Update of the Flood Hazard and Flood Risk Maps in the International River Basin District 'Rhine'

(Catchment > 2,500 km^2, Part A)

Second cycle of the Floods Directive

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Foreword

During the first cycle until 22 December 2013 and according to Article 6(1) of the Directive 2007/60/EC[1] of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks (in the following: "FD") the **EU Member States** drafted **flood hazard maps and flood risk maps**[2] for areas with potential significant flood risk identified under Article 5(1) FD[3].
FD Article 6(2) presupposes an exchange of information of the Member States concerned prior to drafting flood hazard and flood risk maps for areas determined according to FD Article 5 and shared by several Member States.

Furthermore, information gathered during the 1st cycle for drafting flood hazard maps and flood risk maps according to Chapters III and IV of the FD have been used in the first Flood Risk Management Plan (FRMP) of the IRBD Rhine[4].

In the second cycle of implementation of the FD, the report on the identification of areas with potential significant flood risk in the IRBD Rhine pursuant to Article 14 FD has been updated until 22 December 2018[5].

At the same time, in the context of the second cycle, the flood hazard and flood risk maps referred to in Article 14(2) FD shall be reviewed and, if necessary, updated by 22 December 2019 on the basis of the update of the areas with potential significant flood risk. Further reviews shall be carried out every six years.

In the Conference of Rhine Ministers of 18 October 2007, the International Commission for the Protection of the Rhine (ICPR) had been charged to support the coordination required within the implementation of the EU FD between EU Member States and Switzerland in the catchment in a comparable manner to what is done for the Water Framework Directive (WFD).

As a non EU member, Switzerland is not obliged to implement the FD. Liechtenstein is also not obliged to implement it, as this Directive has not been incorporated into the EEA Agreement due to its lack of EEA relevance. As is the case within the implementation of

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32007L0060
[2] https://www.iksr.org/en/eu-directives/floods-directive/flood-hazard-and-flood-risk-maps/: "Report on the Drafting of Flood Hazard and Flood Risk Maps in the IRBD Rhine" (1st cycle, 2014)
[3] https://www.iksr.org/en/eu-directives/floods-directive/flood-risk-assessment/: "Report on the identification of potential significant flood risk areas in the IRBD Rhine" (1st cycle, 2011)
[4] https://www.iksr.org/en/eu-directives/floods-directive/ und https://www.iksr.org/en/eu-directives/floods-directive/flood-risk-management-plan/
[5] https://www.iksr.org/fileadmin/user_upload/DKDM/Dokumente/BWP-HWRMP/EN/bwp_En_1st_FD_report_Update_2018.pdf : "Update of the identification of potential significant flood risk areas in the IRBD Rhine" (2nd cycle, 2018)

the WFD, and based on national law, Switzerland and Liechtenstein have supported the coordination of the EU Member States with respect to implementing the FD.

The EU Member States are in charge of reporting on the state of implementation of the FD to the EU Commission.

The reporting of the EU Member States to the EU Commission is based on the "Guidance for Reporting under the Floods Directive (2007/60/EC)[6]"(2013) including a "Reporting Sheet for Flood Hazard Maps and Flood Risk Maps".

The update at hand is available to the States in the Rhine river basin for their reporting on the FD to the EU according to Article 6(1)(2), resp. Article 14(2). It is the result of the exchange of information during the period 2014-2019 at the level of the IRBD Rhine pursuant to Article 6(2) FD and, including the Annexes, it serves the EU Member States:

(1) as documentation for the application of Article 14 FD (review and, if necessary, for updating flood hazard and flood risk maps) in the IRBD Rhine (Part A, catchment > 2,500 km²) in the second cycle
(2) as proof for the exchange of information in the IRBD Rhine required according to Article 6(2) and covered by the reporting obligation.

For further details on flood risk management, reference is made to the internationally coordinated FRMP drawn up in 2015 as part of the 1st cycle in accordance with the FD[7].

Exchange of information according to FD Article 6(2) on reviewing and, if necessary updating flood hazard and flood risk maps

In its Article 6(2) the FD provides that, for areas determined according to Article 5 and which are shared by several Member States, the preparation of the maps shall be *„subject to prior exchange of information between the Member States concerned"*.

