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The Interreg IVB
North Sea Region
Programme



‘Shallow water area Rönnebecker Sand’

Measure analysis 25
in the framework of the Interreg IVB project TIDE

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Part 1: Measure description

Measure Category: Biology/Ecology

Estuary: Weser

Salinity zone: limnic

Pressure: Habitat loss and degradation

Measure status: implemented

River-km: Weser-km 26 – 28.5

Country: Germany

Specific location: Lower Saxony, District Wesermarsch, near Berne

Responsible authority: Water and Shipping Authority Bremerhaven

Costs: 2.800.000 €

Cost category: 1.000.000 – 5.000.000 €

Picture/Map:

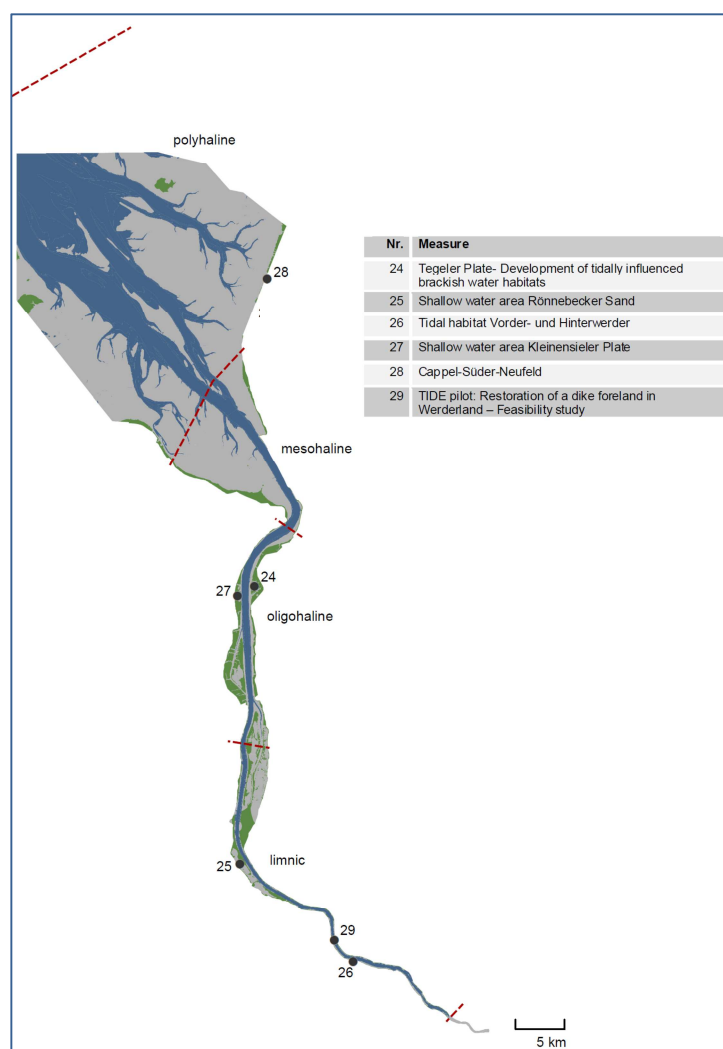


Figure 1: Location of compensation measure 25: „Shallow water area Rönnebecker Sand“



1.1 Measure description

The measure 'Shallow water zone Rönnebecker Sand' was designed and implemented as a compensation measure after national environmental law for the outer Weser deepening (chart datum -14 m) which was executed in 1998 and 1999.

The project area of the compensation measure is situated on a river island of the lower Weser River ('Weserdeicher Sände'). On a 37 ha former disposal area, a typical habitat succession including tidal waters, reeds, bushes and wide grasslands was established (Figure 2).



Figure 2: Aerial photograph of project area

The 7.8 ha large shallow water zone represents the core piece of the compensation measure. It is surrounded by tidal reeds (5.3 ha) and connected to the river Weser by an overflow barrier installed 0.5 m below mean high water level. The overflow barrier guarantees a permanent minimum water level of 2 m within the shallow water zone.

