



Project part-financed by the European Union (European Regional Development Fund)



## **‘Tegeler Plate – Development of tidally influenced brackish water habitats ’**

Measure analysis 24  
in the framework of the Interreg IVB project TIDE

S. Saathoff <sup>1</sup>, M. Wernick <sup>2</sup>

<sup>1</sup> Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency, Germany

<sup>2</sup> Free Hanseatic City of Bremen, Germany

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Sonja Saathoff  
Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency (NLWKN)  
Department Brake-Oldenburg  
Germany

[www.nlwkn.niedersachsen.de](http://www.nlwkn.niedersachsen.de)

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# Table of contents

- Table of contents..... 1
- List of figures ..... 2
- List of tables ..... 2
- Part 1: Measure description ..... 3
  - 1.1 Measure description ..... 4
  - 1.2 Monitoring..... 4
  - 1.3 Monitoring results..... 5
- Part 2: Execution of main effectiveness criteria..... 5
  - 2.1 Effectiveness according to development targets of measure..... 5
  - 2.2 Impact on ecosystem services..... 6
  - 2.3 Degree of synergistic effects and conflicts according to uses..... 9
- Part 3: Additional evaluation criteria in view of EU environmental law ..... 9
  - 3.1 Degree of synergistic effects and conflicts according to WFD aims..... 9
  - 3.2 Degree of synergistic effects according to Natura 2000 aims..... 9
- Part 4: Crux of the matter ..... 12
- Part 5: Literature ..... 13



## List of figures

Figure 1: Location of compensation measure 24: ‚Tegeler Plate – Development of tidally influenced brackish water habitats‘ .....	3
Figure 2: Aerial photograph of project area.....	4
Figure 3: Percentages of breeding bird guilds regarding overall breeding population on project area in 2009 (KÜFOG 2010A).....	5
Figure 4: Ecosystem services analysis for measure ‚Tegeler Plate – Development of tidally influenced brackish water habitats‘: Indication of habitat surface and quality change, i.e. situation before versus after measure implementation. ....	6
Figure 5: Effects of Galloway activity: open water and ground areas, increased structure diversity (KÜFOG 2010A).....	7
Figure 6: Structure diversity on the Tegeler Plate before (left) and after (right) measure implementation (TESCH WBLN, KÜFOG 2002; KÜFOG 2010B).....	8
Figure 7: Different water levels on the Tegeler Plate (tidal low water (A); spring tide high water (B)); source: BREMENPORTS 2009.....	8

## List of tables

Table 1: Ecosystem services analysis for measure ‚Tegeler Plate – Development of tidally influenced brackish water habitats‘: (1) expected impact on ES supply in the measure site and (2) expected impact on different beneficiaries as a consequence of the measure.....	7
Table 2: Measure effects on main pressures of the oligohaline zone of the Weser estuary.....	9
Table 3: Natura 2000-objectives with specifications for operational area 2 (source: simplified after NLWKN, SUBV 2012).....	10
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.....	11



## Part 1: Measure description

Measure Category: Biology/Ecology

Estuary: Weser

Salinity zone: oligohaline

Pressure: Habitat loss and degradation

Measure status: implemented

River km: Lower Weser-km 54,5 – 58

Country: Germany

Specific location: Lower Saxony, District Cuxhaven, near Dedesdorf

Responsible authority: bremenports GmbH und Co. KG

Costs: unknown

Cost category: unknown

Picture/Map:

