

MILJØKONTROLLEN	
20 APR 2004	004086
SAGS NR. 684-482101	



DELVIST SCANNET

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Attn.: Finn Bjerre

København, 19. april 2004  
Vor ref.: milj-0641-HO/pko

### Rapport om indsamling af miljødata ved udvalgte bropiller under Øresundsbron

Efter anmodning fremsendes hermed de foreløbige resultater fra Øresundsbro Konsortiets undersøgelse af udvalgte bropiller, som blev påbegyndt i 2003, og forventes afsluttet i indeværende år.

Der foreligger p.t. en delrapport, som behandler data fra 4 bropiller. Der fremsendes hermed 1 eksemplar af denne rapport "Biological sampling (E25, E15, E01 and W01)" udarbejdet af AB Dykma for Øresundsbro Konsortiet.

Endvidere vedlægges Øresundsbro Konsortiets miljøreddegørelse for 2003.

#### Øresundsbro Konsortiets sammenfatning og vurdering

Øresundsbro Konsortiet har i forbindelse med den årlige miljøreddegørelse foretaget en yderligere vurdering af de indsamlede data. Data vedrørende bevoksningens tykkelse er sammenfattet i nedenstående tabel 1 og 2.

Den gennemsnitlige tykkelse af bevoksningen er ca. 30 mm, i den øverste meter under overfladen dog kun ca. 15 mm. Øverst, i bølgezonen, domineres bevoksningen af grønalger, som et stykke under overfladen afløses af en kombination af rødalger, blåmuslinger, rurer og krebsdyr.

BEVOKSNING TYKKELSE (mm)		Dybde (m)		I ALT
		< 1	> 1	
Pylon	W01	7,00 ± 6,89	27,31 ± 17,66	17,16 ± 16,66
	E01	5,15 ± 3,22	23,65 ± 16,93	14,40 ± 15,16
	E15	15,25 ± 4,64	37,49 ± 13,02	33,78 ± 14,63
	E25	33,96 ± 13,66	31,82 ± 26,09	32,18 ± 24,35
I ALT		15,34 ± 13,94	33,13 ± 20,30	28,68 ± 20,38

Tabel 1 Bevoksningens tykkelse i mm ved de enkelte fundamenter

På baggrund af disse data og målingerne af biomasse er det skønnet, at den samlede overflade af bropiller og pyloner rummer en biomasse af blåmuslinger på ca. 70 tons. Der er overvejende tale om små muslinger hvor længden sjældent overskrider 15 mm. Dog er der en tendens til at muslingerne bliver lidt

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større i Lernacken kanalen (E25), op til ca. 25-30 mm. Dette kan skyldes en mindre påvirkning af bølger og strøm i Lernacken kanalen.

Bevoksningen er noget mindre ved pylonerne end ved de bropiller, der står længere mod Lernacken (tabel 1). Forskellen er især tydelig i den øverste meter, hvilket indikerer, at den mindre bevoksning i den centrale del af Flintenden skyldes en større stresspåvirkning af bølger og strøm.

BEVOKSNING TYKKELSE (mm)		Dybde (m)		I ALT
		< 1	> 1	
Retning	NW	8,14 ± 8,29	25,63 ± 16,99	21,88 ± 17,05
	W	15,29 ± 16,03	38,33 ± 20,74	32,57 ± 21,91
	SE	12,64 ± 7,14	38,47 ± 25,61	32,93 ± 25,22
	E	15,48 ± 13,50	30,73 ± 7,14	26,92 ± 16,06
I ALT		15,34 ± 13,94	33,13 ± 20,30	28,68 ± 20,38

**Tabel 2** Bevoksningens tykkelse i mm på forskellige sider (retning) af fundamenterne

Der er en tendens til, at bevoksningen på nordvest siden af pylonerne er tyndere end på de øvrige sider, især i den øverste m under overfladen. Det formodes, at dette kan skyldes en kombination af belysning, strøm- og bølgeforhold samt eventuelt fouragering på bevoksningen.

Endelig skal det bemærkes, at bevoksningen ikke er jævn. På alle pyloner og overflader er der en mosaik af bare pletter uden bevoksning, som typisk udgør 15-25 % af arealet. Dette kunne indikere en dynamik i bevoksningen, således at denne jævnlige fjernes lokalt, og herefter afløses af ny bevoksning.

#### Afslutning


Undersøgelserne af pylonerne fortsættes og afsluttes i 2004, således som det fremgår af Dykmas rapport.

Udover selve rapporten og ovenstående vurderinger foreligger der videooptagelser fra de undersøgte pyloner. Såfremt disse vurderes af relevans, kan de rekvireres hos undertegnede. Eventuelle bemærkninger og kommentarer til rapporten eller ovenstående i øvrigt er meget velkomne.

Vi vil fremover være opmærksomme på at fremsende rapporter om undersøgelser i Øresunds vandmiljø til Øresundsvandsamarbejdet.

Med venlig hilsen  
Øresundsbro Konsortiet

Hans Ohrt  
Miljøkoordinator



Bilag: Dykma rapport, miljøredegørelse

Dato: 19. april 2004  
Ref: miljø-0641-HO/pko

**Biological Sampling**  
**(E25, E15, E01 and W01)**

**REPORT**

**For**

**ØRESUNDSBRON**

## Biological Sampling (E25, E15, E01 and W01)

**REPORT No. : ÖSB-4215-009-BS-01**

**CLIENT : ØRESUNDSBRON  
Vester Søgade 10  
1601 København V  
Danmark**

01	09-01-04	Complementary Info	K. Edmonds	C. Ingers	K. Andersson
00	19-11-03	Inspections 2003	K. Edmonds	C. Ingers	K. Andersson
No Revision	Date	Note	Prepared by	Checked by	Approved by

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## SUMMARY

A number of diving surveys combining biological sampling and measurements have been carried out on selected bridge piers E25, E15, E01 and W01 respectively in connection with the undervatten inspektioner av Øresundsbron anläggningar.