The shallow water habitat is surrounded by a 21 ha buffer zone. The buffer zone is partly left to natural succession, but mainly used as extensive grassland in order to promote the grassland bird population (e.g. Lapwing (*Vanellus vanellus*), Black-tailed godwit (*Limosa limosa*)). The buffer zone was designed to compensate direct negative effects of dredging and disposal activities in the outer Weser estuary.

The building measures started in spring 2001 and were finished in 2002.

1.2 Monitoring

The monitoring program runs ten years and includes the following aspects:

- Birds (breeding, resting and migrant birds)
- Aquatic fauna (fish, benthic invertebrate fauna, vagile epifauna, zooplankton)
- Vegetation (species and habitats)

1.3 Monitoring results

Birds

Immediately after measure implementation, several breeding pairs of Pied avocet (*Recurvirostra avosetta*) used the sandy open bank areas within the project area as breeding grounds. By now, these pioneers have left the area mostly to Lapwing (*Vanellus vanellus*), Redshank (*Tringa totanus*) and Little Ringed Plover (*Charadrius dubius*). On the shallow water zone, numerous water and wading birds were observed. Hundreds of Graylag geese (*Anser anser*), Common Teals (*Anas crecca*) and Eurasian Widgeons (*Anas penelope*) were present.

Mainly due to the occurrence of breeding Corn Buntings (*Miliaria calandra*), the breeding bird population on Rönnebecker Sand was considered as important for the federal state of Lower Saxony in 2003 after WILMS ET AL. 1997. Since the breeding bird species which founded the area status in 2003 could no longer be observed in 2007, the project area based on more recent counts would have to be considered as of general importance for Lower Saxony. In this context, it has to be mentioned that the method according to WILMS ET AL. 1997 was designed in view of larger spatial units (80-200 ha) and requires multiannual observations in order to prevent coincident effects. Considering the entire 117 ha river island ('Weserdeicher Sände') would lead to a designation as important breeding bird site for the federal state of Lower Saxony due to occurrences of Corn Crake (*Crex crex*) (Bios 2007A).

According to Bios 2004, the resting and migrant bird population of the project area can be described as species and individuals rich mostly due to structure diversity and a low degree of disturbances (Figure 3). In particular, the newly created shallow water area provides favorable conditions for most species and individuals during resting and migration time. In addition, the functional connection with other suitable resting grounds has positive effects on the resting bird population of the project area. Therefore, the project area 'Rönnebecker Sand' can be considered as integral part of a network of especially suitable resting bird areas in the outer dike area of the Weser River.



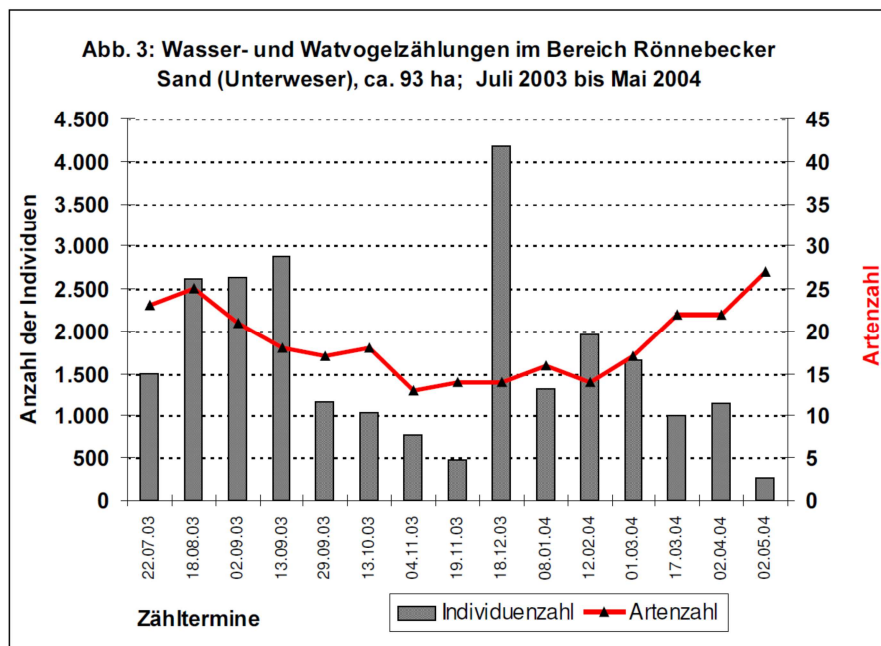


Figure 3: Water and wading bird countings on the project area between July 2003 and May 2004. The occurrence of few species ('Artenzahl') in winter and many species in late summer/spring is typical for bird migration areas visited by Nordic water and wading birds on their way back to or away from home. The number of individuals ('Anzahl der Individuen') principally reflects this course. Only during winter, exceedingly high individual numbers due to a high amount of migrating geese belonging to few species were observed (Bios 2004).