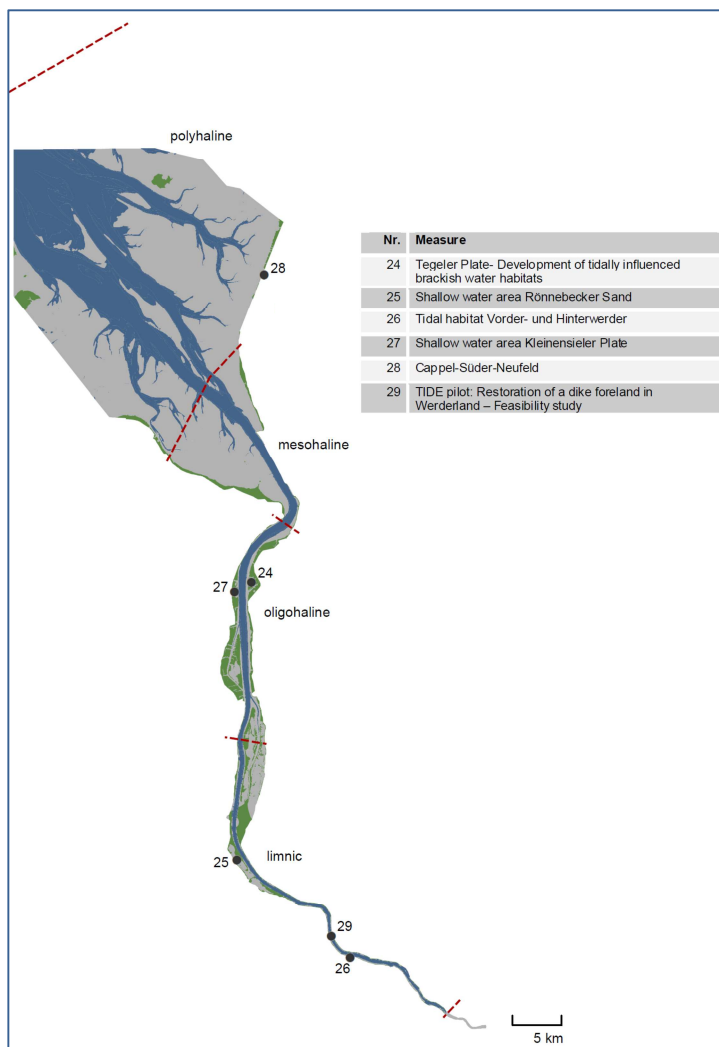


Figure 1: Location of compensation measure 24: ‚Tegeler Plate – Development of tidally influenced brackish water habitats‘



## 1.1 Measure description

The measure 'Tegeler Plate – Development of tidally influenced brackish water habitats' was designed and implemented as a compensation measure after national environmental law for the third container terminal expansion (Container Terminal III, CT III) in the overseas port of Bremerhaven. The building measures for CT III were realized between 1994 and 1997. The 210 ha Tegeler Plate – formerly used as agricultural land – was converted into a tidal habitat with creek systems, shallow water areas and reed. After the building measures have been finished in 1997, the project area (Figure 2) was almost completely left to natural succession.



Figure 2: Aerial photograph of project area

One focal point of the compensation measure was to optimize or create tidally influenced habitats and associated fauna and vegetation features of the brackish water zone of the Weser. Another focal point was to promote typical water regime conditions as well as characteristic soil formation and sedimentation processes.

To initiate the development of mudflat structures, creek systems, shallow water zones and tidal reeds, the following measures were carried out:

- Replacement of agricultural use by natural succession over large areas
- Opening of summer dikes
- Making a connection to the river by creating a new creek system in the north and expanding an existing creek system in the south of the project area
- Creating small, tidally influenced standing waters and wider shallow water areas
- Deconstruction of buildings, streets and supply lines

## 1.2 Monitoring

The monitoring program runs 15 years and includes the following aspects:

- Structure of the project area
- Sediment distribution and attributes
- Water levels and basic hydrological parameters
- Vegetation
- Breeding and migrant birds
- Fish fauna
- Terrestrial invertebrate fauna



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### 1.3 Monitoring results

After measure implementation, the former grassland areas of the Tegeler Plate evolved to wide wet fallows with a high percentage of Canary reed-grass (*Phalaris arundinacea*) with Common reed (*Phragmites australis*) coming in from the ditch banks. The new habitats were quickly settled by common species like Reed warbler (*Acrocephalus scirpaceus*) and Common grasshopper warbler (*Locustella naevia*). Also, relatively rare and partly endangered species like Segde warbler (*Acrocephalus schoenobaenus*; max. 31 breeding pairs), Bearded reedling (*Panurus biarmicus*; max. 14 breeding pairs), Bluethroat (*Luscinia svecica*; max. 22 breeding pairs) and Savi's warbler (*Locustella luscinioides*; max. 2 breeding pairs) were found. After eight years of undisturbed development, the carabid fauna was dominated by typical reed species (e.g. *Agonum thoreyi*, *Demetrius monostigma*, *Demetrius imperialis*) and some specific tidal reed species appeared (e.g. *Chloriona glaucescens*). The natural scenery on the Tegeler Plate thus changed completely within few years: The former open, cultivated landscape changed to a tall, reed dominated 'natural' landscape which is widely inaccessible for people. The species composition depends mainly on frequency and duration of flooding events and on salinity.