The work was carried out for Øresundsbron.

The fieldwork was carried out during the period 12<sup>th</sup> August, 2003 to 2<sup>nd</sup> October, 2003 and comprised diving inspections covering different sides of the respective piers measuring the organic growth and taking occasional representative samples in –order to classify the growth along with underwater video filming.

The classifications and report was carried out by our sub-consultant Dykoptic MiljöSyn AB.

On completion of the fieldwork a factual report was compiled based on the information gained during the fieldwork.

## 1. INTRODUCTION

At the request of Øresundsbron a number of diving inspections combined with biological sampling and measurements of selected bridge piers have been carried out in connection with the undervatten inspektioner av Øresundsbron anläggningar.

The purpose of the diving inspections was to inspect and measure the organic growth and take occasional representative samples in order to classify the growth along with underwater video filming.

The fieldwork comprised:

Date	Sted	Dybder (m)	Retninger	Variable		Prøver			
				Måling af tykkelse	Video	Antal i alt	Biomasse	Artsammensætning	Størrelsesfordeling muslinger
to be carried out in 2004	Pylon E, sydlige ben	3 (bund)	N,S	x	x	2	x	x	x
to be carried out in 2004		3 (bund)	Ø,V	x	x				
to be carried out in 2004		1	N,S,Ø,V	x	x				
to be carried out in 2004	Pylon E, nordlige ben	3 (bund)	N,S	x	x	2	x	x	x
to be carried out in 2004		1	N,S	x	x				
to be carried out in 2004	Pylon W, nordlige ben	3(bund)	N,S,Ø,V	x	x				
to be carried out in 2004		1	N,S	x	x				
<b>2003-08-12</b>	<b>Bropille E25</b>	<b>3</b>	<b>N,S</b>	<b>x</b>	<b>x</b>	<b>2</b>	<b>x</b>	<b>x</b>	<b>x</b>
<b>2003-08-12</b>		<b>3</b>	<b>Ø,V</b>	<b>x</b>	<b>x</b>				
<b>2003-08-12</b>		<b>1+5 (bund)</b>	<b>N,S,Ø,V</b>	<b>x</b>	<b>x</b>				
to be carried out in 2004	Bropille E22	3	N,S,Ø,V	x	x	4	x	x	x
to be carried out in 2004		1+5	N,S,Ø,V	x	x				
<b>2003-08-12</b>	<b>Bropille E15</b>	<b>3</b>	<b>N,S</b>	<b>x</b>	<b>x</b>	<b>2</b>	<b>x</b>	<b>x</b>	<b>x</b>
<b>2003-09-01</b>		<b>3</b>	<b>Ø,V</b>	<b>x</b>	<b>x</b>				
<b>2003-09-01</b>		<b>1+5</b>	<b>N,S,Ø,V</b>	<b>x</b>	<b>x</b>				
to be carried out in 2004	Bropille E8	1+3+5+7	N,S	x	x	8	x	x	x
to be carried out in 2004		1+3+5+7	Ø,V	x	x				
<b>2003-10-01</b>	<b>Bropille E1</b>	<b>1(bund)</b>	<b>N,S,Ø,V</b>	<b>x</b>	<b>x</b>				
<b>2003-10-02</b>	<b>Bropille W1</b>	<b>1(bund)</b>	<b>N,S,Ø,V</b>	<b>x</b>	<b>x</b>				
to be carried out in 2004	Bropille W10	1+3+5+7(bund)	N,S	x	x	8	x	x	x
to be carried out in 2004		1+3+5+7(bund)	Ø,V	x	x				
to be carried out in 2004	Bropille W22	3	N,S	x	x	2	x	x	x
to be carried out in 2004		3	Ø,V	x	x				
to be carried out in 2004		1+5(bund)	N,S,Ø,V	x	x				

Reference document:

Note: from OMK 2003-06-13 program for indsamling af miljødata

This report presents the results of the fieldwork obtained during the inspections. It presents descriptions of the techniques and procedures undertaken.

A factual report only was requested.

## 2. DESCRIPTION OF THE SITE

The sites (Approach Bridges and high Bridge) are located in the Öresund between Denmark and Sweden.

## 3. FIELDWORK

### 3.1 General

The fieldwork was carried out during the period 12<sup>th</sup> August, 2003 to 2<sup>nd</sup> October, 2003. All site operations were directed by a Dykma site manager based on site along with our subconsultant from Dykoptic Miljösyn AB.

The horizontal and vertical control is related to DKS.

### 3.2 Primary Survey Vessel (M/S Frida)

The primary vessel for the works was Dykma's flat-bottomed vessel Frida.

The vessel was chosen for the works due to its large deck space and quick anchoring system further information on the vessel see Appendix 1.