Vegetation

The banks of the shallow water zone were settled by reeds and helophytes directly after measure implementation. Especially mass occurrences of Water mudwort (*Limnosella aquatica*) are worth mentioning (Figure 4, left). The Water mudwort is a raw floor pioneer which is rare in the lower Weser region. To the benefit of pioneer species, the banks of the shallow water zone are grazed by cattle (Figure 4, right). In the longer term, restrictions of cattle grazing are planned and tidal reeds are expected to establish (Bios 2003).

Inventories of 2007 prove an advanced stage of vegetation development which is no longer exclusively determined by the constructional measures implemented in 2001 and 2002 (Figure 5). A consolidation in terms of a decline of species indicating disturbances and species not belonging to area specific communities can be stated e.g. at the shore of the shallow water zone and on grassland areas. As projected by Bios 2003, a closed reed belt established at the southern shore of the shallow water zone within four years after cattle grazing was restricted. The northern shore continues to be available for grazing livestock. This guarantees a coexistence of different development stages of shore vegetation (Bios 2007b).



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Figure 4: Water mudwort (*Limnosella aquatica*) at the shore of the shallow water zone (left) and cattle at the northern shore of the shallow water zone (Bios 2007b)

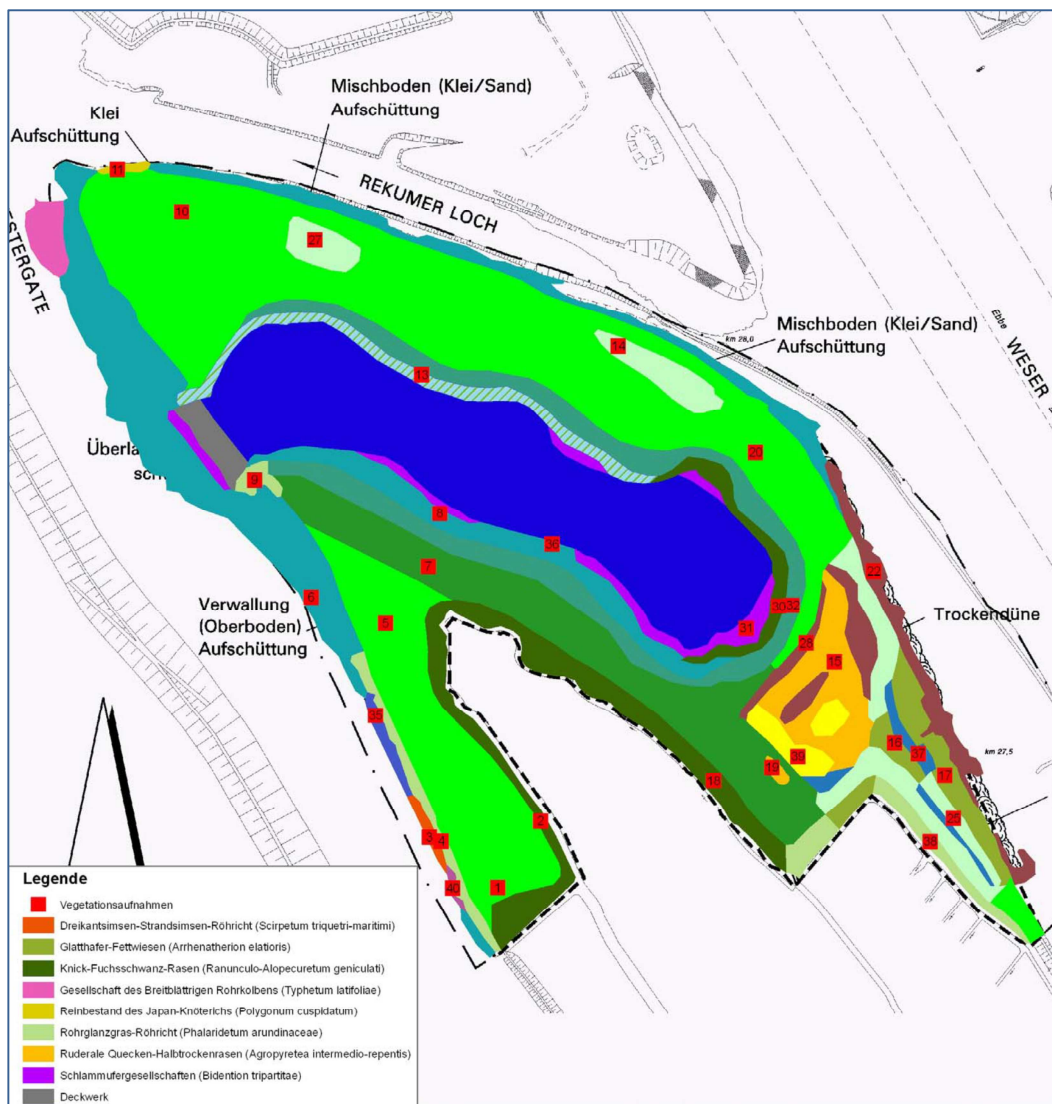


Figure 5: Structure diversity on the project area after measure implementation (Bios 2007b)

Benthic invertebrate fauna and fish

Compared to the poor infauna of the lower Weser River, the bed of the shallow water zone is to be considered as species rich. For example, numerous individuals of different Oligochaeta species and Chironomidae larvae occurred (approx. 10 000 individuals of both groups per square meter).

Comparable abundances were observed in muddy sections of 'Westergate' and 'Rekumer Loch' which connect the shallow water zone 'Rönnebecker Sand' to the Weser River.

Worth mentioning are occurrences of several endangered aquatic bivalve mollusk species of the family Sphaeriidae (*Pisidium henslowanum*, *Pisidium moitessierianum*, *Pisidium supinum*), but the species richness in the shallow zone is mainly due to undemanding fresh water species widely spread in the lower Weser region and to extreme impoverishment of this component of fauna in the river itself.