The exchange of information within the ICPR concerning the drafting of the flood risk maps is based on concrete earlier ICPR work.

a. Following the great floods of the Rhine in 1993/1995, the ICPR adopted the "Action Plan on Floods" in 1998. In this connection, in 2001, an ICPR Atlas of Flood Danger and Potential Damage due to Extreme Floods of the Rhine[8] from the outlet of Lake Constance until the North Sea was drafted.

b. In the first cycle of the FD, following the joint preparation of the report on the identification of potentially significant flood risk areas in the IRBD Rhine (2011), the states in the Rhine catchment area regularly exchanged information and subsequently published the Report on the drafting of flood hazard maps and flood risk maps in the IRBD Rhine in 2014[9]. In the second cycle of the FD, the report on the identification of potentially significant flood risk areas in the IRBD Rhine was updated (2018)[10].

c. Since 2015, the ICPR Rhine Atlas (flood hazard and flood risk maps of the IRBD Rhine) (see Annex 4) has been available on the IKSR website as a map portal based on national GIS data[11]. Based on the coordination within the ICPR - including the internationally agreed discharge values (see Annex 3) for the three flood scenarios (low, medium and high probability) - the Rhine Atlas presents the flood hazards and flood risks for the areas identified as presenting a potentially significant flood risk of the type "fluvial flood" for the main stream of the Rhine from the Alpine Rhine to the North Sea estuary. The Interactive Rhine Atlas 2015 also includes links to all portals of member states, regions and federal states in order to be able to visualize detailed

[6] See Guidance Doc. No. 29 "A compilation of reporting sheets adopted by WD CIS for the WFD (2000/60/EC)", Technical Report – 071", 2013. Link: http://ec.europa.eu/environment/water/flood_risk/implem.htm
[7] https://www.iksr.org/en/eu-directives/floods-directive/flood-risk-management-plan/
[8] See ICPR Rhine Atlas 2001
[9] https://www.iksr.org/fileadmin/user_upload/Dokumente_en/Communique_/FD_-_2nd_report.pdf
[10] https://www.iksr.org/en/eu-directives/floods-directive/flood-risk-assessment/
[11] https://www.iksr.org/en/public-relations/documentsarchive/maps/rhine-atlas/

maps of the Rhine and its main tributaries. The Rhine Atlas will be updated at the beginning of 2020 in accordance with the national maps updated according to Article 14(2) FD.

The report at hand presents the results of the information exchange 2014-2019 and the updated flood risk and flood hazard maps (Part A) based on the update of areas with potentially significant flood risk. The following products are available:

1. An **updated survey map showing the river sections** in the IRBD, part A (catchments > 2.500 km²), **for which the Member States have drafted flood hazard maps and flood risk maps (see Annex 1)**.

   This map provides for the following categories:
   a. *green: river sections without any potentially significant flood risk*
   b. *red: Water body sections and areas with potentially significant flood risk[12] for which flood hazard maps and flood risk maps have to be prepared in accordance with Article 6 FD and updated in accordance with Article 14 FD.*

2. List of **internet links** towards the national or regional map portals for flood hazard and risk maps **(see Annex 2).** It equally includes links towards national reports or reports for sub basins (e.g. Moselle-Sarre of ICPMS), which contain the details on how the maps were drafted for flood risk areas in border regions for which a coordination is required.

3. Coordination results between the Rhine bordering states for the **preparation of the Rhine Atlas 2015 (flood hazard and flood risk maps of the International River Basin District Rhine)**: **Coordinated discharge values for the three scenarios** of the FD for the main stream of the Rhine; these values apply to the ICPR Rhine Atlas and the national maps for the main stream of the Rhine **(see Annex 3).**

4. **Legend and excerpt of the online Rhine Atlas (see Annex 4)**

Comments on the FD maps for the Netherlands:

In 2017, the Netherlands moved from standardisation based on the probability of exceedance of water levels to standardisation based on the probability of flooding for primary flood protection installations. For the second cycle of the FD, the Netherlands have decided to produce maps for protected areas based on available current probabilities of flooding. In contrast, in the first cycle of the FD, the norm of the probability of exceedance of water levels was assumed for protected areas. The background for this change in relation to flood risk management maps is the starting point that the maps are intended to communicate the risk to citizens to which they are currently exposed.

