TIDE
Tidal River Development

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

The Interreg IVB North Sea Region Programme

‘Cappel-Süder-Neufeld’

Measure analysis 28
in the framework of the Interreg IVB project TIDE

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December 2012

NLWKN

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Citation:
Saathoff, S. & J. Lange (2012): 'Cappel-Süder-Neufeld' (Weser estuary). Measure analysis in the framework of the Interreg IVB project TIDE. Measure 28. 13 pages. Oldenburg, Bremerhaven.

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Part 1: Measure description

Measure Category: Biology/Ecology
Estuary: Weser
Salinity zone: polyhaline
Pressure: Habitat loss and degradation
Measure status: implemented
River-km: Weser-km 88
Country: Germany
Specific location: Lower Saxony, District Cuxhaven, near Dorumer Neufeld
Responsible authority: Water- and Shipping Authority Bremerhaven (WSA Bremerhaven)
Costs: 450.000 €
Cost Category: 250.000 – 1.000.000 €
Picture/Map:

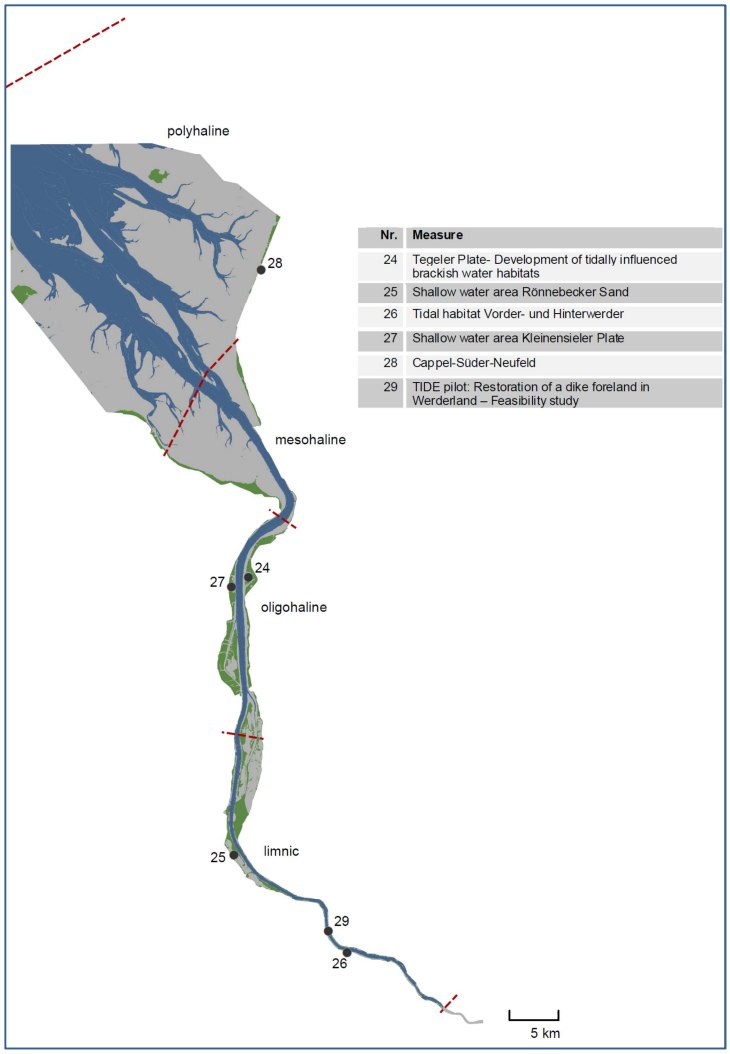

Figure 1: Location of compensation measure 28: ‚Cappel-Süder-Neufeld‘

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1.1 Measure description

The measure 'Cappel-Süder-Neufeld' was realized as a compensation measure after national environmental law for the outer Weser deepening (chart datum -14 m) which was executed in 1998 and 1999. It was designed to compensate considerable impacts on vegetation, avifauna and aquatic fauna in the outer Weser estuary.
The 27 ha project area is located in the summer polder Cappel-Süder-Neufeld north of Dorumer Neufeld at the Wurster coast (Figure 2). Extensive use was established. As a result, the grazing density was decreased and mechanical activities during the breeding time of grassland birds were stopped.
In the northern part of the project area, ditch banks were flattened (Figure 3) and a small standing water body was deepened. In the south of the project area, the summer dike was partly removed and two small standing water bodies were created. The drainage sluice within the summer dike was rebuilt in order to allow a controlled salt water inflow to the ditch system. As a consequence, new habitats for mudflat fauna were developed.