The establishment of flowing water species in the mostly stagnant tidal habitat is expected to be possible to a limited extend only. Also more demanding species preferring standing waters or areas with low current velocities were proven to a limited extend within the newly created shallow water zone. For many benthic invertebrate species originally established in the less influenced lower Weser River and its tidal floodplains, nowadays inner dike ditch systems in the lower Weser region serve as substitute habitats.

In 2009, 23 fish species were proven in the newly created shallow water zone and the bordering section of the lower Weser River. Mainly juveniles of Smelt (*Osmerus eperlanus*), Ide (*Leuciscus idus*) and Common goby (*Pomatoschistus microps*) were observed. In the lower Weser River, the number and importance of euryhaline migratory fish species and occasional marine species is significantly higher than in the shallow water zone. Here, only few euryhaline species –mainly juvenile gobies and flounders (*Platichthys flesus*)- were of importance. The frequently appearing freshwater species were numerous both in the river and in the shallow water zone. The establishment of a specific fish community of standing water or waters with low current velocities could not be confirmed in 2009. Occurrences of under-water-vegetation as habitat for associated invertebrates and as spawning habitat for different fish species could not be proven. Regarding the shallow water zone, convincing evidences for a significant importance in view of reproduction and overwintering of fish are missing yet (HAESLOOP 2009).

The monitoring program is being continued until 2012.

Part 2: Execution of main effectiveness criteria

2.1 Effectiveness according to development targets of measure

-Step 1: Definition of development targets

The measure aims at compensating considerable impacts on vegetation, avifauna and limnic fauna by

- Construction of a tidally influenced shallow water zone
- Development of reed communities
- Creation of a buffer zone with extensive grassland use and development of succession areas

-Step 2: Degree of target achievement

The monitoring results show that the development targets defined for the compensation measure are fully reachable until the end of the 10 year runtime of the monitoring program. At the same time, it has to be stated that the development targets are formulated very unspecific.



