

# HMWB designation

Mitigation measures applicable to navigation



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# Context of the study

- Article 5 review: a simplified inventory of the waterbodies candidates to be HMWB
  - Navigable waterbodies are automatically candidate
  - No ecological assessment
  - No study of potential mitigation measures
  - No economical analysis
- After this review
  - Designation improvement:
    - Is it really impossible to reach good ecological status (step 5) ?
    - Mitigation measures study (step 7)
    - Other means study (step 8)
  - Good ecological potential definition (steps 10 and 11)
  - Integration of HMWB in the programme of measures building process, including disproportionate costs analysis

# Aim of the study

A national and common approach is needed for the nine french districts: a study is order by the Ministry of Ecology MEDD ans drawn by Artois-Picardie and Rhine-Meuse water agencies.

- To build a catalog of mitigation measures transposable to other districts
- To anticipate further developments with working on a reference costs catalog
- To implement these tools on a few examples
- To transpose the methodology to other french districts

*NB: similar studies are ongoing on hydropower and large scale channel resizing/modification*

# Methodology

- To make an inventory of the alterations on waterbodies made up for navigation
- To list ecological impacts
- To make a « check-list » of possible restoration measures for each alteration, based on feedback, experts and bibliography
- To propose an effectiveness indicator:
  - To reach good ecological status
  - To reach good ecological potential
- To establish a range of cost values for each measure

**NB: the cost evaluation is clearly out of the HMWB designation process but this point is misunderstood by local actors and partners (whose first problem is generally money !). It seems to be necessary to make this inventory within the step 7 in order to explain this process and provide usefull informations for the following steps (article 4.4 and 4.5).**

# Catalog of restoration measures

Physical modification <sup>(*)</sup> A	Alteration 1	Measure 1
		Measure 2
		Measure 3
	Alteration 2	Measure 4
		Measure 5
Physical modification B	Alteration 3	Measure 6
		Measure 7
		Measure 8

(\*) equipments, understructure, civil engineering, etc.

# Catalog of restoration measures

✓	Physical modification <sup>(*)</sup> A	✓	Alteration 1	✓	Measure 1
					Measure 2
					Measure 3
			Alteration 2		Measure 4
					Measure 5
✓	Physical modification B	✓	Alteration 3		Measure 6
				✓	Measure 7
				✓	Measure 8

**Waterbody 1**

(\*) equipments, understructure, civil engineering, etc.

# Catalog of restoration measures

✓	Physical modification <sup>(*)</sup> A	✓	Alteration 1	✓	Measure 1
					Measure 2
				✓	Measure 3
		✓	Alteration 2	✓	Measure 4
				✓	Measure 5
	Physical modification B		Alteration 3		Measure 6
					Measure 7
					Measure 8

**Waterbody 2**

(\*) equipments, understructure, civil engineering, etc.

[Catalog of restoration measures](#)

# Catalog of reference costs

- Is not a part of the designation process but is necessary to « reassure » local actors and partners
- Based on feedback from real experiences in France
- Evaluation of 3 values:
  - Direct costs (work, material, etc.)
  - Indirects costs (additional works, loss of production, increasing costs on other activities, etc.)
  - Environmental benefits (improvement of fish population, etc)
- A very difficult exercise:
  - Very high variability of values from one district to another, according to the local situation of waterbodies (large rivers are often specific cases)
  - In many cases, no or very few feedback from real experiences (e.g. measures from bibliography, never conducted in France)

[Catalog of reference costs](#)



## Pilot sites

- Artois Picardie basin
  - Canal du Nord :artificial canal linking the north of France to North Europe
  - Wateringues :composed of a heavily modified part and an artificial part with a network of canals and watergangs built up by humans for drainage purposes.
- Rhine-Meuse basin:
  - Navigable Moselle: wide and deep gauge, large urban areas
  - Meuse navigable: narrow and shallow gauge, very few urban areas

# The canal du Nord

- Choise based on the fact that is a water body in a major and regional navigation network
- Canal of 41 Km
- Links three major catchment areas
- 10 300 boatings a year
- 3 835 109 tonnes a year of trading transport (granular particules, coal, ...)
- 16 km of rockfills
- Numerous obstacles to fish
- Densily populated area

[Map](#)

[Pictures](#)

[Table](#)

