Implementation of the Sediment Management Plan

Report on the State of Implementation by End 2013

IKSR
CIPR
ICBR

Internationale Kommission zum Schutz des Rheins

Commission Internationale pour la Protection du Rhin

Internationale Commissie ter Bescherming van de Rijn

Report No. 212

Imprint

Publisher:
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ISBN-Nr 978-3-941994-55-3

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1. Sediment Management Plan

1.1 Problem Analysis

Older polluted sediments in particular present in lower sediment layers in the Rhine and its tributaries can partly be remobilised by floods or be dredged and thus get into the flowing water and impact downstream river sections.

1.2 Target

The priority target of the Sediment Management Plan is to localize those sediment areas that pose the greatest risk for attaining a good quality of the water body. For these areas posing a risk of great importance for the Rhine, proposals for measures have been presented which are meant to serve as recommendations for actions for the authorities in charge of the further handling of the sediments in these river sections.

Furthermore, a common basis of assessment has been established for the assessment of further sedimentation areas which have so far not been systematically examined and for which appropriate restoration measures may eventually be proposed.

This procedure also underpins the implementation of article 3, point 3 of the Rhine Convention with respect to the “improvement of sediment quality in order to dispose of dredged material without causing any harm”. Additionally, the legal framework is given by decisions taken by the OSPAR Commission for the Northeast Atlantic, the German-French Commission on the Training of the Upper Rhine and the Water Framework Directive (WFD) of the EU.

1.3 Compilation of relevant sediment analyses

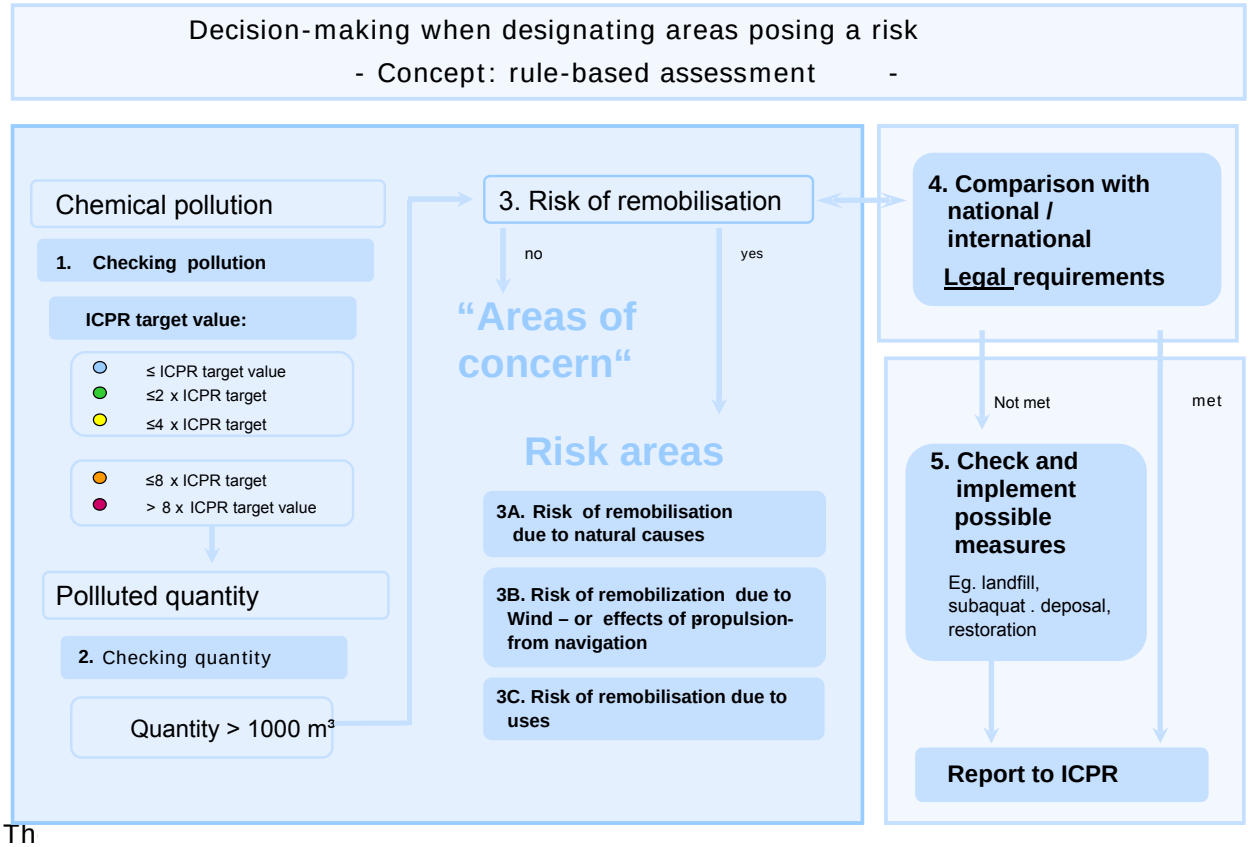
All in all, more than 90 locations along the Rhine and in sections near the outlets of Rhine and its tributaries (e.g. rivers Neckar, Main, Ruhr) were inventoried when drafting the Sediment Management Plan. They also comprise German-Swiss border areas on the High Rhine.