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2.2 Impact on ecosystem services

The measure 'Shallow water area Rönnebecker Sand' in the freshwater zone of the Weser estuary was about the creation of estuarine habitats by transforming adjacent land into marshland as well as subtidal moderately deep habitat connected with a high change in the habitat quality (Figure 6). From the ecosystem services (ES) assessment, it is concluded that this measure generates overall a positive expected impact for many ES, mainly for 'biodiversity' and some regulating services (erosion and sedimentation regulation by water bodies, water quality regulation: reduction of excess loads coming from the catchment). The expected impact on the development targets ('biodiversity') is very positive. The expected impact for the different beneficiary groups is overall positive, with a positive to very positive expected impact for indirect and future use and for local and regional use (Table 1).

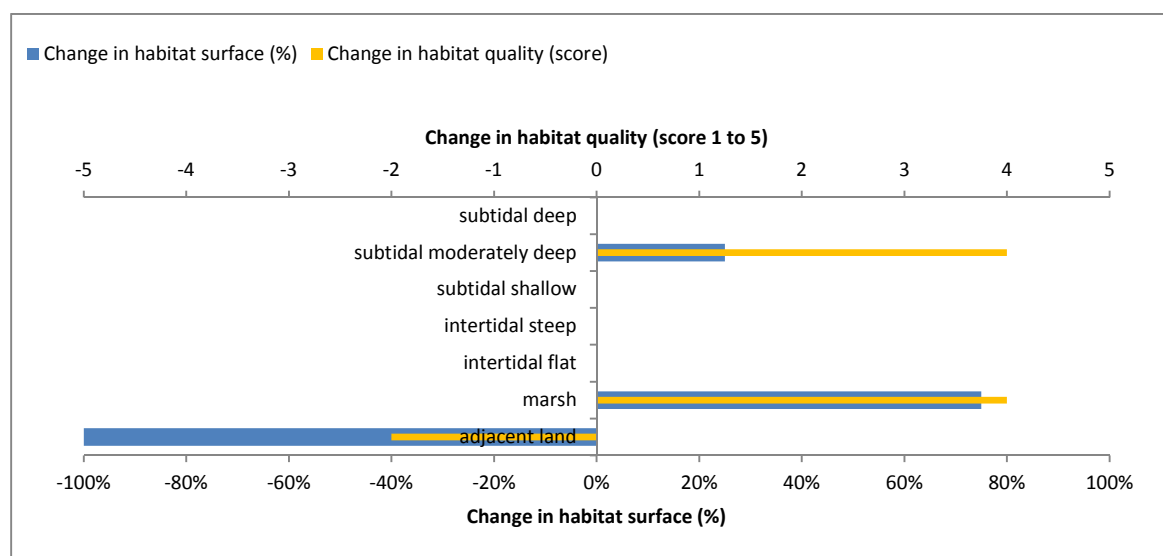


Figure 6: Ecosystem services analysis for measure 'Shallow water area Rönnebecker Sand': Indication of habitat surface and quality change, i.e. situation before versus after measure implementation.

Table 1: Ecosystem services analysis for measure 'Shallow water area Rönnebecker Sand': (1) expected impact on ES supply in the measure site and (2) expected impact on different beneficiaries as a consequence of the measure.

Shallow water area Rönnebecker Sand			
Cat.	Ecosystem Service	Score	Beneficiaries:
S	"Biodiversity"	3	Direct users 0
R1	Erosion and sedimentation regulation by water bodies	3	Indirect users 2
R2	Water quality regulation: reduction of excess loads coming from the catchment	3	Future users 3
R3	Water quality regulation: transport of pollutants and excess nutrients	1	Local users 2
R4	Water quantity regulation: drainage of river water	0	Regional users 2
R5	Erosion and sedimentation regulation by biological mediation	2	Global users 1
R6	Water quantity regulation: transportation	1	
R7	Water quantity regulation: landscape maintenance	2	
R8	Climate regulation: Carbon sequestration and burial	2	
R9	Water quantity regulation: dissipation of tidal and river energy	0	
R10	Regulation extreme events or disturbance: Wave reduction	1	
R11	Regulation extreme events or disturbance: Water current reduction	1	
R12	Regulation extreme events or disturbance: Flood water storage	2	
P1	Water for industrial use	0	
P2	Water for navigation	1	
P3	Food: Animals	0	
C1	Aesthetic information	2	
C2	Inspiration for culture, art and design	2	
C3	Information for cognitive development	2	
C4	Opportunities for recreation & tourism	2	