# The navigable river Moselle

- Moselle river between Meurthe river and border with Luxembourg and Germany
- Large calcareous river, with a wide floodplain and high natural hydrodynamics (lateral mobility, changing loops, etc.)
- 170 km, through Metz and Thionville urban areas
- Channelized and deepened for 1500 tons boats
- 60 km derivations (non navigables stretches)
- 12 weirs
- > 10 Mt tons of freights (coal, cereales, gravels, ore, etc.) on the borderline (decreasing with going upstream)
- 1 nuclear power plant, 2 coal power plants

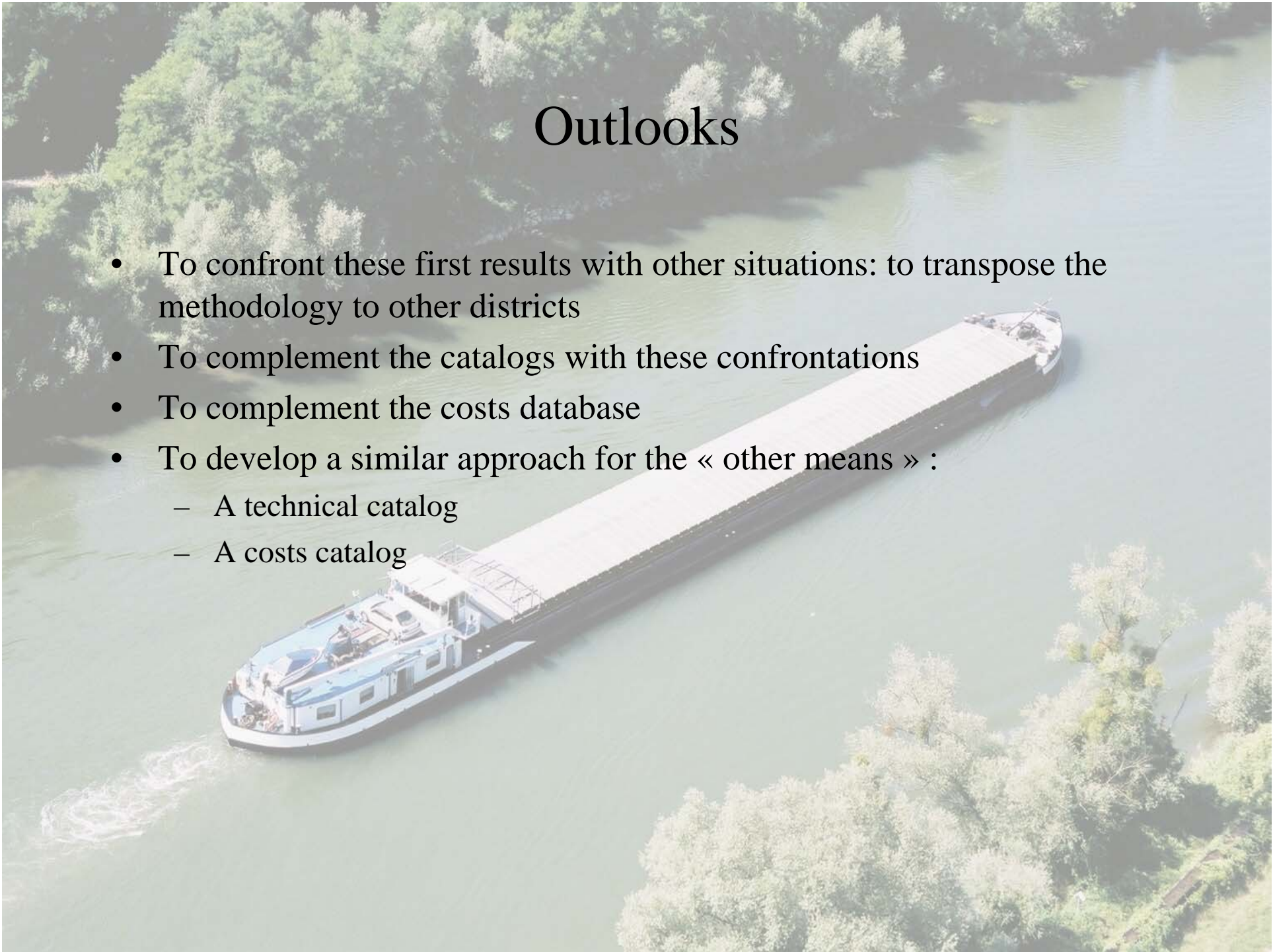
[Map](#)