## 4. RESULTS

### 4.1 General

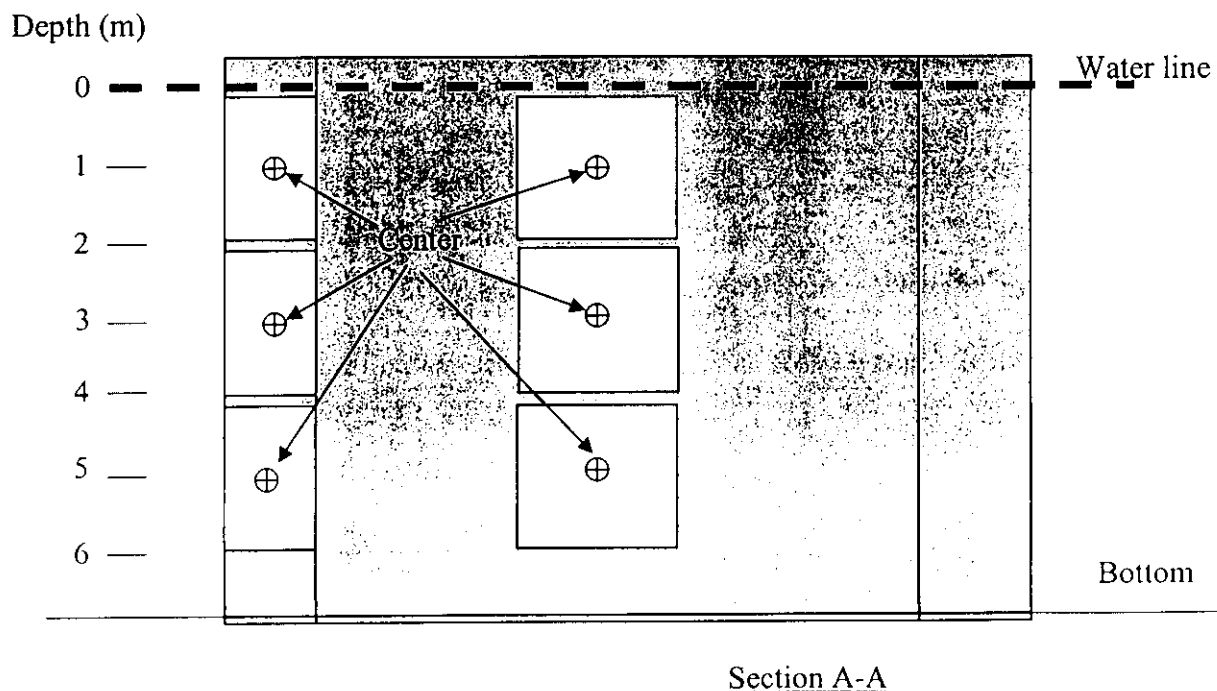
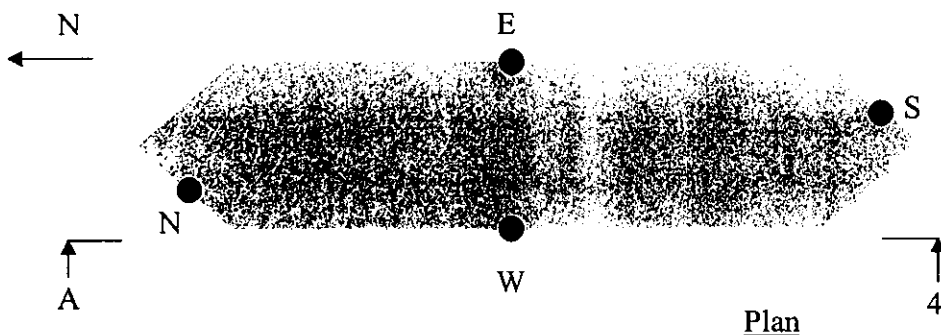
In general the visibility in the water was acceptable therefore allowing good coverage.

For the report of the findings see Appendix 2 prepared by Dykoptiv MiljöSyn AB.

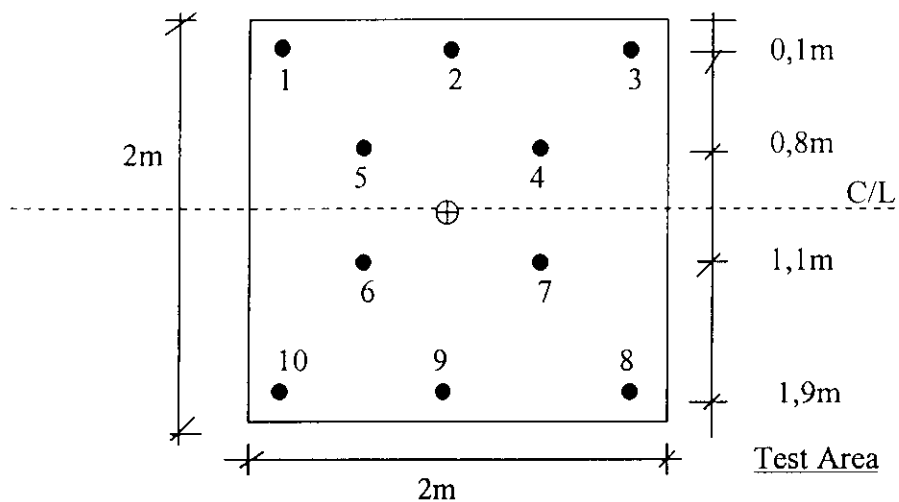
### 4.2 Method for Thickness Measurements

Before any measurements were taken a 2m x 2m area was marked out from the centre of the specified position by a diver.

The specified position was located in the middle of the pier's vertical face i.e. N, S, W or E and at the depth's specified by ÖSB's instruction dated 13<sup>th</sup> June 2003. (See below).

