to set up forums for the exchange of expert knowledge, in order to push ahead with sustainable, efficient flood protection throughout the Danube river basin, based on these measures.

In November 2004 the Platform on Natural Hazards of the Alpine Convention (PLANALP) was launched as a platform for developing risk management strategies for natural hazards. All Member States of the Alpine Convention are participating in this project. Even though the focus of this platform is on alpine natural hazards, many solution approaches discussed in the PLANALP can be transferred to the management of flood risks. The PLANALP therefore supports the exchange of experience at an international level.

In the spring of 2008 a “Bavarian Platform on Natural Hazards - BayPlanat“ was launched, based on the Planat organisation in Switzerland. The main objective of BayPlanat is to coordinate and optimise strategies for an integral flood risk management. Besides water management experts this organisation involves representatives from spatial planning, disaster protection and also representatives of towns and municipalities.

Over the past few years, the exchange of experiences and expert knowledge has also been increasingly coordinated on the basis of **transnational projects**. For example, through INTERREG pilot projects an effort has been launched to develop river management schemes internationally in the direction of a river basin management plan. The intention is to thus boost structured cooperation and the exchange of knowledge between all the administrative departments working in the river basin, starting with hydrology, and then involving spatial planning, water rights, nature conservation, agricultural and forestry departments, etc. For example measures have been implemented to reactivate former retention areas in Pertisau in the catchment area of the Loisach.

- Avoidance and reduction of water pollution resulting from floods

The destructive effect of large-scale floods is also accompanied by the pollution of waters. Floods can therefore have far-reaching consequences for the environment. Liquid fuels which escape from storage tanks, damage to supply lines, industrial enterprises, sewage treatment and chemical plants or filling stations can lead to contamination or the loss of biological diversity in waters. Increased efforts must therefore be made by planners and executing bodies to prevent the contamination of waters in the event of disaster in the future. To achieve this, it is necessary for spatial planning to be integrated to a much greater extent into the protective water

management planning process and for the legislator (building regulations) to make clear stipulations in this regard.

Bavaria: In the past, environmental damage caused by flooding was especially due to fuel spilling from heating system tanks. However, shortly after the floods had died down, there was no little pollution to be found. Through the introduction of a non-recurring compulsory test for above-ground installations in flood-prone areas the situation has improved considerably.

Sewage treatment plants are basically built in such a way that they guarantee protection against a 100-year flood event. The same applies to industrial plants. If a particular environmental risk is involved the level of protection can also be set higher in individual cases.

The insurance industry has published a guide on protection concepts and protection measures for industry and trade. The guide provides information on how to develop suitable provisions using a hazard analysis and the definition of protection targets. Besides reducing damage to a minimum the avoidance of water pollution also plays an important role.

Baden-Württemberg: A few years ago, the Order for constructions handling with water hazardous substances (VAwS) was revised in connection with an amendment of the State Water Statute to make the storage of substances hazardous to water safer in flood-endangered areas. Under that amendment, requirements as to the storage of substances hazardous to water will be guided by the respective level of protection prescribed for a housing estate or local situation. The degree of a hazard, in relation to statistical incidence in terms of years, has been marked in the flood-hazard maps.

Austria: The Ministry offers the public valuable information with regard to flood-proof building in its brochure “The Force of Water – How to protect buildings adequately from floods and high groundwater levels”. The brochure explicitly goes into the floodproof design of heating systems, with the aim of preventing pollution of waters with heating oil later on. In addition, flood protection strategies in Austria aim to encourage citizens to take individual precautions by offering them good information and, if need be, suitable incentives.

With respect to the threat of water pollution in the event of flooding, some of the building regulations provide for special precautions and stipulations concerning the installation of storage containers for liquid fuels (heating oil). However, the building regulations of the provinces of Tyrol and Vorarlberg, which are affected by the sub-basin of the Upper Danube, do not (yet) contain any special stipulations in this regard.

In Austria constructions, such as new sewage plants or industrial workshops, are basically built outside the inundation zones of floods that statistically occur every 100 years, and/or suitable structural precautions are taken to design the construction to be floodproof. This represents the primary foundation for preventing the pollution of waters in the event of flooding. When carrying out construction measures on watercourses in future, the Hydraulic Engineering Administrations will endeavour not to lay any more pipelines from which polluting emissions could escape in the event of disaster.