1.4 Assessment and classification of polluted sedimentation areas and major results

In the following, approach and rules of assessment and classification of sediments are described. This description may lead to the identification of areas posing a risk. The most important elements of the approach are the assessment of the chemical pollution based on the ICPR target values and the assessment of the risk of re-mobilisation of great contaminated sediment areas, taking into account national/international regulations. The scheme of assessment (fig. 1) summarizes the rules.

For adsorption to and accumulation in suspended matter/sediments, the heavy metals lead (Pb), cadmium (Cd), copper (Cu), nickel (Ni), mercury (Hg) and zinc (Zn) and the organic micro-pollutants hexachlorobenzene (HCB) and benzo(a)pyrene (representing the polycyclic aromatic hydrocarbons (PAH) and the polychlorinated biphenyls (PCB) with PCB 153 and sum (7 indicator PCB) are relevant as representing this group of substances.

Fig. 1: Scheme of assessment



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values and a classification in 5 levels (see table 1).

The limit for relevant sediment contamination was fixed to the fourfold target value. The (pragmatic) definition of this criterion partly also takes into account national assessment criteria. This is represented in the left part of the assessment scheme in fig. 1.

Table 1: Assessment of the sediment contamination (relevant sediment pollution: > fourfold ICPR target value)

Contaminant	Unit*	Categories for the comparison with the ICPR target values				
Cd	mg/kg	≤ 1	> 1 – 2	> 2 - 4	> 4 - 8	> 8
Cu	mg/kg	≤ 50	> 50 - 100	> 100 - 200	> 200 - 400	> 400
Hg	mg/kg	≤ 0,5	> 0.5 – 1	> 1 - 2	> 2 - 4	> 4
Ni	mg/kg	≤ 50	> 50 - 100	> 100 - 200	> 200 - 400	> 400
Pb	mg/kg	≤ 100	> 100 – 200	> 200 - 400	> 400 - 800	> 800
Zn	mg/kg	≤ 200	> 200 – 400	> 400 - 800	> 800 - 1600	> 1600
Benzo(a)pyrene	mg/kg	≤ 0.4	> 0.4 - 0.8	> 0.8 - 1.6	> 1.6 - 3.2	> 3.2
HCB	µg/kg	≤ 40	> 40 – 80	> 80 - 160	>160 - 320	> 320
PCB 153	µg/kg	≤ 4	> 4 – 8	> 8 - 16	>16 - 32	> 32
PCB (sum 7)	µg/kg	≤ 28	> 28 – 56	> 56 - 112	> 112 - 224	> 224

* All indications refer to dry substance

22 of the 93 investigated sedimentation areas were classified as areas posing a risk, 18 as "area of concern" (see table 2):

a) Classification as area posing a risk

Further areas of sedimentation will be assessed, where values are equally in excess of those applicable to the criteria of contamination and sediment amounts but where, in addition, sediments may be re-mobilised. They will be subject to differentiated analysis depending on the risk of re-mobilisation and thus the probability that they will impact the good water status of downstream areas.