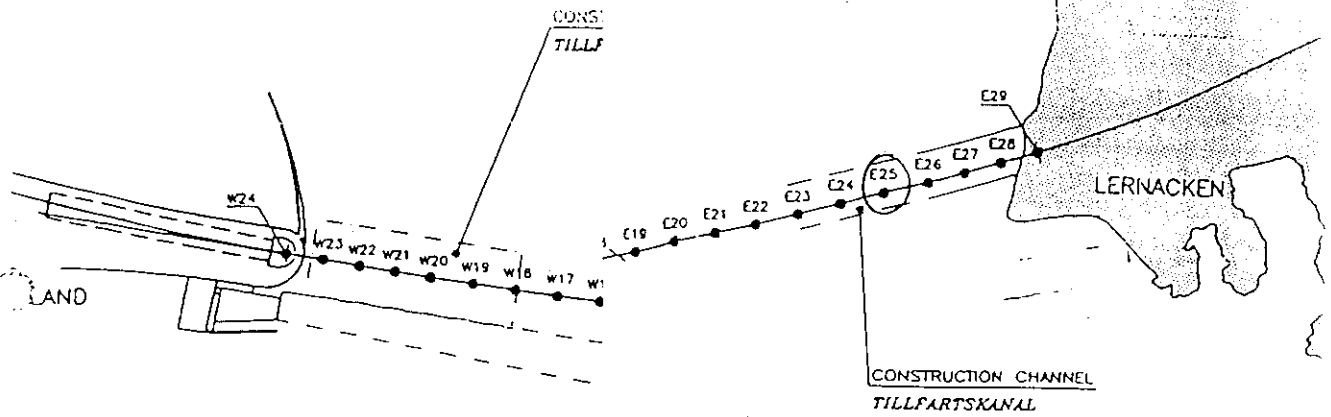


Each sampling area was representatively measured at 10 points evenly distributed across the entire sampling area to determine a mean value. The measurements were taken using a measuring stick of the thickness of the unsuspended organic material in chronological order. (See diagram below) The results were presented in the report table 4 in descending chronological order i.e.(1,2,3,4 etc.).



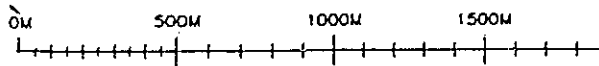
## REFERENCES

Note: from OMK 2003-06-13 program for indsamling af miljødata



cal Sampling

PLAN  
1:12500 (A1)



001

WGS84 COORDINATES FOR PIERS AND

Pier No.	Northing	Easting	Easting
EABT	55 35,35	12 46,58	12 52,02
W23	55 35,32	12 46,68	12 52,15
W22	55 35,28	12 46,78	12 52,28
W21	55 35,25	12 46,87	12 52,41
W20	55 35,21	12 46,97	12 52,54
W19	55 35,17	12 47,09	12 52,68
W18	55 35,14	12 47,20	12 52,81
W17	55 35,10	12 47,32	12 52,94
W16	55 35,06	12 47,43	12 53,07
W15	55 35,03	12 47,55	12 53,21
W14	55 34,99	12 47,67	12 53,32
W13	55 34,96	12 47,79	12 53,43
W12	55 34,92	12 47,91	12 53,55
W11	55 34,89	12 48,03	

NOTES

1. ALL DIMENSIONS ARE IN METRES.
2. COORDINATES ON SEPARATE SHEETS.
3. SWEDISH TEXT IN ITALIC.

Original Drawing Sheet Size - A1

1	LERNACKER CONSTRUCTION CHANNEL	NEW	JC	KF
Rev.	Description	By	Checked	Approved

**THE ØRESUND L**

ØRESUND  
KONSORTIET

ASO G

DEFINITION DRAWINGS - TYPE B BRIDGE  
BRIDGES CONTRACT  
POSITION OF PIERS

Drawn	SAH	Checked	NEW	Drawn by	JC	Approved	
Date	1996-01-11	Scale		Sheet No.	0-14-033		

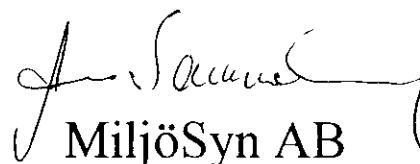
## APPENDIX 2

### REPORT OF FINDINGS

(Prepare by Sub-consultant Dykoptic MiljöSyn AB)



**Report**  
**Sampling of environmental data**  
**Öresundsbron**  
**Autumn 2003**



**MiljöSyn AB**

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## 1 Conclusions

The plants (algae) show a typical stratification with the green algae close to the water surface and below brown algae are sometimes found. Below the green (and brown) algae, red algae are dominating.

The two animal species dominating on the pier surfaces: Common mussels (*Mytilus edulis*) and barnacles (*Balanus improvisus*). There are other species hiding among the mussels, especially different species of amphipoda and isopoda (crustaceans). The organic content is very high, especially on the south east sides of the piers.

## 2 Introduction

### 2.1 Background

Before the Öresundsförbindelsen was built, an Environmental Impact Assessment was performed. The Environmental Court (Vattendomstolen) judgement stated that assessments of the marine environment should be done not only before and when the construction was ongoing but also when it was finished.

### 2.2 Aim of research

As part of the control-programme for evaluation of the environmental effects of the Öresundsförbindelsen on the underwater environment, biological sampling as well as video recordings on some of the bridge piers have been performed during the period August to October 2003.

## 3 Material and methods

### 3:1 Sampling

The biological sampling was done 12<sup>th</sup> August 2003.

First a diver made 10 measurements on each sampling place and the thickness of the epiflora- and fauna was recorded. The diver took 1 sample 15 cm x 15 cm from the depth of 3 m on pier E 15 south east and north west and on pier E 25 south east and north west by using a special knife and collected the material in a previously marked plastic bag. The samples were preserved in alcohol for later analysis in the lab.

Video recordings were carried out on the piers E 1, E 15, E 25 and W 1. These recordings were performed on 3<sup>rd</sup> September 2003 (E 15), 1<sup>st</sup> October 2003 (E 1) and 2<sup>nd</sup> October 2003 (W 1).

### 3:2 Work up

In the laboratory the species of plants and animals were analysed under microscope. The organic content was estimated by using a Mettler AC 100 after pressing the wet algae between two filter-papers for ten seconds and weighing.

The animals were dried for a moment against a filter-paper before the weighing, the mussels with their shells.

The mussels were all measured and their length was noted.

The video recordings were analysed regarding degree of cover and as far as possible the species were analysed and noted.