Given the high protection level of the primary flood defences in the Netherlands, 4 maps are to be produced which correctly describe the entire range of probabilities of flooding from 1/10 to 1/10,000 per year. The first three maps correspond to probabilities of flooding in the order of 1/10, 1/100 and 1/1000 per year. The additional 4th map shows the scenario of an extraordinary (maximum conceivable) event with a probability of flooding in the order of ≤ 1/10,000 years.

On the basis of the preliminary risk assessment and the identification of areas with significant flood risks, the Netherlands produce maps showing floods of rivers and lakes (fluvial), coastal floods (sea water) and of artificial water-bearing infrastructures.
The coast of the Rhine catchment area lies entirely within the national borders of the Netherlands and the influence of the water levels of the North Sea, including the possible rise in sea level on the water levels of the Rhine, is limited to the Netherlands. Therefore,

[12]Coordination in the ICPR concerns floods from rivers and lakes ("fluvial" type) but no other types of floods (see updated report on the identification of potentially significant flood risk areas in the IRBD Rhine, 2nd cycle, 2018). For this reason, the coastal areas of the North Sea in the Netherlands are not included in this report.

storm surges are not considered in the following. However, this information can of course be obtained from the Dutch flood hazard and flood risk maps.

The maps show the current state according to the latest information. On the basis of the discharges calculated with climate scenarios of the KNMI, the extreme discharges increase and, for example, a scenario of a flood that occurs once every 100 years today will occur more frequently in the future. With respect to flood risk management measures, the Netherlands take climate change into account.

Remark concerning national maps available for Switzerland:

In Switzerland, maps representing the ***flood intensity*** and ***flood hazard*** in settlement areas are being drafted. Outside the settlement area, ***hazard index maps*** with a lower level of detail show the possible hazard areas.

The Swiss maps of ***flood intensity*** represent the spatial extension (flooded surface) and occurring intensities (flow depth and velocity) for different probability classes. Thus, their contents correspond to the flood hazard maps according to the FD.

The Swiss ***hazard maps*** include a 5 level classification based on the intensities and probability of occurrence. They thus go beyond the flood risk maps provided for by the FD, but they do not make any indications with respect to goods at risk. With respect to their contents their position is between the flood hazard map and the flood risk map according to the FD. As far as the planning of measures is concerned, the risks are identified and assessed in detail.

Since 1991, the federal laws on hydraulic engineering and forests have obliged the cantons to draw up hazard maps and to take these into account in their guidance planning and land-use planning as well as in all spatially effective activities. While the intensity maps represent an important basis for emergency planning and technical action planning, the hazard maps derived from them are the basis for the identification of hazard zones in land use planning and the drafting of building requirements in the context of building permit procedures. Hazard maps must be updated periodically and the zone and usage plans adapted accordingly. In addition, hazard maps are important for raising public awareness of natural hazards.

By the end of 2018, around 97% of the areas to be mapped with respect to floods throughout Switzerland had been registered. About 75 % of the hazard maps available for floods were implemented in spatial planning.

All existing hazard maps are freely accessible via the respective cantonal geoportals.

For Switzerland, the survey map concerning flood hazard and flood risk maps indicate existing Swiss flood hazard maps.

In Switzerland, the initial mapping has been completed. Hazard maps for floods, landslides, gravitational processes and avalanches are available throughout Switzerland and are continuously updated and spatially supplemented.

Since mid-2018, new hazard data and documentation has been available in the form of the hazard map for surface runoff. This closes an important gap in the hazard data and documentation. Insurance damage analyses show that surface runoff due to heavy rainfall accounts for around 50 % of water damage (approx. CHF 140 million per year). The new map shows which areas in Switzerland are potentially affected by surface runoff. It is an important tool for damage prevention.

Various cantons are now analysing the risks posed by natural hazards in their territory and for their own purposes. In 2016, the Swiss Federal Council decided to draw up a national overview of existing risks in the field of natural hazards and a long-term overarching plan for the implementation of integral risk management for natural hazards.

Remarks concerning national maps available for Liechtenstein:

In Liechtenstein, ***maps of intensity*** and ***hazard maps*** are drawn up for natural hazards related to water, avalanches, landslides and gravitational processes in settlement areas. Outside the settlement areas, ***hazard index maps*** with a lesser degree of detail indicate possible hazard areas.