The approach for assessing the risks of re-mobilisation was as follows:

If polluted amounts of sediment according to a) are detected, and there is a real risk of re-mobilisation due to natural (e.g. floods) or manmade impact (e.g. dredging in connection with re-deposition), the area of sedimentation was classified as area posing a risk. All depending on the kind of re-mobilisation the areas thus identified are classified at risk level A, B and C.

The classification of contaminated sediment areas as areas posing a risk differentiates between three kinds of risks of remobilisation (see figure 1):

Type A: Risk of remobilisation due to natural causes (floods)

Type B: Risk of remobilisation due to the impact of wind or ship propulsion

Type C: Risk of remobilisation due to maintenance dredging in order to grant navigation, in particular in harbours.

From type A to type C, the risk of remobilisation is increasingly better controllable.

A map of the Rhine catchment and its identified type A, B and C areas posing a risk is enclosed in annex I.

b) Classification as "area of concern"

If a relevant sediment contamination is assessed and the amounts of contaminated sediments are in excess of 1,000 m³, the sedimentation areas requires particular attention. These sedimentation areas are called "areas of concern", if there is no natural or manmade risk of re-mobilisation. In general, these areas do not pose a risk for downstream river sections. Nonetheless, attention must be paid to these sediments and during periodic maintenance dredging or individual construction measures they should be treated in accordance with the rules for national re-deposition of dredged material or they should be subject to controlled disposal.

Annex II includes a map of the Rhine catchment with the identified "areas of concern".

c) Investigation into other sedimentation areas

Analysis data of further 53 sedimentation areas were available. They were not in excess of the internationally agreed assessment criteria for chemical pollution. However, 18 sedimentation areas were in excess of national criteria.

Table 2: Assessment result for all 93 sedimentation areas

	DE/FR	DE	NL
Areas posing a risk			
Type A	3	2	11
Type B			2
Type C		4	
Areas of concern			
		9	9
Assessment of the other sedimentation areas			
Chemical pollution < 4x target value and in excess of national criterion	3	15	
Chemical pollution < 4x target value and national criterion respected		22	
Quantitative pollution < 1,000 m³		7	
Without assessment as number of samples < 2 or because rehabilitation accomplished		6	

d) Identification of measures implemented

For the purpose of the web representation, a fifth classification (green dot) was added to the four afore mentioned classifications ("area of concern" and 3 types of risks) represented in the sediment management maps describing the state of implementation of the Sediment Management Plan. When clicking this option in the interactive map, those locations appear, the status of which has changed within the Sediment Management Plan after restoration measures or the classification of which has changed after closer assessment. The information represented under the option "state of implementation" depends on reports of the ICPR Member States. The original information on the areas posing a risk and on the "areas of concern" can still be visualized.

Annex III represents a map of the Rhine catchment with the identified areas posing a risk (type A, B and C), the "areas of concern" and the sedimentation areas, in which measures under the Sediment Management Plan have been implemented.

2. Implementation of the Sediment Management Plan by 2013

2.1 Introduction

The following chapters give a first short summary of the state of implementation in Switzerland, Germany, France and the Netherlands. Annex IV to the report includes more detailed information on the implementation of the Sediment Management Plan. A comprehensive description of all locations analysed within the framework of the Sediment Management Plan is given in the ICPR report no. 175 (www.iksr.org) and in the final report on the Sediment Management Plan available upon request addressed to the ICPR secretariat.