### 3:3 Reporting

All figures are available in the following tables

Table 1	Species found on pillar E 15 and E 25
Table 2	Organic content from sampling on pillar E 15 and E 25
Table 3	Measurements of mussels on pillar E 15 and E 25
Table 4	Measurements of thickness, all piers
Table 5	Reporting from video recordings

## 4 Results

### 4:1 Bio-sampling

The plants show typical stratification with the green seaweeds close to the water surface. Below there are red seaweeds and sometimes spots with brown algae.

Common mussels (*Mytilus edulis*) dominate all surfaces, but sometimes barnacles (*Balanus improvisus*) can be found directly on the concrete surface, however most times they are growing on the mussels as well as the seaweeds do.

As there is just one sample from each site, no statistical evaluation can be done.

### **E 15, SE -3 m**

There are few red seaweeds of the genus *Polysiphonia* found, Table 1. Even if they cover the surface up to 5 %, their organic content is low as compared to the mussels and the barnacles. Table 2.

Common mussels dominate on the surface (90 %) and on the concrete as well as on the mussels, and on 20 % of the surface barnacles can be seen. Among other animals found, the crustaceans dominates. In total 9 animal species were found, Table 1.

The thickness of epi-flora / epi-fauna has a mean of 62,5 mm (55mm – 75mm), Table 4:E15, and the organic content is very high, 15, 8 kg per square meter.

The total number of Common mussels are about 43 000 per m<sup>2</sup>. Almost 60 % of the Common mussels measured are less then 10 mm and about 6 % are bigger then 31 mm, one as big as 54 mm, Table 3.

### **E 15, NW -3 m**

Only single plant species *Ceramium strictum* was found.

Also here the common mussels dominate the surface (80 %) and on 25 % of the surface barnacles can be seen. In total 8 animal species were found, mainly crustaceans, Table 1.

The thickness measurements range between 30 mm and 65 mm with a mean of 50,5 mm, Table 4:E15.

The organic content is high, 7,7 kg per square meter, Table 2.

64 % of the Common mussels are small, less the 10 mm, and below 5 % are bigger then 31 mm.

### **E 25, SE -3 m**

One single plant of the green seaweed *Chaetomorpha* was found. It is filamentous and consists of a single row of cells. The surface is almost totally covered (90 %) of the red seaweed *Polysiphonia*.

As the red seaweed covered so much of the surface, it is hard to evaluate how much of the surface is covered by other species, but barnacles and Common mussels covers about 25 % each. 9 species of animals was found, see Table 1.

The organic content is 2, 4 kg per m<sup>2</sup> and the thickness measurements shows a mean of 7, 5 mm (range 2,5 mm to 17,5 mm).

80 % of the Common mussels have a size less then 10 mm and no one are bigger then 35 mm, see Table 3.

The organic content is 2,4 kg /m<sup>2</sup>.

### **E 25, NW -3 m**

Red seaweed was represented by *Gracilaria tikvahiae* and *Gracilaria lemaneiformis* covering about 50 percent of the surface. Common mussels and barnacles covered approximately 40 % each. 9 animal species were found.

The result of thickness measurements has a mean of 12 mm (2,5 mm – 27,5 mm) and the organic content is “low”, 1,2 kg per square meter.

The Common mussels are rather small, 78 % are up to 10 mm and no one is bigger than 30 mm (Table 3).

### **4:2 Video sampling**

In general the underwater visibility was not of excellent quality therefore from the screen it is impossible to evaluate accurately the species or even genus on Piers E1 and W1, sometimes it was not even possible to see if the seaweed is red, brown or even green. From most of the sites, there is no overview picture, which makes it hard to estimate how much the species covers.

### **E1**

Green seaweeds are seen along the waterline and cover about 10 %. There are spots of algae which looks brown on the E and SE side below the green and mixed with red which covers between 25% (NW) and 75 % (SE).

Common mussels cover from 90 % to 100 %. Barnacles are seen, but cover at most 5 %.

### **E15**

Also here the green seaweeds are seen close to the surface and cover from 10 % to 20 %. The red seaweeds are seen almost all the way to the bottom at 5 m, even there are just single specimens. In NW 75 % is covered, but on the other sides 5 % to 25 % are covered by the red seaweed. The Common mussels cover between 80 % to 90 % of the surfaces except the SE -1 m, where they just cover 10 % and the barnacles cover 95 %. On all other surfaces the barnacles cover from 10 % to 20 %.

### **E25**

In the recordings from E 25, there are no comments in which order the sides were carried out (except SE -3 m and NW -3 m). Estimations are performed and the site on the tape is noted, see Table 5:E25

The thickness of cover was noted and is shown in Table 4.

### **W 1**

Green seaweeds cover 10% on all sides but the NW where they cover 25 %. The red seaweeds cover 25 to 40 %.

In E and SE 90 to 95 % are covered by Common mussels and 5 % by barnacles, and in W and NW 60% respectively 40 % are cover by the Common mussels and only single specimens of barnacles are found.

## 5 Reference literature

Dickinson, Carola I.: British Seaweeds, Eyre & Spottiswoode 1963

Hayward, P. J & Ryland, J. S.: Handbook of the Marine Fauna of North-West Europe, Oxford 1995.