The ***maps of intensity*** represent the spatial extension (surface concerned) and occurring intensities (intensity of the process) for different probability classes. Thus, their contents correspond to the flood hazard maps according to the FD.

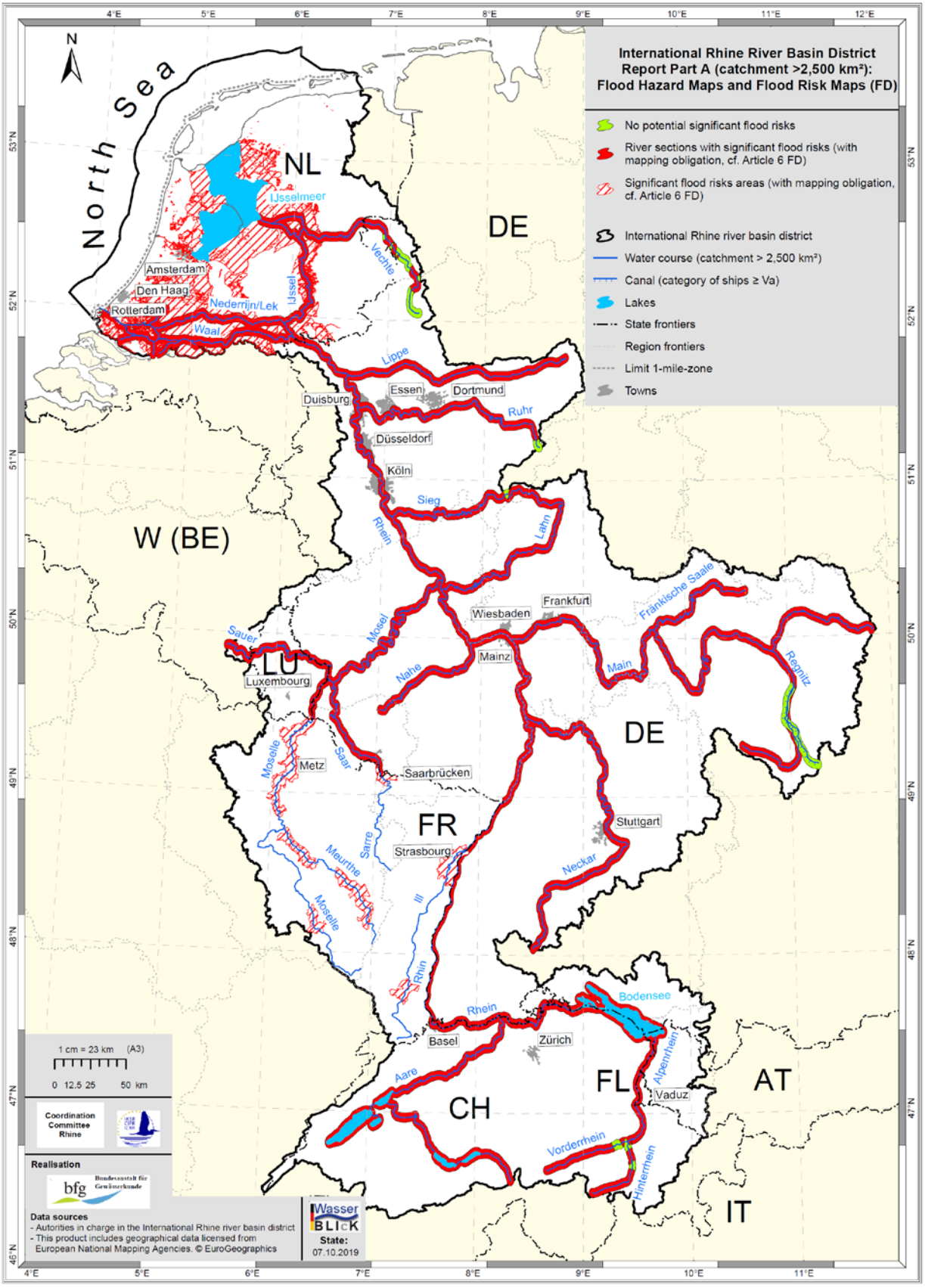
The ***hazard maps*** include a 5 level classification based on the intensities and probabilities of occurrence. They thus go beyond the flood risk maps provided for by the FD, but they do not make any indications with respect to goods at risk. With respect to their contents their position is between the flood hazard map and the flood risk map according to the FD. As far as the planning of measures is concerned, the risks are identified and assessed in detail.