2.2 Sustainable flood protection - Flood - Action - Programme

- Targets and Measures of the Flood - Action - Programme

The 4 main targets of the Flood - Action - Programme - concerning the entire catchment area can be summarised as follows:

- Improvement of flood forecasting and early warning systems, as well as the networking of national or regional systems
- Support in drawing up and coordinating flood action plans for the sub-basins
- Establishment of forums for the exchange of technical knowledge
- Recommendation of a common approach for assessing areas threatened by flooding and determining the flood risk

The following six aims have been formulated for the individual sub-basins:

- Reduction of the negative effects and the probability of flooding in each sub-basin through developing and implementing a retention measure that is as natural as possible.
- Improvement and networking of flood forecasting and warning systems throughout the Danube river basin, as well as adapting them to local and regional needs.
- Promotion of active awareness-raising with regard to flood risk and anti-flood measures, as well as an expansion of the capacity of flood protection and flood control organisations.
- Development of flood risk maps in order to promote the sensible use of land, to check investments in land and to raise the awareness of the general public.
- Standardisation of dimensioning criteria and safety regulations at the national and international level.
- Avoidance and reduction of the water pollution caused by flooding.

The Flood-Action-programme will make it possible to effectively reduce the existing damage potential, avoid future damage potential in a sustainable manner and establish adequate flood defence systems for buildings and infrastructure installations.

To this end, the Action Programme pursues an integrated, future-proof flood control strategy comprising the three fields of action: natural retention, technical flood defence and preventive flood control.

3. Target Settings

3.1 Regulation of land use and spatial planning

Target 1 Avoiding new settlement activity in areas with a medium probability of flood events

3.2 Reactivation of former, or creation of new, retention and detention capacities

Target 1 Maintaining natural retention areas

Target 2 Creating new retention areas

Target 3 Improvement of Flood control

3.3 Technical flood protection

Target 1 Improvement of Flood protection of towns and municipalities

Target 2 Appropriate measures for sediment management and avoiding flash floods

Target 3 Guaranteeing constant preparedness of the flood defence system

Target 4 Improving the protection of objects

3.4 Preventive actions (Non-structural measures)

Target 1 Enhancing early-warning systems

Target 2 Adopting the principles set out in the EU Floods Directive

3.5 Capacity building of professionals

Target 1 Improving rules for action in response to emergencies

Target 2 Preparation of flood-risk management plans

Target 3 Improving international cooperation

3.6 Raising awareness and preparedness of general public

Target 1 Improving response by the population affected, operating facilities, and those responsible for national treasures, to flood events so as to avoid detrimental effects

3.7 Prevention and mitigation of water pollution Due to floods

Target 1 Improving the storage of water-endangering substance

4. Measures to achieve targets

Measures	Type of intervention	Responsibility	Costs	Deadlines	Remarks
4.1 Regulation of land use and spatial planning					
Target 1: Avoiding new settlement activity in areas with a medium probability of flood					
M 1: Developing flood-hazard maps and flood-risk maps	Research	Administration of Water Management G: Bavarian State Ministry of the Environment and Public Health (StMUG), Ministry of the Environment of Baden-Württemberg A: Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW)		by 2013	G: In January 2008, the Environment Agency (LfU) held a workshop entitled "Flood Hazard Maps", with the objective of initiating a co-ordinated course of action within the administration for preparing those maps. In Baden-Württemberg, flood-hazard maps have been drawn up since 2003. A: To be worked out in cooperation with the Austrian Insurance Association. In certain sub-areas (informing the public, flood-endangered areas), this already corresponds to the EU Directive on the assessment and management of flood risks.
M 2: Identifying flood plains	Act of Law	Administration of Water Management		Ongoing	D: Bavaria has provided for the determination of flood plains for approx. 5,100 km alongside rivers ("Flkm"), of which approx. 3,000 Flkm have already been completed. By the end of 2010, these investigations will be concluded. The flood plains thus determined will be stipulated in a binding manner by way of statutory instrument. This will provide for types of use within such areas. In Baden-Württemberg, flood plains were secured by law years ago. A: Complete identification of all hazard zones in the sphere of competence of the Federal Hydraulic Engineering Administration will take place by 2020. Complete identification of all hazard zones in the sphere of competence of the Forest Engineering Service in Torrent and Avalanche Control will be completed by 2010.
M 3: Identifying priority areas	Act of Law	Spatial Planning Provinces		Ongoing	In Bavaria, priority areas for securing flood outflow and flood retention are provided for in a binding manner in regional planning. In Baden-Württemberg, the flood-plain areas determined will be included as priority areas in regional planning.
4.2 Reactivation of former, or creation of new, retention and detention capacities					
Target 1. Maintaining natural retention areas					
M 1: Maintaining natural retention areas	Administrative	Administration of Water Management		Ongoing	Targeted flood retention in the catchment areas. Passive flood protection takes priority over active flood protection.