2.2 Implementation in Switzerland

A large share of the rest of pollutants discharged into the rivers by the Swiss industry is deposited in the next impoundment downstream the industrial sites. The larger industrial sites located in the Swiss part of the Rhine catchment are located in the downstream section beginning with the canton of Aargau. As a part of new licenses for hydro power plants in the Swiss High Rhine, selective investigations into the pollutant load of the impoundment are carried out. As there is no maintenance dredging in the impoundments, sediments may potentially only be re-mobilised by floods. The two impoundments on the Swiss/German High Rhine (Albbruck-Dogern, no. 1 and Birsfelden, no. 2) were neither assessed as areas posing a risk, nor as "areas of concern".

2.3 Implementation in Germany and France

In 2012, Germany and France signed two financing agreements, in order to arrange for further investigations into the HCB problem on the Upper Rhine and to reduce sedimentation trends. The agreements have been drafted by two Franco-German expert groups: “Resi” and “Urmel”.

The finanincing agreement of the “Urmel” expert groups provide for
a) the analysis of suspended matter originating from suspended matter collectors,
b) several laboratory tests on the HCB anomaly in the Upper Rhine (adsorption to large particles),
c) further engineering services concerning the handling of polluted sediments.

The agreement of the “Resi” expert group serves the financing of further tests in situ in order to determine, at what flow velocity deposited sediments are remobilised.

2.4 Implementation in Germany

Irrespective of the two common financing projects, Germany is further investigating into possibilities of restoring sedimentation areas posing a risk. In this connection, in 2012, vast sampling operations were carried out in the Marckolsheim and Rhinau impoundments and further samples were taken in those at Gerstheim and Strasbourg. Due to these sampling operations, more precise information is available on the quantity and location of polluted sediments in the Marckolsheim and Rhinau impoundments. No pollution requiring restoration measures was detected in the Gerstheim and Strasbourg impoundments. Based on these results, the options for handling the contaminated sediments in the risk areas of the impoundments Marckolsheim and Rhinau are now being looked into.

The KLIWAS research project (2009 - 2013) investigated into possible effects of climate change on the shipping lanes and navigation in Germany. Among others, and as a by-product, this leads to supplementary knowledge on the HCB problems on the Upper Rhine.