X Targeted ES

Legend: expected impact*

3	very positive
2	positive
1	slightly positive
0	neutral
-1	slightly negative
-2	negative
-3	very negative

*: Indicative screening based on ES-supply surveys and estimated impact of measures on habitat quality and quantity. Quantitative socio-economic conclusions require local supply and demand data to complement this assessment.

2.3 Degree of synergistic effects and conflicts according to uses

There are no considerable conflicts or synergistic effects to be stated.

Part 3: Additional evaluation criteria in view of EU environmental law

3.1 Degree of synergistic effects and conflicts according to WFD aims

The compensation measure 'Shallow water zone Rönnebecker Sand' was not designed to meet the requirements of the Water Framework Directive. However, it covers five of six main pressures the limnic zone of the Weser estuary is affected by (Table 2).

Table 2: Measure effects on main pressures of the limnic zone of the Weser estuary

Indicator	Code	Main pressures freshwater zone Weser	Effect?					Description
			--	-	0	+	++	
S.I.	-	Habitat loss and degradation during the last 100 years: Subtidal					X	Additional subtidal area was created (shallow water zone).
S.I.	1.1	Habitat loss and degradation during the last 100 years: Intertidal				X		Intertidal habitats (e.g. reeds) were created.



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S.I.	1.4/ 1.5	Gross change in morphology/hydrographic regime during the last about 100 years					X	Due to Weser deepening, many side habitats of the river including shallow water areas got lost. The compensation measure creates new side habitats and therefore contributes to mitigating the negative effects of the gross changes in morphology/hydrographic regime which took place during the last 100 years.
D.I.	1.3	Land claim during the last about 100 years				X		The project area – a former disposal area without tidal influence – was reconnected to the river.
D.I.	1.7	Relative Sea Level Rise				X		Project area provides additional holding capacity.
D.I.	2.6	Capital dredging			X			There are no direct effects to be stated, but measure generally contributes to mitigating the negative effects of capital dredging.

S.I. = state indicator;

D.I. = driver indicator

3.2 Degree of synergistic effects according to Natura 2000 aims

The Rönnebecker Sand is located in a Special Protection Area (SPA) after the Habitat Directive (Site Name: Nebenarme der Weser mit Strohauser Plate und Juliusplate; site code: DE 2516-331). According to the Integrated Management Plan Weser (IBP Weser), the project area is assigned to operational area 3. Although the compensation measure was not designed to meet the requirements of Natura 2000, potential positive effects on several conservation objectives defined for operational area 3 (Table 3) and for the entire investigation area of the IBP Weser (Table 4) can be stated.

-Step 1: Estimate potential measure effects on conservation objectives for certain special units

Table 3: Natura 2000-objectives with specifications for operational area 3 (source: simplified after NLWKN, SUBV 2012)

Operational area 3: Freshwater zone in the lower Weser (Weser km 12 - 32)				
Specifications for operational area 3	Effect of measure 25 on conservation objectives			Short explanation
	positive effect	no effect	negative effect	
Conservation and development of specific estuarine habitats and (tidal) floodplains and their dynamic changes				
Development, enlargement and upgrade of shallow water zones with moderate current climate	++			A shallow water zone with reduced tidal range was created.
Development of passable shore structures	+			The shallow water zone is connected to the Weser River by an overflow barrier which is basically passable for organisms.
Conservation and development of typical habitats of operational area 3 (e.g. river flats, reeds and typical shore vegetation not being affected by neophytes, tidal floodplains and extensively used grasslands) in a dimension, spatial distribution and interconnection ensuring long-term appearance of typical species	++			Typical habitats of operational area 3 were developed (e.g. reeds, extensively used grassland).