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M 2:	Keeping narrow passages open through a maintenance of water bodies adapted to ecological requirements	Maintenance of water bodies	Administration of Water Management, Municipalities		Ongoing	
Target 2. Creating new retention areas		Constructional				
M 1	Design concepts for smaller rivers (third order rivers in Bavaria or Waters of the second order in Baden Württemberg)	Administrative	Municipalities, Administration of Water Management,		Ongoing	Specific support provided by the municipalities for flood protection and retention measures on third order rivers in Bavaria.
M 2:	Renaturation of water bodies	Planning Constructional	Municipalities, Administration of Water Management		Ongoing	In Bavaria, along 1300 km of waterways and 5300 ha of alluvial floodplains. In Baden-Württemberg the rehabilitation of the Danube started in the autumn of 2008 along a stretch measuring 2.7 km. Other measures for establishing good ecological status in compliance with the WFD are in preparation.
M 3:	Flood polders / Flood retention basins – controlled retention	Planning Constructional	Administration of Water Management			In Bavaria 5 controlled flood polders are planned for a total volume of 37 million m ³ . In Baden-Württemberg the Wolterdingen retention basin with a capacity of 4.7 million m ³ will be completed in 2011.
Target 3. Improvement of Flood control					Ongoing	
M 1:	Controlled retention	Planning			Ongoing	Regarding controlled retention, greater potentials for the future lie in the continual further development of prognosis and forecasting models. The taking into account of protective water management aspects in the operating regulations of power stations, valley dams or lake reservoirs
M 2:	"Forecast of flood situation along the Danube in Bavaria taking into account the retention potential and optimised control strategies "between Donauwörth and Kelheim	Research	TU Munich			
M 3:	Connection project between Neu-Ulm and Donauwörth	Research	TU Munich			
4.3 Technical flood protection						
Target 1 Improvement of Flood protection of towns and municipalities						
M 1:	Construction of technical flood protection for towns and municipalities	Technical	Administration of Water Management, Municipalities		Projects Ongoing	
M 2:	Dyke upgrading	Technical	Administration of Water Management, Municipalities		Ongoing	
M 3:	Upkeep and improvement of floodwater passability on watercourses	Technical	Federal government, provinces, Municipalities		Ongoing	Improvement of passability (outlets, channels, bridges...)
Target 2 Appropriate measures for sediment management and avoiding flash floods						
M 1	Flood plain programme	Administrative			Ongoing	
Target 3. Guaranteeing constant preparedness of the flood defence system						
M 1:	Maintenance	Technical	Administration of Water		Ongoing	

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		Management, Municipalities			
Target 3. Improving the protection of objects					
M 1: Measures towards object protection	Constructional	Private Sector, Municipalities		Projects	
4.4 Preventive actions					
Target 1. Enhancing early-warning systems					
M 1: Improving flood forecasts	Administrative	Administration of Water Management		Ongoing	
M 2: Information service, flood-endangered areas	Administrative	Administration of Water Management		Ongoing	
M 3: Information service, alpine natural hazards	Administrative	Administration of Water Management		Ongoing	
M 4: Adaptation and development of the gauge network	Constructional, maintenance	Administration of water management		Ongoing	Further development of, in particular, the basic network of telecommunicating gauges. Deployment of state-of-the-art technical devices and systems.
Target 2. Adopting the principles set out in the EU Floods Directive (pursuant to Bavarian proposal)					
M 1: Preparation of the new water law	Administrative	Federal government, provinces,			
4.5 Capacity building of professionals					
Target 1 Improving rules for action in response to emergencies					
M 1: Implementation of FLIWAS (Flood Information and Warning System)	EDV-System	Administration of Water Management, Administration of inner affairs, Municipalities		Project	Is being introduced state-wide in Baden-Württemberg from 2009 onwards.
M 2: Developing alert and operations plans	Planning	Municipalities		Ongoing	
M 3: Holding training sessions, meetings	Administrative	Administration of Water Management			
M 4: Danube action programme for flood protection		Administration of Water Management			
Target 2 Preparation of flood-risk management plans					
M 1: Flood-risk management planning	Concept	Administration of Water Management		Ongoing	
Target 3 Improving international cooperation					
M 1: Intensifying international cooperation in flood management	Administrative			Ongoing	
4.6 Raising awareness and preparedness of general public					
Target 1 Improving response by the population affected, operating facilities, and those responsible for national treasures, to flood events so as to avoid detrimental effects					
M 1: PR work as part of flood-risk communication (the Internet, leaflets)	Information	Administration of Water Management		Ongoing	In Baden-Württemberg, provision has been made via flood cooperation schemes since 2004.

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M 2:	Holding training sessions, meetings	Administrative	Administration of Water Management		Ongoing	
4.7 Prevention and mitigation of water pollution due to floods						
Target 1 Improving the storage of water-endangering substance						
M 1:	Rigorous application of rules for the storage of water-endangering substances	Administrative	Administration of Water Management, Administration of inner affairs, Municipalities		Ongoing	
M 2:	Information on flood-proof building	Information	Federal government, provinces, municipalities		Ongoing	Information on constructing flood-proof heating systems