[Pictures](#)

[Form](#)

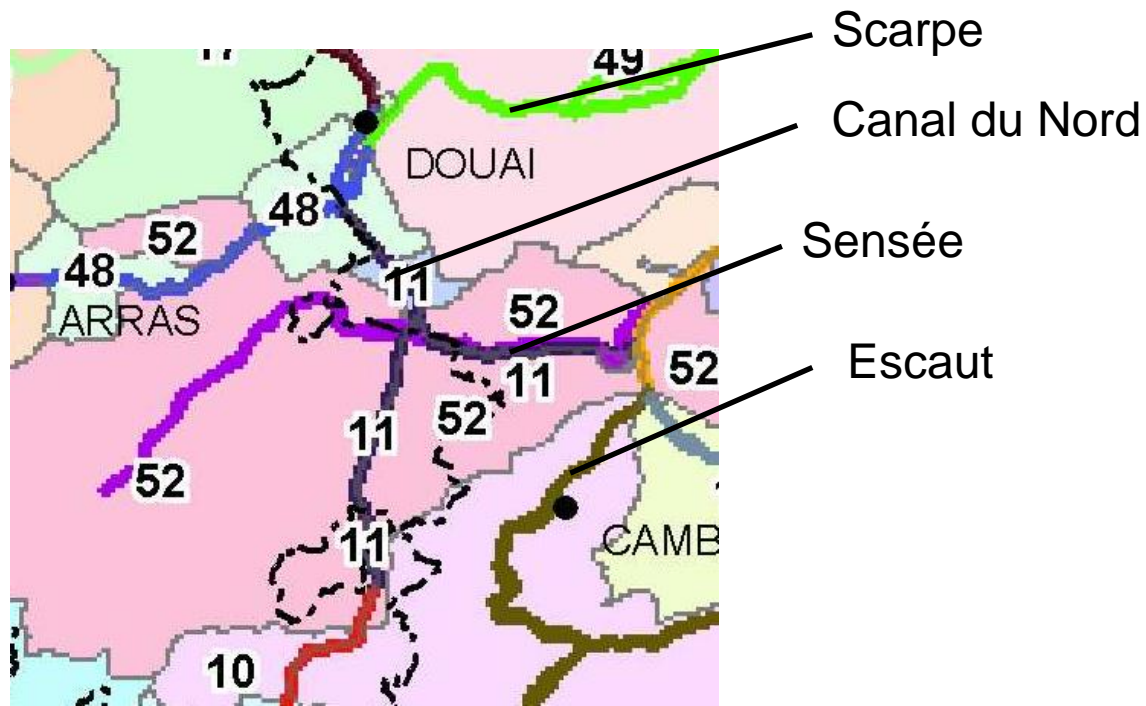
# Outlooks

- To confront these first results with other situations: to transpose the methodology to other districts
- To complement the catalogs with these confrontations
- To complement the costs database
- To develop a similar approach for the « other means » :
  - A technical catalog
  - A costs catalog

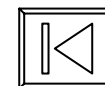


An aerial photograph of a long, dark-colored barge with a white cabin and a long, flat deck, moving down a wide river. The water is a greenish-brown color. The riverbanks are lined with dense green trees and vegetation. A white speech bubble with a black outline is positioned on the left side of the barge, containing the text "Thank you for your attention".