Kristiansen, Aase & Svedberg, Ulf: Havets växter, Prisma 2001

## 6 Enclosures

Table 1	Species found on pillar E 15 and E 25
Table 2	Organic content from sampling on pillar E 15 and E 25
Table 3	Measurements of mussels on pillar E 15 and E 25
Table 4	Measurements of thickness, all piers
Table 5	Reporting from video recordings

	E 25 SE	E 25 NW	E 15 SE	E 15 NW
<b>ALGAE</b>				
<b>Green</b>				
<i>Chaetomorpha spp</i>	x			
<b>Red</b>				
<i>Polysiphonia spp</i>	x	x	x	
<i>Ceramium rubrum</i>		x		
<i>Ceramium strictum</i>			x	x
<b>FAUNA</b>				
<b><u>TURBELLARIA</u></b>				
<i>Turbellaria spp</i>	x	x	x	x
<b><u>CRUSTACEA</u></b>				
<b>AMPHIPODA</b>				
<i>Gammarus spp</i>	x	x	x	x
<i>Amphitoe rubricata</i>	x	x	x	x
<i>Meiita palmata</i>			x	x
<b>ISOPODA</b>				
<i>Isoera albifrons</i>	x	x	x	x
<b>CIRRIPEDA</b>				
<i>Balanus improvisus</i>	x	x	x	x
<b><u>MOLLUSCA</u></b>				
<b>GASTROPODA</b>				
<i>Theodoxus fluviatilis</i>	x		x	
<i>Littorina saxatilis</i>	x	x		
<b>BIVALVIA</b>				
<i>Mytilus edulis</i>	x	x	x	x
<b>BRYOZOA</b>				
<i>Bryozoa spp</i>	x	x	x	x

Table 2

Organic content from sampling 2003-08-12

	E 25 SE	E 25 NW	E 15 SE	E 15 NW
Algae (g)	4,02	3,85	1,05	0,45
Animals (g)	50,59	24,93	355,25	174,6
Total (g)	54,61	28,78	356,3	175,05
g/m <sup>2</sup>	2427,087	1279,098	15835,4	7779,922

Table 3

## Measurements of Mytilus from sampling 2003-08-12

mm	E 25 SE		E 25 NW		E 15 SE		E 15 NW	
	Number	%	Number	%	Number	%	Number	%
1 - 5	93	47,69	112	64,00	270	27,81	90	33,33
6 - 10	63	32,31	24	13,71	299	30,79	84	31,11
11 - 15	21	10,77	33	18,86	154	15,86	35	12,96
16 - 20	2	1,03	1	0,57	91	9,37	27	10,00
21 - 25	3	1,54	1	0,57	59	6,08	12	4,44
26 - 30	8	4,10	4	2,29	33	3,40	10	3,70
31 - 35	5	2,56			35	3,60	4	1,48
36 - 40					21	2,16	4	1,48
41 - 45					7	0,72	4	1,48
46 - 50					1	0,10		
51 - 55					1	0,10		
Sum	195		175		971		270	

Measurements of thickness  
 E 01 Sampling date: 2003-10-01

Table 4.E1

Position	NW	W	SE	E
Depth	5	3	16	5
1 m	5	2	16	5
	2	5	5	5
	2	5	5	3
	2	1	5	10
	2	50	5	5
	10	35	5	35
	1	60	15	40
	1	60	10	25
	35	30	30	40
Mean	6,5	25,1	11,2	17,3
Uncovered area:	25%	5%	5%	15%
Seaweeds	25%	40%	60%	30%
Green alg:	25%	10%	25%	10%
Animals	90%	100%	90%	100%
Mytilus	Singel	Singel	Singel	Singel
Balanus				

Common mussel: *Mytilus edulis*  
 Barnacles: *Balanus* sp

Measurements of thickness  
 E 15 Sampling date: see under depth

Table 4.E15

Position	NW	W	SE	E
Depth		Depth	Depth	Depth
1 m	20	1 m	1 m	1 m
2003-09-01	20	2003-09-03	2003-09-03	2003-09-03
	20	17,5	20	15
	15	15	7	10
	20	15	7	10
	20	35	20	30
	17,5	40	15	25
	35	35	25	30
	15	30	40	30
	15	35	45	25
Mean	19,75	25,75	21,9	20,5
Uncovered area:	25%	25%	25%	15%
Seaweeds				
Red algae	60%	40%	20%	40%
Green algae	25%	10%	20%	20%
Brown algae			10%	
Animals				
Mytilus	80%	95%	20%	80%
Balanus	10%	20%	90%	20%

Common mussel: *Mytilus edulis*  
 Barnacles: *Balanus* sp

Measurements of thickness  
 E 15 Sampling date: see under depth

Table 4:E15

Position	NW	W	SE	E
Depth	(mm)	Depth	Depth	Depth
		3 m	3 m	3 m
2003-08-12	65	2003-09-03	2003-08-12	2003-09-03
	35			
	40			
	30			
	35			
	55			
	30			
	35			
	45			
	40			
Mean	50,5		62,5	29
Uncovered area:	15%	15%	15%	15%
Seaweeds	Red algae	5%	Singel	50%
	Green algae	0%		0%
Animals	Mytilus	90%		90%
	Balanus	25%		20%

Common mussel: Mytilus edulis  
 Barnacles: Balanus sp



Measurements of thickness  
 E 25 Sampling date: 2003-08-12

Table 4 E25

Position	N	W	S	E
Depth 1 m	(mm)	Depth 1 m	Depth 1 m	Depth 1 m
	(mm)	(mm)	(mm)	(mm)
	25	55	35	35
	15	45	25	25
	25	30	25	55
	5	35	55	35
	20	35	60	35
	15	20	45	35
	10	35	25	10
	5	25	45	55
	5	20	80	85
Mean	20	55	40	75
	14,5	35,5	43,5	44,5
Uncovered area	20%	15%	15%	15%

Measurements of thickness  
 E.25 Sampling date: 2003-08-12

Table 4: E25

Position	NW	W	SE	E
Depth	3	3 m	3 m	3 m
	(mm)	(mm)	(mm)	(mm)
	10	45	10	25
	12,5	35	10	50
	7,5	45	10	100
	2,5	75	5	65
	7,5	65	17,5	35
	27,5	15	7,5	0
	12,5	15	2,5	15
	10	55	5	25
	20	110	5	0
	10	95	2,5	75
Mean	12	55,5	7,5	39