Since 1991, the Forest Codes obliges the country to draft hazard maps and to take them into account in the guidance and utilization planning. While maps of intensity are an important basis for emergency planning and the planning of technical measures, the hazard maps derived from them are the basis for excluding hazard zones in the utilization planning of municipalities and for drafting building control requirements within building permit procedures. Also, hazard maps are important for sensitizing the population for natural hazards.

All existing hazard maps are readily available on the geoportal of the country.

In Liechtenstein, first mapping was done until 2001. Hazard maps for water, avalanches, landslides and gravitational processes are available for the entire country and are regularly updated. The first revision of the hazard maps was concluded in 2019. Zonal, resp. utilization plans will subsequently be adapted.

Annex 1 - Survey map on flood hazard maps and flood risk maps



Annex 2 - Internet links towards maps of flood hazard and flood risk including the ICPR Atlas of the Rhine

ICPR:

Report on the Drafting of Flood Hazard and Flood Risk Maps in the International River District Rhine (first cycle, publication 2014):
https://www.iksr.org/en/eu-directives/floods-directive/flood-hazard-and-flood-risk-maps/

Rhine Atlas 2015 (flood maps of the International River Basin District Rhine) *(to be updated beginning 2020)*:
https://www.iksr.org/en/public-relations/documentsarchive/maps/rhine-atlas/ or direct link: https://geoportal.bafg.de/mapapps/resources/apps/ICPR_EN/index.html?lang=en

States

Netherlands: https://www.risicokaart.nl/

Germany: https://geoportal.bafg.de/karten/HWRM *(site activation: 1st quarter of 2020)*
Report of the River Basin Community on the update of the flood hazard maps and flood risk maps: http://www.fgg-rhein.de/servlet/is/87526/

France: http://www.grand-est.developpement-durable.gouv.fr , http://www.grand-est.developpement-durable.gouv.fr/cartographie-des-surfaces-inondables-des-tri-a15506.html and http://www.georisques.gouv.fr/cartes-interactives/#/

Luxembourg:
https://map.geoportail.lu/theme/eau (see „Directive Inondation“)

Belgium (Wallonia):
https://geoportail.wallonie.be/home.html,https://geoportail.wallonie.be/walonmap (see “Aléa d'inondation” and “Zones inondables”)

Austria:
https://www.bmnt.gv.at/wasser/wisa/fachinformation/hochwasserrisiko/RMP2021.html

Liechtenstein: http://geodaten.llv.li/geoportal/naturgefahren.html,
https://www.llv.li/#/12004/naturgefahren

Switzerland:
State of hazard mapping
https://map.geo.admin.ch/?topic=bafu&lang=en > Natural hazards > state of natural hazard mapping
Hazard maps:
:
English: https://map.geo.admin.ch/?topic=bafu&lang=en > Natural hazards > floods
http://www.bafu.admin.ch/gefahrenkarten
http://www.bafu.admin.ch/cartes-dangers
http://www.bafu.admin.ch/carte-pericoli
Overland flow map:
English: https://map.geo.admin.ch/?topic=bafu&lang=en > Natural hazards > floods > overland flow map
http://www.bafu.admin.ch/oberflaechenabfluss
http://www.bafu.admin.ch/ruissellement
http://www.bafu.admin.ch/ruscellamento

International Commissions for the Protection of the Moselle and the Saar (ICPMS):
http://www.iksms-cipms.org

Annex 3 - Coordinated discharge values (Q) and water levels (H) for the production of the flood hazard maps (main stream of the Rhine) and the Rhine Atlas 2015 (and the updated version from late 2019/early 2020)[13]

1. Main stream

Within the coordination activities, the following discharge values were coordinated with a view to **drafting flood hazard maps** (basic water network >2,500 km²) and thus also for updating the Rhine Atlas:

(1) Floods with a low probability or extreme event scenarios.