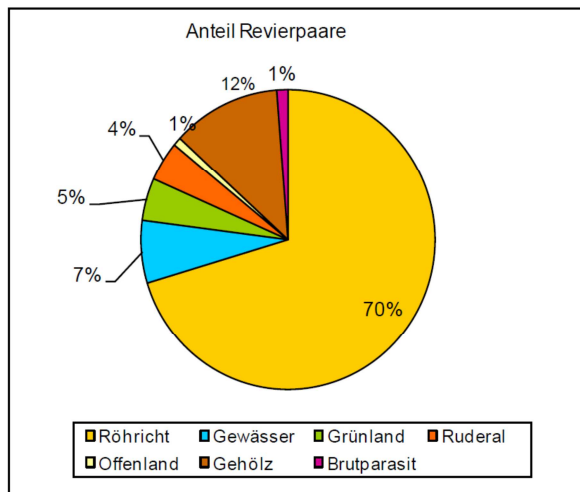


Figure 3: Percentages of breeding bird guilds regarding overall breeding population on project area in 2009 (KÜFOG 2010A)

Despite of regularly flooding and several storm surge events, the morphological changes observed were determined to small areas with high current velocities. The creek systems in the north and south of the project area were not affected by siltation and remained stable on a large scale. The tidally influenced creek systems represent important feeding grounds and refuges for water and wading birds as well as for marine and euraline fish species; e.g. juvenile stages of Three-stined stickleback (*Gasterosteus aculeatus*), European flounder (*Platichthys flesus*) and Common goby (*Pomatoschistus spec.*).

## Part 2: Execution of main effectiveness criteria

### 2.1 Effectiveness according to development targets of measure

#### -Step 1: Definition of development targets

- Development of tidally influenced habitats (mudflat and shallow water areas, creeks, reed) with species rich vegetation and fauna



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- Development of specific water regime conditions as well as soil formation and sedimentation processes
- Improvement of the natural scenery

### -Step 2: Degree of target achievement

The available monitoring results show that the development targets defined for the compensation measure are fully reachable until the end of the 15 year runtime of the monitoring program. One crucial point for the successful development of tidally influenced habitats on the Tegeler Plate was the creation of suitable site specific conditions by means of hydraulic engineering works. In summary, the measures realized on the Tegeler Plate represent a sustainable habitat development which contributes to restore the lower part of the river Weser which is strongly affected by human activities. The degree of target achievement is high.

## 2.2 Impact on ecosystem services

The measure ‘Tegeler Plate- Development of tidally influenced brackish water habitats’ in the oligohaline zone of the Weser estuary was about the creation of estuarine habitat by transforming adjacent land into mainly marshland and intertidal flat habitat connected with a very high change in the habitat quality (Figure 4). From the ecosystem services (ES) assessment, it is concluded that this measure generates overall a positive expected impact for many ES, mainly for ‘biodiversity’, the cultural services and various regulating services (erosion and sedimentation regulation by water bodies, water quantity regulation: landscape maintenance, climate regulation: Carbon sequestration and burial, regulation of extreme events or disturbance: Flood water storage. The expected impact on both development targets (‘biodiversity’ and ‘erosion and sedimentation regulation by water bodies’) 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).