Thank you for  
your attention

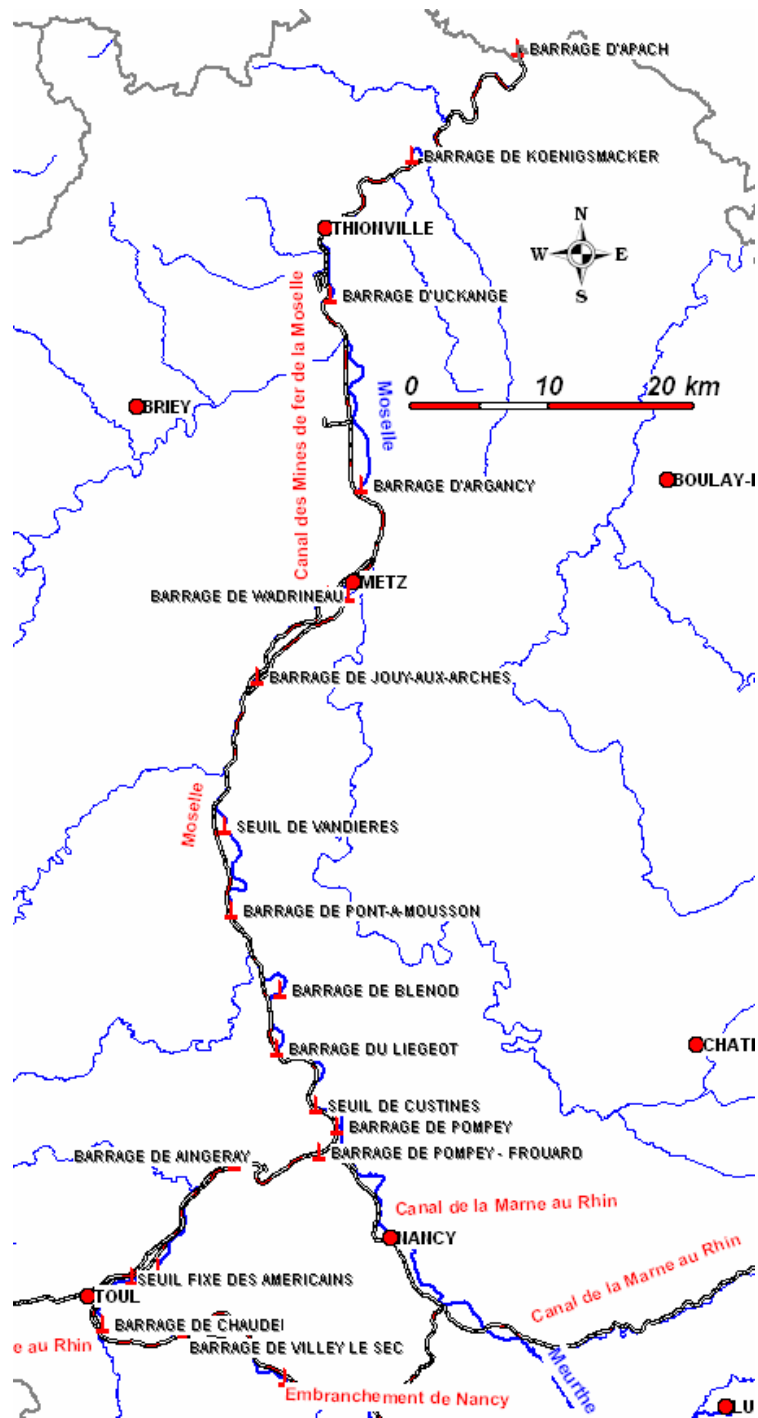


[Pictures](#)



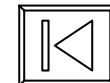
Quelques photos du canal du  
Nord





## Masse d'eau MOSELLE 6

[Pictures](#)



# Quelques photos aériennes de la Moselle



Type of development	Type of mesures	Direct costs				
		Description	Cost for rhin meuse	cost for artois picardie	cost for seine normandie	
Dams and pondages	Construction of fishpass / improvement of the existing fishpass	Maintenance of the fishpass	not significant	500 €/month		
		Construction or resumption of fishpass (+5m)	1000 k€ / m (average)*		61 k€ / m	
		Construction or resumption of fishpass (-5m)	15 - 30 k€ / m	40 - 70 k€ / m		
		Development of apron (neckline + macro-bollards)		15 - 30 k€ / m		
	Modification of the sluices regime	Construction of small sluices	to be estimated sluice 185x12m for 5m steep = 15,2 to 45,7 M€			
Maintenance of channels	Improvement of the quality of the dredges	Improvement/Modification of dredge tools	to be estimated			
		Usual mecanic dredge		15 € / m <sup>3</sup>		
		Usual hydraulic dredge		20 € / m <sup>3</sup>		
		barge transport		1 € / m <sup>3</sup>		
		Transport canalisation		1 € / m <sup>3</sup>		
		Land storage		20 € / m <sup>3</sup>		
		confined storag		50 € / m <sup>3</sup>		
Canalisation	Reconnexion of old meanders with the main channel	Connexion downwards=> light dreging (without dikes)	10 - 100 k€**		21 € / m3	
		Water supply point in the dike	100 - 200 k€			
		Reconnexion ofsecondary oxbow	300 k€ / km			
	Creation or re-creation of ox bow and wet lands	Creation or re-creation of oxbow without restoration of flood planes	100 - 100 k€ + property purchase	dredge 15€/m3 + transport + storage		
Maintenance of river banks and management operations for navigation uses	Plantation	Plantation	5 - 7 € / m linear			
		Ligneou planting (4 units every 15 ml)		1,60 € / ml		
		herbaceous plants		1,80 € / ml		
	Diversification / resloping	bank without dike	300 € / m linear	cost of earthworks	earthworks = 1,5 €/m3	
		bank with dike	500 - 1000 € / m linear	1000 - 2000 € / ml (VNF)		
	Diversification / emplacement of sedimentary groynes	sedimentary groyne without dike	1000 € / work			
		river banks protection	developed sheet pile		600 €/ml	
			vegetalised riprop		90 €/ml	
			Protection without dikes	300 € / m linear	60 - 300 € / ml (VNF)	15 - 100 € / ml (river bank development in light technics)
resumption of existing vegetation	vegetation resumption	3 - 25 € / m linear				
* according to :	- dimension of the site					
	- state of the site					
	- secondary equipment (footbridge = 10 k€)					
** dimension of oxbow						