Scope	Low probability $HQ_{extreme}$
Alpine Rhine - Landquart to mouth R. Ill	5,250 m³/s*
Alpine Rhine - mouth R. Ill to Lake Constance	6,500 m³/s*
Lake Constance to mouth R. Thur	1,250 m³/s
Mouth R.Thur to mouth R. Aare	2,930 m³/s
Mouth R. Aare to mouth R. Wiese (point of reference: Basel)**	5,480 m³/s
Iffezheim to downstream mouth R. Neckar	6,500 m³/s
from mouth R. Neckar	7,600 m³/s
from mouth R. Main	10,300 m³/s
from mouth R. Nahe	10,400 m³/s
from mouth R. Moselle	15,250 m³/s
from Lower Rhine	15,300 m³/s
from Lobith	16,000 m³/s

*Values taken from the Development Concept Alpine Rhine of the International Government Commission Alpine Rhine. For the assessment of the present risk with respect to low probability, Austria applies 3,350 resp. 4,300 m³/s and additionally takes into account dike breaches and solid matter scenarios. The calculation values for concrete constructional protection measures are bilaterally agreed upon for each individual case for the shared border section

**Discussions aimed at coordinating the section between the mouth of R. Wiese and Iffezheim are going on. The results will be included into the report as soon as they will be known.

(2) According to FD Article 6(3b), a flood with a medium probability is defined by a return period of HQ 100-120 years.

Scope	Medium probability $H_{100-120}$
Alpine Rhine - Landquart to mouth R. Ill	2,550 m³/s
Alpine Rhine - mouth R. Ill to Lake Constance	3,050 m³/s
Lake Constance to mouth R. Thur	1,100 m³/s
Mouth R.Thur to mouth R. Aare	2,260 m³/s
Mouth R. Aare to mouth R. Wiese (point of reference: Basel)**	4,780 m³/s
Iffezheim to downstream mouth R. Neckar	5,000 m³/s
from mouth R. Neckar	6,000 m³/s
from mouth R. Main	7,900 m³/s
from mouth R. Nahe	8,000 m³/s
from mouth R. Moselle	11,850 m³/s
from Lower Rhine	11.700[14] m³/s
from Lobith	12,700 m³/s

**Discussions aimed at coordinating the section between the mouth of R. Wiese and Iffezheim are going on. The results will be included into the report as soon as they will be known.

[13] https://www.iksr.org/en/public-relations/documentsarchive/maps/rhine-atlas/

[14] The difference in discharge between the mouth of R. Moselle and the Lower Rhine can be explained by retention effects.

(3) According to FD Article 6(3b) a flood of medium probability is defined by a return period of HQ 100-120 years, for the Alpine Rhine of HQ 30.

Scope	High probability H_{10}
Alpine Rhine - Landquart to mouth R. Ill	1,950 m³/s*
Alpine Rhine - mouth R. Ill to Lake Constance	2,450 m³/s*
Lake Constance to mouth R. Thur	920 m³/s (basic value CH HQ_{30} = 1,010 m³/s)
Mouth R.Thur to mouth R. Aare	1,660m³/s (basic value CH HQ_{30} = 1,940 m³/s)
Mouth R. Aare to mouth R. Wiese (point of reference: Basel)**	3,980 m³/s (basic value CH HQ_{30} = 4,380 m³/s)
Iffezheim to downstream mouth R. Neckar	4,100 m³/s
from mouth R. Neckar	4,750 m³/s
from mouth R. Main	5,700 m³/s
from mouth R. Nahe	5,800 m³/s
from mouth R. Moselle	8,810 m³/s
from Lower Rhine	8,900 m³/s
from Lobith	9,500 m³/s

*The basic value for AT and CH is HQ 30

**Discussions aimed at coordinating the section between the mouth of R. Wiese and Iffezheim are going on. The results will be included into the report as soon as they will be known.

2. Tributaries

Many tributaries to the Rhine (Aare, Ill, Neckar, Main including Franconian R. Saale and Regnitz, Nahe, Lahn, Moselle/Sarre including Sûre, Sieg, Ruhr, Lippe, Vechte - see map in annex 1) equally belong to the International River Basin Rhine (part A, catchment > 2,500 km²). According to the WFD, the **major tributaries Neckar, Main and Moselle/Sarre** constitute separate areas of operation. This is also supposed to apply to the FD.