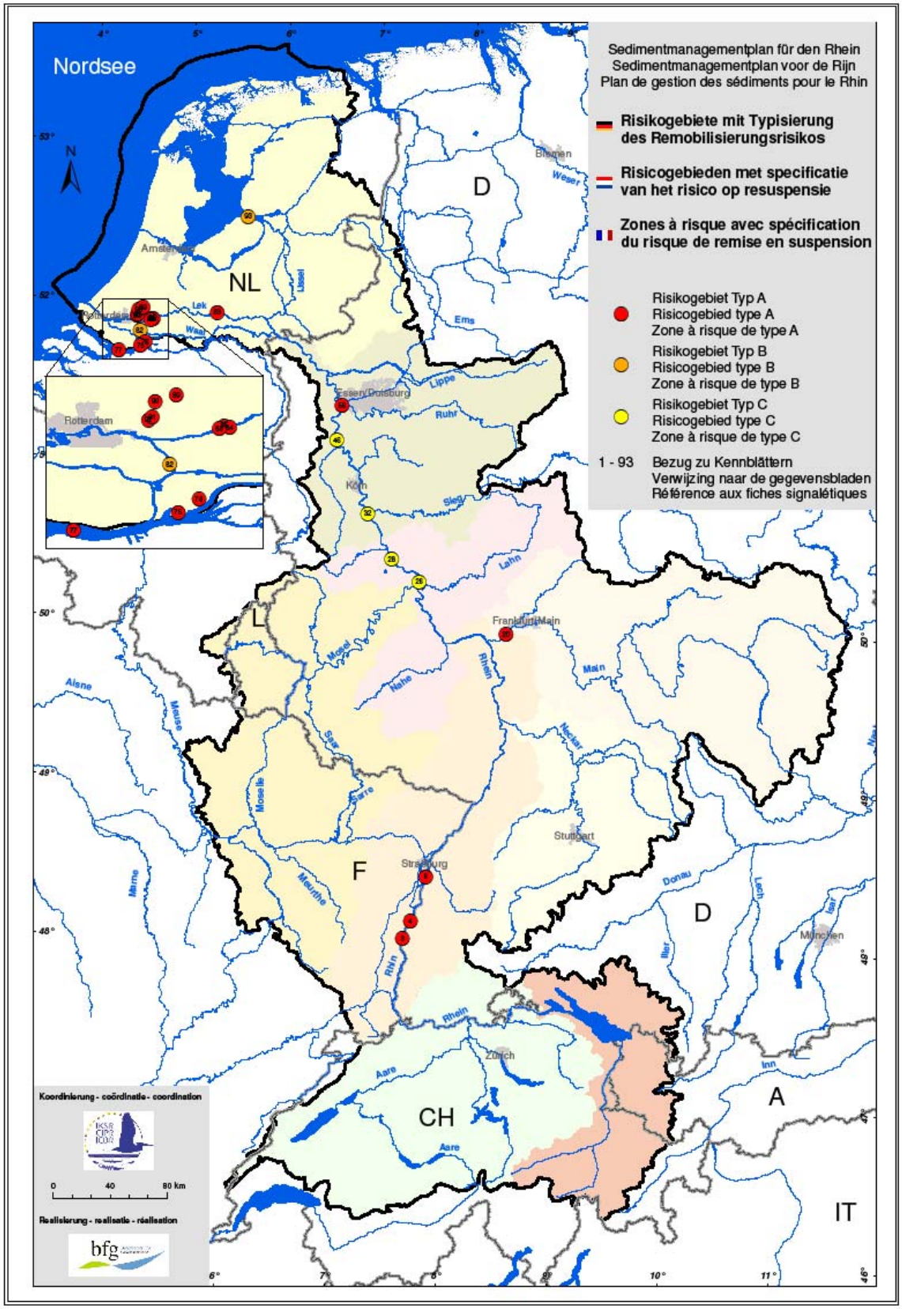
In 2011/2012, further investigations aimed at controlling results obtained so far have been carried out at the locations Ruhrwehr Duisburg/Ruhr, Hafen Duisburg-Hüttenheim, Außenhafen Duisburg and at the entrance to the port in Neuss; the evaluation has not yet been concluded. It depends on the results of this evaluation whether restoration measures will be planned for these locations beginning in 2014.

2.5 Implementation in the Netherlands

There are 13 areas posing a risk and 9 "areas of concern" in the Dutch part of the Rhine catchment. Restoration has been concluded at 11 of these 22 sedimentation areas. In this connection, all in all 3.5 million m³ of polluted sediments have been dredged and deposited in different land fill deposits. Costs for restoration amounted to approx. 80 million €. For one of the locations classified as "area of concern" it was finally decided not to carry out any restoration work. The reason for this decision is that according to findings of a more precise investigation into the location the danger of detrimental ecological effects and spreading is limited.