Altérations linked to hydromorphological modification and navigation	Potential measure(s)
I1 Water warming upstream of the dams	Increase biological flow during summer due to hdropower stop.
	Bottom water supply point if dam > 7m
	shadow. Riparian restoration mainly in artificial parts
i2 Water cooling ( lock gates downsteam of the dams)	Surface water supply
I7 Oxygen shortage	Modification of the water storage rate, possibly hydroelectricity stop
I9 Eutrophication	Modification of the water storage rate, possibly hydroelectricity stop
I4 Reduction of the transparency	
I12 Mean low water increase (intakes in low waters, reduced buffer capacity) in the bypassed parts downstream	Increase biological flow in bypassed parts
I15 Reduction of floodings (frequency, duration) by an increase of the wet section and during eel dam management I49 Bypass of flooding areas (construction of dykes not necessarily linked to navigation)	Management improvement of flooded eel dams
	Creation of dynamic decreasing zones (transverse dykes in the stream channel) reduction of the wet section during flood.
	Restoration of downstream zones (in floodplain) of tributaries and re - connexion. See also I48 and I49
I20 Steep slope banks (naked banks, absence of macrophytes, of hiding places and of spawning site) navigated areas.	protection and diversification of river banks
	Hanging of sheet piles or of breakwater fills (CF Moselle between Metz and Thionville : Malroy or Niffer Mulhouse)
I21 tidal range on buffered downstream parts	Modification of the water storage rate upstream of the dams. Management of hydroelectricity.
I22 Uniformity of the transvers profile (length, width) et I36 Uniformity of the banks (hight, slope), I37 Reduction the bank, lilearity, I38 Reduction of hiding places and bank hiding places (blocs, under banks, stumps, stump gorge...), I40 Bank artificialisation. I41 Reduction of riparian vegetation (helophytes), navigated parts	protection and diversification of river banks by embankment (differeents degrees)
	Replacement of sheet piles, stoned (etc) riparian vegetation on banks.
	protection and diversification of banks by breakwaves Sedimentary groyne
I22 Uniformity of the cross profil (width, depth), buffered parts	Increase of the biological flow in buffered parts. Increase of the wet section
	Sedimentary groyne
I 23 deepening of the bed (by a lack of solid transport or digging, consequence : reduction of floods and lowering of groundwaters)	Granular discharge
	Creation of stabilasation sills
	Recreation of meanders according to an energetical approach
<i>I25 Reduction of sinuosity, lenth (=uniformity of the length profile)</i>	Recreation of meanders according to an energetical approach
I 28Reduction of grain size (blocs, stones) with I26 clogging of substrate (migratory fish rivers and t intermediate)	See I22
I42 Réduction/alteration of riparian vegetation	Planting, management of canal river beds
I46 Obstacle to fish migration upwards	Fish pass

I47 Obstacle to fish migration downwards	Fish slope for downstream migration
	Fine grids in hydropower stations
I48a De-connexion of annexes (oxbow and tributaries)	connexion (pipe way or bridge)
	Improvement of annex in case of "high-pitched "environment
I48b De-connexion of old meanders	connexion upwards and downwards
	Improvement of annex in case of 'high-pitched' environment

Water body	Activities	Size characteristics of activities
Canal du Nord	Goods transport	3 835 109 tonnes
	Pleasure boating	10 300 passages
	Fishing	8 fish groups (ngo)
Wateringues, Aa	Goods transport	1 358 731 tonnes
	Drainage	
	Water transfer	
	Pleasure boating	1500 passages
	Fishing	5 fish groups (ngo)
	Agricultural production	