	HQ_{10}	$HQ_{100-120}$	$HQ_{extreme}$
Neckar	1,875 m³/s	2,840 m³/s	3,970 m³/s
Main	1,580 m³/s	2,580 m³/s	3,350 m³/s
Moselle/Sarre:	3,250 m³/s	4,500 m³/s	6,500 m³/s

Table: Relevant discharges for the implementation of the FD in the areas of operation at the mouth of R. Neckar, Main and Moselle/Sarre

3. Lake Constance

The flood hazard is due to the water level of Lake Constance. The values for defined return periods are taken from the report of the Working Group Water Level Prediction Lake Constance (determination of the extreme water level of Lake Constance, final version, state: 07.06.2011).

The water levels are indicated for different reference periods. The reason is that the riverine states to Lake Constance, i.e. Germany, Austria and Switzerland use different standard water levels as a reference for their indications of altitude (see Annex 1 of the above mentioned report):
- Germany: Standard water level of the North Sea near Amsterdam (m ü. NN)
- Austria: Standard water level of the Adriatic Sea near Trieste (m ü. A)
- Switzerland: Standard water level near Marseille (m ü. M]

Within the coordination, the following water levels were convened for drafting the **flood hazard maps**:

(1) according to FD Article 6(3a) the lake level with low probability is defined for a return period of 1,000 years or scenarios for extreme events.

Lake Constance	**Water level for the national vertical datum**		
	DE [m ü. NN]	**AT** [m ü. A]	**CH** [m ü. M]
Lake Constance - Upper Lake	398.00	398.25 Basic value AT HW_{300} = 398.02*	398.30
Lake Constance - Lower Lake	397.75	-	398.05

*For the assessment of the present risk situation and low probability AT uses the lake level and a return period of 300 years, additionally taking into account scenarios of dike breaches.

(2) According to FD Article 6, par. 3b) the lake level with medium probability is defined by a return period of 100 years.

Lake Constance	**Water level for the national vertical datum**		
	DE [m ü. NN]	**AT** [m ü. A]	**CH** [m ü. M]
Lake Constance - Upper Lake	397.57	397.82	397.89
Lake Constance - Lower Lake	397.30	-	397.62

(3) According to FD Article 6(3c) the lake level with high probability is defined by a return period of 10 years, resp. 30 years for AT and CH.

Lake Constance	**Water level for the national vertical datum**		
	DE [m ü. NN]	**AT** [m ü. A]	**CH** [m ü. M]
Lake Constance - Upper Lake	397.01	397.26 Basic value AT HW_{30} = 397.55*	397.33 Basic value AT HW_{30} = 397.62*
Lake Constance - Lower Lake	396.81	-	397.13 Basic value CH HW_{30} = 397.39*

*Basic value for AT and CH is a lake level with a 30 years return period.

4. Lake IJssel area

As a matter of principle, the same approach applies to the **Lake IJssel area** as for the main stream and the tributaries, even though a flood with low probability (according to FD Article 6(3a)) is defined as an extreme event with a probability of flooding of about ten thousand years. The corresponding water levels (H) in Lake Ijssel are caused by extremely heavy storms. With respect to drafting **flood risk maps** for the Lake IJssel area, this leads to the following starting points:

A low probability according to FD Article 6(3a) is defined as an extreme event.

Lake IJssel area	Low probability $HQ_{extreme}$
Mouth R. IJssel	NAP* + 2.9 m
Lemmer	NAP + 2.0 m
Workum	NAP + 1.3 m
Enkhuizen	NAP + 1.1 m
Almere	NAP + 0.8 m

* The Normal Amsterdam Pegel (NAP) is the reference state for altitude measures in the Netherlands. The level Zero approximately corresponds to today's average sea level (North Sea). The German measure Normal Null has been derived from the Dutch NAP.

A medium probability according to FD Article 6(3b) is defined as an event with a return period of ≥ 100 years.