Figure 2: Aerial photographs of project area (source: WSA Bremerhaven, http://www.wsa-bremerhaven.de/weserausbauten/14m_Ausbau/kompensation/cappel_sueder_neufeld/index.html)

Figure 3: Flattened ditch bank (left) and Salicornia colonizing a new ditch bank (source: WSA Bremerhaven, http://www.wsa-bremerhaven.de/weserausbauten/14m_Ausbau/kompensation/cappel_sueder_neufeld/index.html)

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1.2 Monitoring

The monitoring program ran from 1998 to 2007 and included the following aspects:

- Vegetation
- Breeding birds
- Electrical conductivity measurements

1.3 Monitoring results

In order to document the vegetation and breeding bird development, several function controls were executed since 1998. The project area represents one of the most valuable breeding sites for birds at the Wurster coast. As expected, salt marsh vegetation developed along the ditches and within the diked-out areas. The salt water influence on the project area was documented by electrical conductivity measurements.

Breeding birds

According to inventories of 2004, Eurasian Skylark (*Alauda arvensis*), Common Redshank (*Tringa totanus*) and Northern Lapwing (*Vanellus vanellus*) represent the dominant breeding bird species on the project area (KÜFOG 2004). Referring to the Red List of Lower Saxony and Bremen, all these species are endangered grassland birds (SÜDBECK & WENDT 2002).

Between 1998 and 2004, the population of Eurasian Skylark and Common Redshank increased significantly on the project area, while the populations of Northern Lapwing (*Vanellus vanellus*) and Oystercatcher (*Haematopus ostralegus*) slightly decreased. Behind the background of generally shrinking grassland bird populations in northwestern Germany (NEHLS ET AL. 2001, SÜDBECK & WENDT 2002, SEITZ 2001), it is likely that the increase of population size can be ascribed to the effects of the compensation measure: Extensive grassland use creates a varied, small scale mosaic of vegetation and soil structure offering suitable breeding grounds for wading birds. According to WILMS ET AL. (1997), the project area is assigned as important breeding bird site for the federal state of Lower Saxony.

The stagnating or decreasing development of breeding bird population on the project area between 2001 and 2004 is possibly due to relatively strong dehydration of the project area during spring time. Therefore, the area irrigation depending on the tides is to be improved. Currently, irrigation hardly contributes to soil moisture or to the establishment of shallow water zones on the project area. The ditch water level in the southern part of the project area sank during spring about 30 cm compared to the starting value. After high precipitation or flooding events, water covered areas remain due to the small standing waters and dams created in the northern part of the project area. This enhances the attractiveness of the area as breeding and resting habitat for coastal birds.

According to observations in 2004, a decline of breeding success regarding Common Redshank compared to the situation in 2001 can be stated, while the low breeding success of Northern Lapwing observed in 2001 can be confirmed. For a reliable statement on the breeding success, systematical breeding success controls would be necessary.

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Vegetation

First vegetation inventories showed that rare and worth protecting species like Pond water crowfoot *(Ranunculus peltatus)*, Marsh arrowgrass *(Triglochin palustris)* and Caraway *(Carum carvi)* are already in place and can be promoted by the compensation measures (KÜVER 2004).

In 2007 (Figure 4), the following positive developments in terms of the development targets were stated:

- The plant community *Puccinellietum maritimae* spread on the outer dike areas of the project area and hints at increasing salt influence.
- According to KÜVER 2004, the flattened ditch banks in the diked-out areas of the project area were settled with patchy salt pioneer vegetation, which presumably developed further to a dense plant community (*Plantagini-Limonietum vulgaris*) with a high percentage of perennial vegetation and dwarf-shrubs (BIOS 2007).
- Within the summer polder, water storage led to extensive inundation and salinization of the rich pastureland. Significant is the increasing distribution of the scarcely vegetated small standing waters with *Puccinellietum distantis* communities in front of the dike.
- The population size of halophytes remained stable or increased. The core area of distribution is situated in the southwestern part of the outer dike area and spreads to the northern summer polder along ditch and creek banks.
- According to investigations in 2007, *Cirsium arvense* is not as dominant in rich pastureland as observed in 2004. Presumably, this development is a result of maintenance mowing practiced in the meantime or/and of increased salt influence.