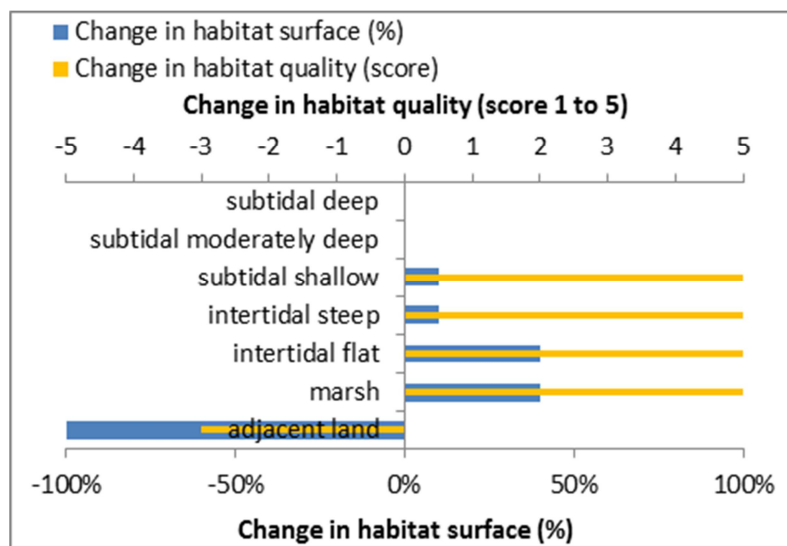


Figure 4: Ecosystem services analysis for measure, Tegeler Plate – Development of tidally influenced brackish water habitats’: Indication of habitat surface and quality change, i.e. situation before versus after measure implementation.





Table 1: Ecosystem services analysis for measure , Tegeler Plate – Development of tidally influenced brackish water habitats': (1) expected impact on ES supply in the measure site and (2) expected impact on different beneficiaries as a consequence of the measure.

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

Beneficiaries:	
Direct users	0
Indirect users	2
Future users	3
Local users	3
Regional users	2
Global users	1

Legend: expected impact*	
3	very positive
2	positive
1	slightly positive
0	neutral
-1	slightly negative
-2	negative
-3	very negative

X Targeted ES

\*: 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.



Figure 5: Effects of Galloway activity: open water and ground areas, increased structure diversity (KÜFOG 2010A)



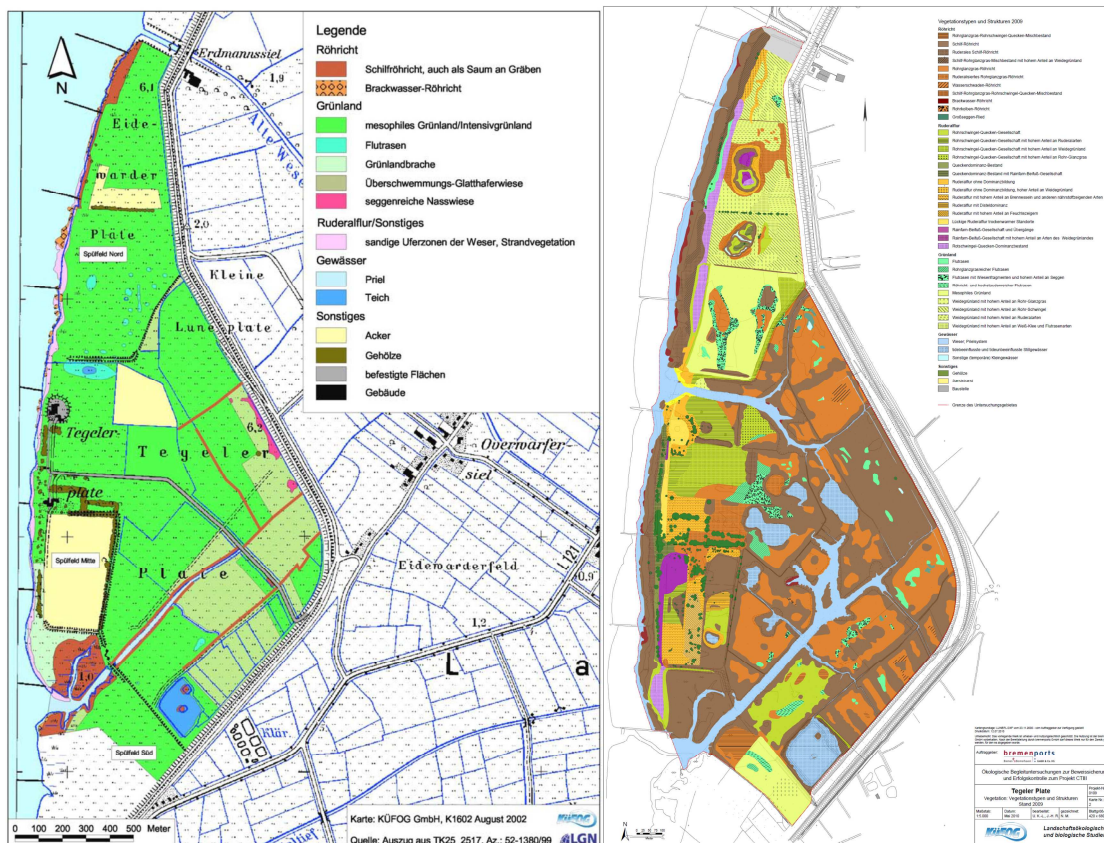


Figure 6: Structure diversity on the Tegeler Plate before (left) and after (right) measure implementation (TESCH WBLN, KÜFOG 2002; KÜFOG 2010b)