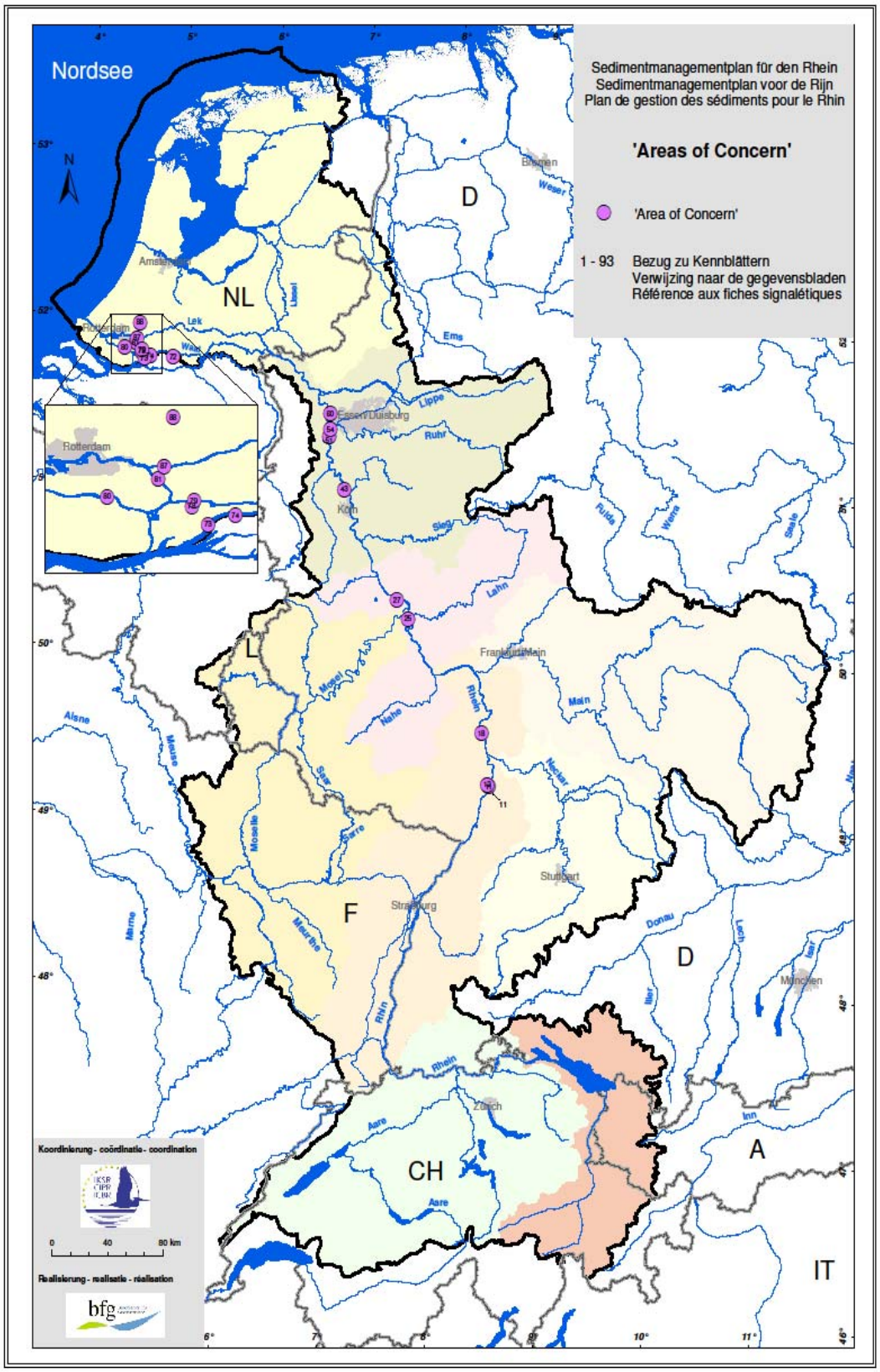
Annex I

Areas posing a risk



Annex II

"Areas of concern"



Annex III

ICPR interactive SMP map (State end 2013)

The map is available under the following link: http://geoportal.bafg.de/iksr/IKSR_Sed_plan.de.html.