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Conservation and development of tidal floodplains at the upper tidal border	++			The shallow water area Rönnebecker Sand takes over various functions of tidal floodplain back waters.
Conservation and development of habitats for viable populations and estuary and (tidal) floodplain specific species as well as species after Annex II Habitats Directive and bird species after Birds Directive				
Conservation of typical breeding bird communities and associated habitats (breeding birds of grasslands, reeds and tidal floodplains)	+			The project area represents a breeding site of importance for the federal state of Lower Saxony (Bios 2007A)
Conservation and development of undisturbed resting and moulting areas for migratory bird populations (high diversity, many individuals) considering all necessary functions	+			The migratory bird population can be described as species and individuals rich due to structure diversity (e.g. shallow and deep water, grassland) and due to few disturbances (Bios 2007A)
Conservation and development of well-structured bordering waters and shore areas with wood, typical shore vegetation and reeds as hunting and feeding ground for Pond bat (<i>Myotis dasycneme</i>)	+			Not investigated, but the occurrence of Pond bat is likely.
Preservation and development of spawning ground function for Twaite shad (e.g. by avoiding disturbances during spawning season)	+			In 2009, some spawn of Twaite shad was found in the shallow water zone. Due to low current velocities, the shallow water zone itself is not supposed to serve as spawning ground for Twaite shad. However, discharges of oxygen, zooplankton (<i>Eurytemora affinis</i>) and Mysida from the shallow water zone directly into the main spawning ground of Twaite shad take place and contribute to improving the growing conditions (HAESLOOP 2009).
Conservation and development of spawning ground function for Smelt (<i>Osmerus eperlanus</i>) (e.g. by avoiding disturbances during spawning season)	+			Larvae and juveniles were found in the shallow water zone in 2004/2005 and in 2009 (HAESLOOP 2009).

-Step 2: Estimate potential measure effects on overall conservation objectives

Table 4: Natura 2000-objectives with specifications for entire investigation area of the Integrated Management Plan Weser (IBP Weser); source: simplified after NLWKN, SUBV 2012

Specifications for entire investigation area of IBP Weser	Effect of measure 25 on conservation objectives?		
	positive effect	no effect	negative effect
Conservation and development of specific functions and processes of estuaries and (tidal) floodplains to reach favourable abiotic conditions and typical hydromorphological structures			
Conservation and development of favourable water structures and water bed dynamics	++		
Development of evenly distributed and reduced current energy and tidal parameters	++		
Conservation and development of favourable gradients of specific aspects regarding estuaries and (tidal) floodplains (e.g. salinity, sediments, current conditions, tidal range, close-to-nature zonation of shore vegetation...); refers to inner estuary and to area between estuary and floodplain within fresh water zone.	+		



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Improvement of water and sediment quality	+		
Conservation and development of specific estuarine habitats and (tidal) floodplains and their dynamic changes			
Conservation and development of habitats and communities which strongly depend on the natural dynamics of morphological processes (e.g. mudflats, shallow waters, creeks...)	+		
Development of balanced area percentages regarding mudflats, shallow waters, shallow and deep sublittoral	+		
Conservation and development of tidal floodplains with typical vegetation structures and biocoenosis and favourable tidal and flooding dynamics; especially floodplain enlargement	+		
Conservation and development of habitats for viable populations and estuary and (tidal) floodplain specific species as well as species of Annex II Habitats Directive and bird species of Birds Directive			
Conservation of habitat functions for breeding and migrant birds especially as feeding grounds (also for bordering or networked areas)	+		
Conservation and development of habitat requirements for migratory fish stocks and cyclostomata within present territories and networked areas	+		
Conservation and development of habitat requirements for autochthon fish communities with typical age composition and typical percentage of estuarine species and diadromous migratory fish species	+		
Conservation and development of long-term viable populations of typical fish species and cyclostomata (estuarine and diadromous guilds)	+		
Reaching of favourable water quality for reproduction, larval development and viability of typical fish communities of different salinity zones	+		
Conservation and development / reestablishment of passability of the tidal river Weser and its tributaries for migratory fish and benthic invertebrates		0	

Part 4: Crux of the matter

No information available.

Part 5: Literature

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