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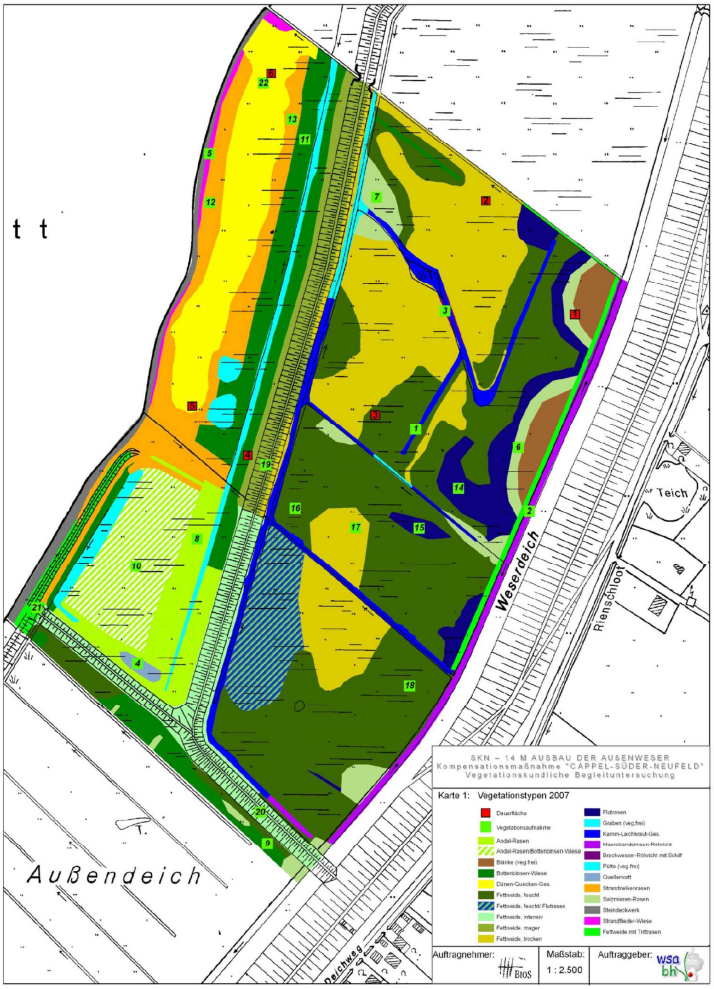

Figure 4: Structure diversity on the project area in 2007 (BIOS 2007)

Part 2: Execution of main effectiveness criteria

2.1 Effectiveness according to development targets of measure

-Step 1: Definition of development targets

The compensation measure 'Cappel-Süder-Neufeld' aimed at promoting close-to-nature vegetation development and at establishing breeding birds of salt marshes and reeds.

-Step 2: Degree of target achievement

As a result of the measure implementation, the breeding bird population on the project area is labeled as important for the federal state of Lower Saxony. Salt marsh vegetation developed as expected along the ditches and within the diked-out area. The degree of target achievement can be considered as high.

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2.2 Impact on ecosystem services

The measure 'Cappel-Süder-Neufeld' in the polyhaline zone of the Weser estuary was about the creation of estuarine habitats by transforming adjacent land into mainly marshland connected with a very high change in the habitat quality (Figure 5). 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 several regulating services (erosion and sedimentation regulation by water bodies, water quantity regulation: reduction of excess loads coming from the catchment, erosion and sedimentation regulation by biological mediation, water quantity regulation: landscape maintenance, climate regulation: carbon sequestration and burial). The expected impact on the development targets ('biodiversity') is very positive. The expected impact for the different beneficiary groups is overall positive, with a very positive expected impact for indirect and future use and for local use (Table 1).