Alterations	Measures to be established	efficiency
7 dams>1m		
Obstacles to fish migration upwards	Fish pass	++
Obstacle to fish migration downwards	slopes for downstream fish migration	++
100% artificialised bed		
100% artificialised bank		
. 16 km of rockfill	vegetation on banks	+
. 34 km of concrete lined channel	??????????	
	flood artificially the canal to re-create reproductive area	
11 dams> 1m		
Obstacles to fish migration upwards	fish pass	++
Obstacle to fish migration downwards	slopes for downstream fish migration	++
100% artificialised bed	adapt dedge technics	
100% artificialised bank		
Big sized canal :sheet piles	Vegetal technics	++
. Canal of Calais : sheet piles	techniques végétales	++
. Furnes : sheet piles & concrete	Vegetal technics	++
. Canal of Bergues : gabions	Vegetal technics	++
.Aa river : hard defence	Vegetal technics	++
Wet land drainage		
5 pumps to the sea		
management of the sea doors	review of the door management to the see	
	Plant growth bands along the floodplain	

Direct unitary				
impact on activities	Specifications	cost in Artois-Picadie	Total costs	Indirect costs
no	Probably technical difficulties linked to the emplacement on the canal	40 to 70 K€m	420 to 735 K€	
no		??????		
no		90 €m	2 880 K€	
no		40 to 70 K€m	660 to 155 K€	
no		??????		
no		60 to 300 €m		
no	31 km	60 to 300 €m	1 860 to 9 300 K€	
no	13 km	60 to 300 €m	780 to 3 900 K€	
no	7,8 km	60 to 300 €m	468 to 2 340 K€	
no	32 km	60 to 300 €m	1 920 to 9 600 K€	

**Benefits**

Increase of some species  
(pikes, eels)

landscape value

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**DESIGNATION DES MASSES D'EAU FORTEMENT MODIFIEES  
FICHE D'ANALYSE**

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**Éléments descriptifs**

Code de la masse d'eau	<b>F_A---0060G10c020</b>
Nom de la masse d'eau	<b>MOSELLE 6</b>
Localisation	<b>La Moselle depuis la confluence de la Meurthe à Frouard jusqu'à la frontière germano-luxembourgeoise à Apach</b>
Type (local)	<b>G10c - Grand cours d'eau à eaux calmes et tempérées en région calcaire</b>
Type (national)	<i>(à compléter)</i>
Longueur totale	<b>173 km (incluant de nombreuses dérivations artificielles)</b>
Motif du classement provisoire en fortement modifié	<b>Navigation, urbanisation et endiguement</b>

## Activités humaines

### **Transport de marchandises**

En 2003, ce sont près de 700 MTkm qui y ont été transportées. Plus précisément, près de 3 M de tonnes ont été transportées de Frouard à Metz et 8,5 M de tonnes l'ont été de Metz à Apach.

Il s'agit de la masse d'eau transportant le plus de marchandises dans le secteur de travail Moselle-Sarre.

### **Tourisme fluvial**

Ce sont environ 1 500 bateaux qui transitent sur cette masse d'eau par an.

### **Production d'énergie**

Très importante. 42 000 GWh produits, grâce à 3 centrales principalement : Cattenom, nucléaire, 90 % de la production ; La Maxe et Blénod, thermiques, 10% de la production.

## Eléments de diagnostic écologique

### **Poissons**

Le peuplement inventorié et en évidence l'absence totale ou quasi-totale des grands migrateurs (Saumon et Anguille) en raison des nombreux ouvrages non ou peu franchissables situés en aval. Par ailleurs, les populations de Brochet et autres espèces (tanches, etc) se reproduisant dans le lit majeur sont extrêmement mal représentées du fait de l'artificialisation des berges et des aménagements limitant le champ d'inondation de la Moselle.

L'indice Poisson se situe au-delà du seuil provisoire du Bon Etat.