Annex IV

Survey of work by end 2013

Location no. / (state):[1]	Name of location:	In excess > 4 times the ICPR target value	Competent authority	State of work	Implementation period	Restoration measure(s)	Quantities removed/ to remove (m^3)	Cost ($\times 10^6$ €)
Risk area A								
3 (DE,FR)	Marckolsheim, impoundment	HCB	BMVBS	Pre-planning stage	2014 - 2016			
4 (DE-FR)	Rhinau, impoundment	HCB	BMVBS	Pre-planning stage	2014 - 2016			
6 (DE, FR)	Strasbourg, impoundment	HCB	BMVBS	During investigations no pollutions requiring restoration were detected in the impoundments Gerstheim and Strasbourg				
20 (DE)	Eddersheim/ Main, impoundment			Checking whether and which new investigations are required				
56 (DE)	Duisburg/ Ruhr, weir on the Ruhr			More recent investigations checking the results so far were carried out in 2011/2012; the evaluation is still going on. Whether restoration measures will be planned beginning in 2014 depends on the result of the evaluation.				
75 + 76 (NL)	Dordtsche Biesbosch, small and large grooves	Hg and PCB 153	RWS WNZ	Finished	2010-2013	Partly dredge and deposit, mostly in land fill deposit Hollands Diep, partly in deposit Put Cromstrijen; partly cover up	600,000	10

[1] According to the data sheets of the Sediment Management Plan Rhine

Location no. / (state):[1]	Name of location:	In excess > 4 times the ICPR target value	Competent authority	State of work	Implementation period	Restoration measure(s)	Quantities removed/ to remove (m^3)	Cost ($\times 10^6$ €)
77 (NL)	Hollandsch Diep	Cd, Zn, PCB 153 and sum 7 PCB	RWS ZH	Finished	2005-2008	Cover up. More thorough investigations have shown that, once the restoration measures will have been accomplished by covering up there is no persisting danger of re-mobilisation for banks and shallows.	-	10
83 (NL)	Amerongen	Cd, Hg, Zn, PCB 153 and sum 7 PCB	RWS ON	Finished	2008	Dredge and store, (a major) part in the landfill site IJsseloog and partly in the landfill site De Slufter; a minor part of not polluted sediments (1,720 m^3) has been relocated.	93,017	1
84 (NL)	Lek (Gorsweg)	PCB153	RWS ZH					
85 (NL)	Lek (Drinkwaterinlaat)	PCB153	RWS ZH					
86 (NL)	Lek (Halfweg)	PCB 153	RWS ZH					

Location no. / (state):[1]	Name of location:	In excess > 4 times the ICPR target value	Competent authority	State of work	Implementation period	Restoration measure(s)	Quantities removed/ to remove (m^3)	Cost ($\times 10^6$ €)
89-92 (NL)	Hollandse IJssel [2]	PCB 153	RWS ZH	Finished	2008-2011	Dredge and deposit, partly in land fill site De Slufter, partly in land fill site Hollands Diep; also cover up at locations 89 and 90	367,000	30[3]
Risk area type B								
82 (NL)	Rietbaan (Noord)	PCB153	RWS ZH	Finished	2010-2011	Partly disposal in landfill Hollands Diep (Rietbaan Noord, landing stages and mouth of smaller rivers), partly cover up (Sophiapolder banks)	27,500	1
93	Ketelmeer-West	Hg, benzo(a)pyrene and PCB 153	RWS IJG	Finished	2010-2012	Partly dredge sediments, partly store in landfill site IJsseloog; partly cover up.	2,100,846	10

[2] Cluster Moordrecht-Gouderak, Cluster Nieuwerkerk-Ouderkerk, Cluster Capelle-Krimpen and navigation channel + hotspots

[3] Incl. costs location no. 88

Location no. / (state):[1]	Name of location:	In excess > 4 times the ICPR target value	Competent authority	State of work	Implementation period	Restoration measure(s)	Quantities removed/ to remove (m^3)	Cost ($\times 10^6$ €)
Risk area C								
26 (DE)	Ehrenbreit-stein, port		BMVBS	No planning				
28 (DE)	Brohl, port		BMVBS	No planning				
32 (DE)	Mondorf, port			More recent investigations checking the results so far were carried out in 2011/2012; the evaluation is still going on.		Whether restoration measures will be planned beginning in 2014 depends on the result of the evaluation.		
46 (DE)	Neuss, entry port			More recent investigations checking the results so far were carried out in 2011/2012; the evaluation is still going on.		Whether restoration measures will be planned beginning in 2014 depends on the result of the evaluation.		
Areas of concern								
11 (DE)	Speyer Speyer, new port			No particular further investigations were carried out. Justification: There is no risk of floods remobilising contaminated sediments in the harbour area. Remobilisation due to navigation does not present any measurable impact. Significant natural remobilisation also of fine-grained sediments in the Rhine can be excluded.				