Uncovered area: 15%

20%

15%

15%

Table 4:E25

Measurements of thickness  
 E 25 Sampling date: 2003-08-12

Position	N	W	S	E
Depth 5 m	45	75	75	0
	20	110	10	15
	0	85	0	65
	0	0	45	20
	35	0	170	5
	30	45	85	0
	10	10	0	0
	35	85	35	25
	45	5	15	45
	65	0	110	45
Mean	28,5	41,5	54,5	22
Uncovered area:	15%	15%	15%	15%

Measurements of thickness  
 W 01 Sampling date: 2003-10-02

Table 4:W1

Position	NW	W	SE	E
Depth	3	1m	Depth	Depth
1 m	4	1m	1 m	1 m
	3		(mm)	(mm)
	2		10	10
	2		10	7
	1		7	10
	1		25	5
	1		20	5
	30		45	20
	40		40	15
	50		40	40
Mean	13,6		45	40
			28,2	17,7
Seaweeds	Red algae	25%	40%	30%
	Green algae	25%	10%	10%
Animals	Mytilus	40%	90%	95%
	Balanus	Singel	5%	5%

Common mussel: *Mytilus edulis*  
 Barnacles: *Balanus* sp

Evaluation of video recordings from F 1.

Table 5:E 1

E 1, SE, surface to - 2 m

		Notes
Green algae	10 %	Close to surface
Brown	5 %	Spots
Red algae	75 %	
Mytilus	90 %	
Balanus	aprox 5 %	Singel

E 1, W, surface to - 2 m

Green algae	5 %	Close to surface
Red algae	40 %	
Mytilus	100 %	
Balanus		Singel specimens on mussels

E 1, NW, surface to - 2 m

Green algae	10 %	Close to surface
Red algae	25 %	
Mytilus	90 %	
Balanus		Singel specimens

E 1, E, surface to - 2 m

Green algae	10 %	Close to surface
Brown?		Spots
Red algae	30 %	
Mytilus	100 %	
Balanus		Singel specimens

Table 5: E 15

		Notes
E 15, NW, -1 m		
Green algae	25 %	Close to surface
Red algae	70 %	
Mytilus	80 %	
Balanus	10 %	
E 15, NW, -3 m		
Red algae		Singel plants
Mytilus	80 %	
Balanus	25 %	
E 15, NW, -5 m		
Red algae	10 %	
Mytilus	80 %	
Balanus	20 %	
E 15, E, -1 m		
Green algae	25 %	Close to surface
Red algae	40 %	
Mytilus	80 %	
Balanus	20 %	
E 15, E, -3 m		
Red algae	5 %	
Mytilus	90 %	
Balanus	20 %	
E 15, E, -5 m		
Red algae	15 %	
Mytilus	90 %	
Balanus	20 %	

Evaluation of video recordings from E 15.

Table 5:E 15

		Notes
<b>E 15, SE, -1 m</b>		
Green algae	20 %	Close to surface
Brown algae	10 %	
Red algae	25 %	
Mytilus	10 %	
Balanus	95 %	
<b>E 15, SE, -3 m</b>		
Red algae		Singel plants
Mytilus	90 %	
Balanus	20 %	
<b>E 15, SE, -5 m</b>		
Red algae	10 %	
Mytilus	85 %	
Balanus	20 %	
<b>E 15, W, -1 m</b>		
Green algae	10 %	Close to surface
Red algae	15 %	
Mytilus	90 %	
Balanus	20 %	
<b>E 15, W, -3 m</b>		
Red algae	5 %	
Mytilus	90 %	
Balanus	20 %	
<b>E 15, W, -5 m</b>		
Red algae		Singel plants
Mytilus	85 %	
Balanus	20 %	
Uncovered	10 %	

There is no voice recording on the tape, and the identified thickness measurement sites are where the biological sampling were done, SE 3 m and NW 3 m.

Find below notes from tape and place on the tape

SE 3 m			
0 - 0,11			Notes
Red algae		90 %	
Mytilus	aprox	25 %	
Balanus	aprox	25 %	
NW 3 m			
0,11 - 0,23			
Red algae		50 %	
Mytilus	aprox	40 %	
Balanus	aprox	40 %	
0,23 - 0,29			
Red algae		80 %	
Mytilus		30 %	
Balanus		30 %	
0,29 - 0,32			
Red algae		75 %	
Mytilus		20 %	
Balanus		40 %	
0,32 - 0,35			
Red algae		50 %	Bottom
Mytilus		10 %	
Balanus		50 %	
0,35 - 0,38			
Red algae		80 %	Surface
Mytilus		20 %	
Balanus		50 %	
0,39 - 0,41			Bottom
Red algae		40 %	
Mytilus		single specimens visible	
Balanus		20 %	

Table 5:F 25

0,41 – 0,44		Surface
Red algae	50 %	
Mytilus	80 %	
Balanus	10 %	
0,44 – 0,48		Bottom
Red algae?	90 %	
Mytilus	20 %	
Balanus	20 %	
0,48 – 0,50		Surface
Red algae and/or brown	50 %	
Mytilus	90 %	
Balanus	10 %	
0,50 – 0,53		Bottom
Red algae	90 %	
Mytilus	singel specimens	
Balanus	20 %	
0,53 – 0,56		Surface
Red algae, and/or brown	100 %	
Balanus	10 %	

Evaluation of video recordings from W 1.