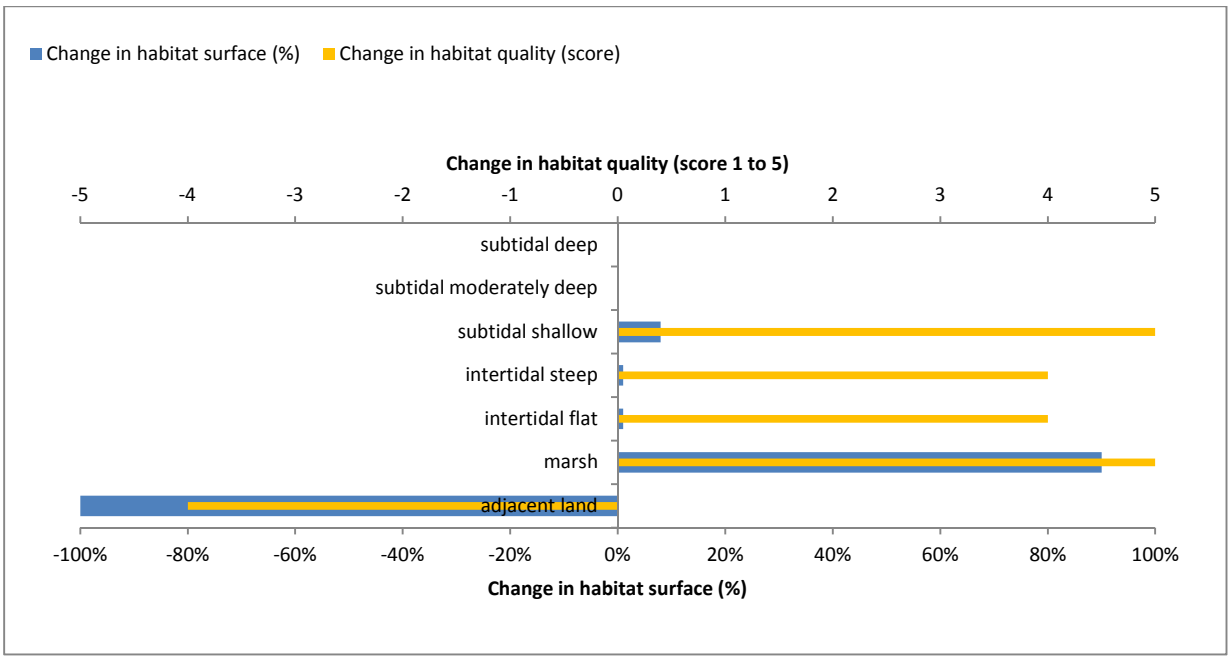

Figure 5: Ecosystem services analysis for measure 'Cappel-Süder-Neufeld': Indication of habitat surface and quality change, i.e. situation before versus after measure implementation

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Table 1: Ecosystem services analysis for measure 'Cappel-Süder-Neufeld': (1) expected impact on ES supply in the measure site and (2) expected impact on different beneficiaries as a consequence of the measure

Cappel-Süder-Neufeld

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	3
R3	Water quality regulation: transport of polutants and excess nutriënts	1
R4	Water quantity regulation: drainage of river water	0
R5	Erosion and sedimentation regulation by biological mediation	3
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	1
R10	Regulation extreme events or disturbance: Wave reduction	2
R11	Regulation extreme events or disturbance: Water current reduction	1
R12	Regulation extreme events or disturbance: Flood water storage	1
P1	Water for industrial use	0
P2	Water for navigation	0
P3	Food: Animals	0
C1	Aesthetic information	3
C2	Inspiration for culture, art and design	3
C3	Information for cognitive development	3
C4	Opportunities for recreation & tourism	3

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

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

Before measure implementation, the project area was agriculturally used as pasture with a stocking density of 3 to 4 cattle per hectare. Between 1996 and 1998, 500 to 620 kg nitrogen fertilizer per hectare was spread. In 2000, extensive agricultural use was established. As a consequence of measure implementation, the project area is no longer available for intensive agricultural use.

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 'Cappel-Süder-Neufeld' was not designed to meet the requirements of the Water Framework Directive (WFD). However, it covers two of six main pressures the polyhaline zone of the Weser estuary is affected by (Table 2).