Location no. / (state):[1]	Name of location:	In excess > 4 times the ICPR target value	Competent authority	State of work	Implementation period	Restoration measure(s)	Quantities removed/ to remove (m^3)	Cost ($\times 10^6$ €)
12 (DE)	Speyer Floßhafen		BMVBS	No planning				
18 (DE)	Worms, Bauhafen		BMVBS	No planning				
25 (DE)	Lahnstein/ Rhine, port			see no. 11				
27 (DE)	Neuwied, Pionierhafen			see no. 11				
43 (DE)	Hitdorf, Hafen		BMVBS	No planning				
51 (DE)	Duisburg-Hüttenheim, port			More recent investigations checking the results so far were carried out in 2011/2012; the evaluation is still going on.		Whether restoration measures will be planned beginning in 2014 depends on the result of the evaluation.		
54 (DE)	Duisburg, Außenhafen			More recent investigations checking the results so far were carried out in 2011/2012; the evaluation is still going on.		Whether restoration measures will be planned beginning in 2014 depends on the result of the evaluation.		
60 (DE)	Walsum, Südhafen			More recent investigations checking the results so far were carried out in 2011/2012; the evaluation is still going on.		Whether restoration measures will be planned beginning in 2014 depends on the result of the evaluation.	-	

Location no. / (state):[1]	Name of location:	In excess > 4 times the ICPR target value	Competent authority	State of work	Implementation period	Restoration measure(s)	Quantities removed/ to remove (m^3)	Cost ($\times 10^6$ €)
72 (NL)	Afgedamde Maas	Cd and PCB 153	RWS ZH					
73 (NL)	Nieuwe Merwede	Cd, Hg and PCB 153	RWS ZH					
74 (NL)	Sliedrechtse Biesbosch	Cd, Hg and PCB 153	RWS ZH	Finished	2006-2008	Partly dredging, partly store in landfill site Put Cromstrijen; partly cover up.	600,000	77
78 (NL)	Wantij	Cd	RWS ZH					
79 (NL)	Beneden-Merwede	Cd, Hg, PCB 153	RWS ZH					
80 (NL)	Oude Maas	PCB 153	RWS ZH					
81 (NL)	Noord	PCB 153	RWS ZH					
87 (NL)	Lek (navigation channel)	PCB 153	RWS ZH					

Location no. / (state):[1]	Name of location:	In excess > 4 times the ICPR target value	Competent authority	State of work	Implementation period	Restoration measure(s)	Quantities removed/ to remove (m^3)	Cost (x 10^6 €)
88 (NL)	Hollandsche IJssel (Zellingwijk)	PCB 153	RWS ZH	Finished	2009	No erosion/remobilization, thus no need for restoration measures	-	No. 89-92:

Legend

Cd	Cadmium
HCB	Hexachlorobenzene
PCB	Polychlorinated biphenyls
Hg	Mercury
Zn	Zinc

BMVBS	Federal Ministry of Transport, Building and Urban Development, Germany
DE	Germany
FR	France
NL	Netherlands
RWS IJG	Rijkswaterstaat IJsselmeergebied
RWS ON	Rijkswaterstaat Oostnederland
RWS ZH	Rijkswaterstaat Zuid-Holland
RWS WNZ	Rijkswaterstaat West Nederland Zuid (formerly Rijkswaterstaat Zuidholland)