### **Invertébrés**

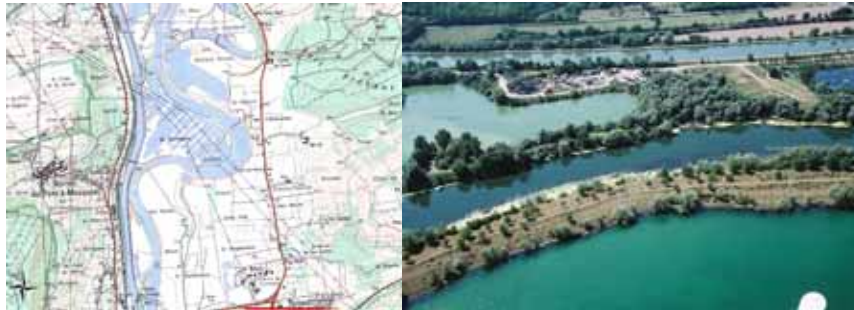
Les peuplement d'Invertébrés montrent une nette diminution de la diversité et de la richesse biologique dans les tronçons aménagés pour la navigation du fait de la banalisation des habitats de fond et de berge.



Moselle à Belleville



Moselle à Pont-à-Mousson



Moselle à Norroy-lès-Pont-à-Mousson



Moselle à Arnaville



Moselle à Metz



Moselle à Saint-Julien-lès-Metz



Moselle à Argancy



Moselle à Uckange



Moselle à Basse-Ham



Moselle à Cattenom



Moselle à Sieck-les-Bains

### Mesures de restauration

Mesure de restauration	Faisabilité technique	Impact sur les activités et l'environnement au sens large	Quantité / Volume / Linéaire	Fonction de coût	Coût estimatif
Rétablissement de zones de frayères à brochet par remise en communication des gravières	Oui	Non	Environ 75 ha de frayères à Brochet sont à restaurer sur l'ensemble de la masse d'eau	Foncier = 1 – 10 k€/ha Connexion bras mort = 40 k€/km en moyenne	Foncier = 75 – 750 k€ Connexion = ???
Remise en communication ou recréation d'anciens méandres	Oui		3 méandres pour un total d'environ 5 km	300 – 600 €/ ml	3 – 6 M€
Rediversification des berges, remplacement des palplanches et des enrochements par des techniques végétales	Oui	Non	14 km (sur deux rives)	40 – 400 €/ ml	1 – 10 M€
Rétablissement des la franchissabilité des ouvrages (montaison)	Oui	Non	9 barrages < 5 mètres Total 34 mètres de chute	Passé : 15 – 30 €/ m Entretien : 6k€/an/passe	500 – 1000 k€ + 540 k€ d'entretien
Rétablissement des la franchissabilité des ouvrages (dévalaison)				?	?

<b>COÛT TOTAL</b>	<b>5 - 18 M€</b>
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**Conclusion : ces mesures permettraient-elles d'atteindre le bon état écologique ?**

Les aménagements ont considérablement réduit la diversité du lit mineur et le fonctionnement du lit majeur. Les mesures présentées ci-dessus ne permettront pas de restaurer un bon état écologique sur la masse d'eau Moselle 6 mais contribueront à atteindre un Bon Potentiel Ecologique (qui reste à déterminer).

**POURSUITE DU TEST DE DESIGNATION**

**OUI**

**NON**

### Solutions alternatives

Solution alternative	Faisabilité technique	Meilleure option environnementale ?	Coût estimatif	Bénéfice
Transfert des marchandises sur voie routière	+ 1000 PL/jour => OUI	NON	Coût environnemental supérieur + Coût perte tourisme + Coût décanalisation	Retour du bon état de la masse d'eau
Transfert des marchandises sur voie ferroviaire	+ 11 trains complets (1400 tonnes) / jour => OUI	OUI	Coût perte + Coût décanalisation	Retour du bon état de la masse d'eau + Gain environnemental fer/eau
Combinaison fer/route	...	...	...	...

### Conclusion : ces solutions alternatives ont-elles un coût disproportionné ?

A priori, le coût serait disproportionné par rapport aux bénéfices attendus.  
 Pour ce qui est du transport routier, l'analyse du coût environnemental suffit à prouver le caractère disproportionné de la mesure. Il n'est même pas utile d'aller jusqu'à cette analyse, puisqu'il ne s'agit pas d'une meilleure option environnementale.  
 Pour ce qui est du transport ferroviaire, l'analyse est à mener plus en détails pour prouver que le coût s'avèrerait effectivement disproportionné, même si il s'agit d'une meilleure option environnementale.

**CONCLUSION : LE CLASSEMENT EN MEFM EST-IL VALIDE ?**

OUI

NON