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Table 2: Effects of compensation measure ‚Cappel-Süder-Neufeld' on main pressures of the polyhaline zone of the Weser estuary

Indi-cator	Code	Main pressures **polyhaline** zone Weser	Effect?					Description
			- -	-	0	+	++	
S.I.	3.1/ 3.2	Decrease of water and sediment chemical quality			X			
S.I.	-	Habitat loss and degradation during the last 100 years: Subtidal				X		Ditches were flattened and small standing waters were deepened or newly created. The connection to the river is given directly or by means of a sluice in the summer dike.
S.I.	1.1	Habitat loss and degradation during the last 100 years: Intertidal					X	New intertidal habitats like salt marshes were created.
D.I.	1.7	Relative Sea Level Rise			X			
D.I.	2.3	Discharge of nutrients and/or harmful substances				X		The use of plant protection products and fertilizer is forbidden. This is the case for all state-owed areas leased to farmers by the Federal Water and Shipping Administration.
D.I.	2.6	Capital dredging			X			

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

3.2 Degree of synergistic effects according to Natura 2000 aims

The project area of the compensation measure 'Cappel-Süder-Neufeld' is located in Special Protection Areas (SPAs) after the Habitat and the Birds Directive (Site name HD: Nationalpark Niedersächsisches Wattenmeer; site code: DE 2306-301/ Site name BD: Niedersächsisches Wattenmeer und angrenzendes Küstenmeer; site code: DE 2210-401). According to the Integrated Management Plan Weser (IBP Weser), the project area is assigned to operational area 1. 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 1 (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 spatial units

Table 3: Natura 2000-objectives with specifications for operational area 1 (source: simplified after NLWKN, SUBV 2012)

Operational area 1: Meso-/polyhaline zone in the outer Weser (Weser-km 65 - 85)				
Specifications for operational area 1	**Effect of measure 28 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				
Conservation and development of typical habitats of operational area 1 (e.g. mudflats, reed, salt marshes, extensively used and salt- influenced grasslands) in a dimension, spatial distribution and interconnection ensuring long-term appearance of typical species	++			Typical habitats of operational area 1 were developed (e.g. salt marshes, mudflats, reeds).

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Development, enlargement and upgrade of shallow water zones with moderate current climate (e.g. Wurster Arm)		0		
Development of passable shore structures	+			The passability of shore structures was improved by partially removing a summer dike.
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 and development of undisturbed resting and moulting areas for migratory bird populations (high diversity, many individuals) considering all necessary functions		0		According to KÜFOG 2004, no suitability of the project area for migratory bird populations could be stated based on incidental counts. A scientifically sound statement would require 14 daily spring tide counts during tidal high water on a full-year basis.
Conservation of adequate habitat quality and undisturbed resting areas for Harbour seals (*Phoca vitulina*) in order to realise a long term stable population		0		
Conservation of adaption and feeding grounds for Twaite shads (*Alosa fallax*) and Lampreys, especially during main migration phases		0		
Development of preferential conditions for settlement of Seagrass, eulittoral and sublittoral mussel beds (*Mytilus edulis*) and Sabellaria-reefs with associated fauna		0		
Conservation of typical breeding bird communities and associated habitats (breeding birds of salt marshes, extensively used, salt- influenced grasslands and reeds)	++			According to WILMS ET AL. (1997), the project area is assigned as important breeding bird site for the federal state of Lower Saxony.
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.		0		
Preservation and development of the Weser estuary mouth as passable migration and feeding area for Harbors porpoise (*Phocoena phocoena*)		0		

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

Table 4: Natura 2000-objectives with specifications for the 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 28 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		0	
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 sublitoral	+		
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		0	
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		0	
Conservation and development of long-term viable populations of typical fish species and cyclostomata (estuarine and diadromous guilds)		0	
Reaching of favourable water quality for reproduction, larval development and viability of typical fish communities of different salinity zones		0	
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

Siltation is no considerable problem. Time after time the sluice and its self-shutting mechanism has to be cleaned up to remove some sediment or flotsam in order to keep it working. This work is made on purpose and the situation is observed based on two controls a year. This is connected with some expense, but it assures the regular delivery of data on presence of birds, activities of the farmer or state of vegetation etc.

Part 5: Literature

-NLWKN, SUBV (2012): IBP. INTEGRIERTER BEWIRTSCHAFTUNGSPLAN WESER FÜR NIEDERSACHSEN UND BREMEN 2012.

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