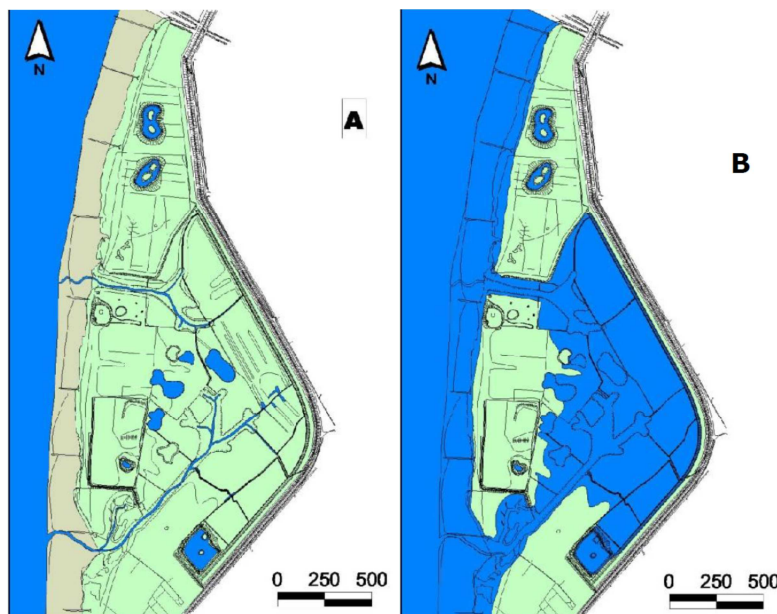


Figure 7: Different water levels on the Tegeler Plate (tidal low water (A); spring tide high water (B)); source: BREMENPORTS 2009

## 2.3 Degree of synergistic effects and conflicts according to uses

In order to realize the development of tidally influenced habitats on the Tegeler Plate, the former agricultural use was widely replaced by natural succession. Also, a farmstead and respective infrastructure was removed before measure implementation. Nowadays, the Tegeler Plate is almost inaccessible for people. Thus, conflicts regarding agriculture, tourism, leisure and local recreation can 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 ‘Tegeler Plate – Development of tidally influenced brackish water habitats’ was not designed to meet the requirements of the Water Framework Directive (WFD). However, it covers five of six main pressures the oligohaline zone of the Weser estuary is affected by (Table 2).

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

Indicator	Code	Main pressures oligohaline zone Weser	Effect?					Description
			--	-	0	+	++	
S.I.	-	Habitat loss and degradation during the last 100 years: Subtidal					X	As a result of measure implementation, additional subtidal areas were created.
S.I.	1.1	Habitat loss and degradation during the last 100 years: Intertidal					X	As a result of measure implementation, additional intertidal areas were created.
S.I.	1.4/ 1.5	Gross change in morphology/hydrographic regime during the last about 100 years				X		Natural erosion and sedimentation processes were promoted.
D.I.	1.3	Land claim during the last about 100 years					X	Due to measure implementation, the tidal influence on the project area was increased and the Tegeler Plate – formerly used for agricultural purposes- was nearly completely left to natural succession.
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.
D.I.	2.4	Maintenance dredging				X		Due to measure implementation, the Tegeler Plate provides additional sedimentation area. As a consequence, this may lead by trend to less maintenance effort in the river Weser.

S.I. = state indicator;  
D.I. = driver indicator

### 3.2 Degree of synergistic effects according to Natura 2000 aims

The Tegeler Plate is located in a Special Protection Area (SPA) after the Habitat and the Birds Directive (Site name: ‘Unterweser’; site code: DE2316331; DE2617401). According to the Integrated Management Plan Weser (IBP Weser), the Tegeler Plate is assigned to operational area 2. 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 2 (Table 3) and for the entire investigation area of the IBP Weser (Table 4) can be stated.