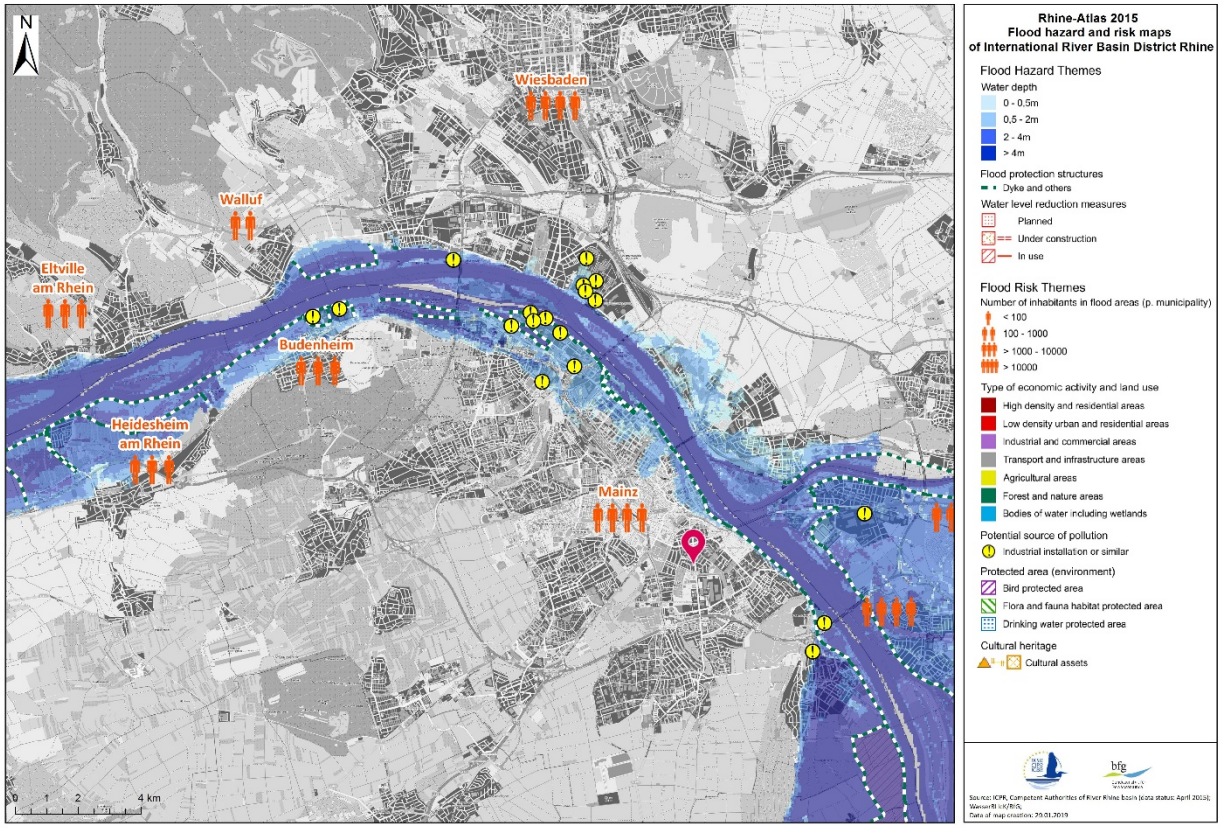
Lake IJssel area	Medium probability H_{100}
Mouth R. IJssel	NAP + 1.6 m
Lemmer	NAP + 1.2 m
Workum	NAP + 0.8 m
Enkhuizen	NAP + 0.7 m
Almere	NAP + 0.3 m

A high probability according to FD Article 6(3c) is defined as an event with a return period of 10 years.

Lake IJssel area	High probability H_{10}
Mouth R. IJssel	NAP + 1.0 m
Lemmer	NAP + 0.8 m
Workum	NAP + 0.6 m
Enkhuizen	NAP + 0.5 m
Almere	NAP + 0.1 m

Annex 4 - Extract from the Rhine Atlas 2015[15] including coordinated and harmonized legend

ICPR: Rhine Atlas 2015 - Flood risk Mainz



Further details relating to the Atlas see document “Rhine Atlas - Maps and legend explanation”[16].

[15] https://www.iksr.org/en/public-relations/documentsarchive/maps/rhine-atlas/
[16] https://geoportal.bafg.de/dokumente/iksr/ICPR_EN.pdf