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

Table 3: Natura 2000-objectives with specifications for operational area 2 (source: simplified after NLWKN, SUBV 2012)

Operational area 2: Oligohaline zone in the lower Weser (Weser-km 40 - 65)				
Specifications for operational area 2	Effect of measure 24 on conservation objectives?			Short explanation
	positive effect	no effect	negative effect	
<b>Conservation and development of specific estuarine habitats and (tidal) floodplains and their dynamic changes</b>				
Development, enlargement and upgrade of shallow water zones with moderate current climate	+			Subtidal shallow water areas were created on the Tegeler Plate.
Development of passable shore structures	++			Due to measure implementation, tidal influence on the project area was considerably increased and about 100 ha of additional flooding space were created, e.g. by opening summer dikes and creating/expanding creek systems. These measures also contribute to improving the passability of shore structures e.g. for organisms.
Conservation and development of typical habitats of operational area 2 (e.g. mudflats, reeds, extensively used and salt-influenced grasslands, tidal floodplains) in a dimension, spatial distribution and interconnection ensuring long-term appearance of typical species	++			Typical habitat structures of operational area 2 (e.g. mudflats and reeds) were created.
<b>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</b>				
Conservation and development of undisturbed resting and moulting areas for migratory bird populations (high diversity, many individuals) considering all necessary functions	+			The number of migratory birds on the Tegeler Plate is currently decreasing (KÜFOG 2010A) due to vegetation growth on tidally influenced areas (especially reeds) of the project area and due to attractive neighbouring inner dike areas on the Luneplate. In the long term, the most important areas of the Tegeler Plate in terms of migratory birds are river mudflats and well-structured grassland areas. One possibility to reduce reed growth is Galloway pasture. First successes were observed on the sandy areas of the Tegeler Plate. However, the Tegeler Plate still represents a site of national importance for Eurasian Widgeon ( <i>Anas penelope</i> ) and Common Teal ( <i>Anas crecca</i> ).



Conservation of typical breeding bird communities and associated habitats (breeding birds of extensively used, salt-influenced grasslands and reeds)	++			Due to the breeding population observed since 2005, the project area is labelled as important breeding bird site for the federal state of Lower Saxony. Key success factor is the undisturbed development of habitat structures and vegetation sequences connected with the dynamics of tidally influenced areas. The resulting changes in structure (e.g. bank erosion) lead to small scale changes in settlement which vitalise and support long term development (KÜFOG 2010A).
Preservation and development of nursery ground function for Twaite shad (e.g. preferential water quality for juveniles and larvae)		0		This aspect was not part of the monitoring program. At the Weser River, side waters do not represent relevant habitats for Twaite shad anyhow. Of course, this would not exclude passive entry of larvae and juveniles.
Preservation and development of undisturbed resting and moulting areas for Pied avocet	+			766 individuals of Pied Avocet were observed in 2009 (24 counting) especially on river mudflat areas and around the northern creek system.
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> ) (e.g. creek systems on Tegeler Plate, on Einswarder Plate, shallow water zone Kleinensiel Plate...),	++			-
Conservation of site specific requirements and area percentages of aquatic structures as habitats for typical benthic invertebrate fauna	++			-
Conservation and development of favorable conditions on estuary grassland in order to promote long term establishment of Bulbous foxtail	+			-
Conservation of wide, salt-influenced reeds representing habitats for specialized invertebrate fauna (e.g. typical Auchenorrhyncha species)	+			-

## -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 24 on conservation objectives?		
	positive effect	no effect	negative effect
<b>Conservation and development of specific functions and processes of estuaries and (tidal) floodplains to reach favourable abiotic conditions and typical hydromorphological structures</b>			
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.	++		
Improvement of water and sediment quality	+		



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<b>Conservation and development of specific estuarine habitats and (tidal) floodplains and their dynamic changes</b>			
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	++		
<b>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</b>			
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

Depending on the position in the estuary and other frame conditions, the compensation measure 'Tegeler Plate – Development of tidally influenced brackish water habitats' shows that it is principally possible to create self-preserving tidal creek systems within highly dynamical estuaries. Looking at the experiences drawn at the Tegeler Plate and at other comparable experiences e.g. at other estuaries, the conditions for achieving self-preserving creek systems should be analyzed in detail. The results are supposed to be helpful in view of future measure planning and implementation processes.



## Part 5: Literature

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