Table 5:W 1

W 1, SE, surface to - 2 m

Green algae	10 %
Red algae	40 %
Mytilus	90 %
Balanus	5 %

Notes

W 1, W, surface to - 2 m

Green algae	10 %
Red algae	25 %
Mytilus	60 %
Balanus	

Singel specimens

W 1, NW, surface to - 2 m

Green algae	25 %
Red algae	25 %
Mytilus	40 %
Balanus	

Singel specimens

W 1, E, surface to - 2 m

Green algae	10 %
Red algae	30 %
Mytilus	95 %
Balanus	5 %

## APPENDIX 3

### DAILY REPORTS FOR FIELDWORK

# Ab Dykma

Ett företag i MarCon gruppen

# DAGRAPPORT

Datum:

2003-08-12

Beställare:

OSB

Arbetsplats:

Öresundsbron

2 mans dykarlag		Tim	Sign	OT veck	OT helg	Tid		Utförda arbeten:
Dykare	Skötare					Från	Till	
		8	ADI					
		8	MHO					
3 mans dykarlag		Tim	Sign					
Dykare						0700		Förbredda utrustning och transport till E25 från Linnhamn.
Skötare							0945	
Dykarledare						0945	1010	SE thickness measurements + Sample -3
Övrig personal						1010	1030	NW thickness measurements + Sample -3
Skeppare		8	PLE			1030	1100	Transport from E25 to E15
Däcksman						1100	1130	SE thickness + Sample -3 E15
						1130	1230	NW " " " -3 E15
						1230	1330	Lunch.
						1330	1345	W thickness -3 E25
						1345	1300	E thickness -3 E25
						1400	1410	E thickness -5 (bottom) E25
						1410	1415	E thickness -1 E25
Övriga Noteringar:						1415	1430	N thickness -1 + -5 E25
						1400	1445	W thickness -1 + -5 E25
						1445	1500	S thickness -1 + -5 E25
						1500	1600	Transport back to Linnhamn.

Extra arbeten / Ändringsdirektiv / Reviderad handling / Avvikelser m.m.

## ARBETSBEKRÄFTELSE (anmälan om dykning)

Godkänt av (kund):

Anmält av:

Fordon, Fartyg, Maskiner	Antal	Enhet	Materialer	Antal	Enhet
Fordon:		Km	Material typ:		
Fartyg: FRIDA	8	Tim	Material typ:		
Maskin typ:			Material typ:		
Maskin typ:			Övrigt typ:		
Maskin typ:			Övrigt typ:		

Ombud /Kontrollant / Beställare:

Kvalitetsledare:



# Ab Dykma

Ett företag i MarCon gruppen

# DAGRAPPORT

Datum:

03-09-01

Beställare:

OSB

Arbetsplats:

ÖRESUNDAS BOTTEN

2 mans dykarlag	Tim	Sign	OT veck	OT helg	väger vid Arbetsstart. (vindhstyrka och riktning, vågor, sikt etc.)		Littra / konto
Dykare					560 Ström 1 knop		
Skötare					Tid		Utförda arbeten:
3 mans dykarlag	Tim	Sign			Från	Till	
Dykare		ADI			0650	0700	Störka var "Fride" till dest-digare
Skötare		MBA			0700	0750	Transport till EIS
Dykarledare		KED			0730	0800	förcbredda inspektion EIS Scow
Övrig personal	Tim	Sign			0800	0900	Utsäat mätband för inspektion.
Skeppare		RLE			0900	1000	Inspektion av Scow Protection EIS
Däcksman					1000	1200	Environmental assessment EIS
					1200	1500	Transport till litgrund Wind mark
					1500	1545	Continue inspektion Scow Protection E
					1545	1600	Hämta mät band
					1600	1730	Transport tillbaka till Malms Hamn

**Övriga Noteringar:**

Extra arbeten / Ändringsdirektiv / Reviderad handling / Avvikelser m.m.

**ARBETSBEKRAFTELSE (anmälan om dykning)**

Godkänt av (kund):

Anmält av:

Fordon, Fartyg, Maskiner	Antal	Enhet	Materialer	Antal	Enhet
Fordon:		Km	Material typ:		
Fartyg: "Fride"		Tim	Material typ:		
Maskin typ:			Material typ:		
Maskin typ:			Övrigt typ:		
Maskin typ:			Övrigt typ:		

Ombud /Kontrollant / Beställare:

Kvalitetsledare:

*[Signature]*



# Ab Dykma

Ett företag i MarCon gruppen

## DAGRAPPORT

Datum:

2003-10-01

Beställare:

OSG

Arbetsplats:

Öresundskan

2 mans dykarlag	Tim	Sign	OT veck	OT helg	Arbetstid (inkl. väntetid, vägar, sikt etc.)		Littra / konto
Dykare							
Skötare							
3 mans dykarlag	Tim	Sign			Tid		Utförda arbeten:
					Från	Till	
Dykare	8,5	ADL			07 <sup>00</sup>	08 <sup>00</sup>	Transport E06
Skötare	8,5	JFR					
Dykarledare					08 <sup>00</sup>	09 <sup>30</sup>	insp E06 och transport EC
Övrig personal	Tim	Sign					
Skeppare	8,5	PLE			10 <sup>58</sup>	16 <sup>30</sup>	insp E05-L02-E01 w.c.
Däcksman							Till hamnen

### Övriga Noteringar:

Extra arbeten / Ändringsdirektiv / Reviderad handling / Avvikelse m.m.

### ARBETSBEKRAFTELSE (anmälan om dykning)

Godkänt av (kund):

Anmält av:

Fordon, Fartyg, Maskiner	Antal	Enhet	Materialer	Antal	Enhet
Fordon:		Km	Material typ:		
Fartyg: "frida"	6,5	Tim	Material typ:		
Maskin typ:			Material typ:		
Maskin typ:			Övrigt typ:		
Maskin typ:			Övrigt typ:		

Ombud /Kontrollant / Beställare:

Kvalitetsledare:



# MILJØREDEGØRELSE

ØRESUNDSBRO KONSORTIET 2003



# Indhold

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# Introduktion

Øresundsbro Konsortiet udgiver årligt en miljøredegørelse med status over miljøarbejdet og de direkte og indirekte miljøpåvirkninger som følge af Øresundsbro Konsortiets virksomhed.

Miljøredegørelsen omfatter den 16 km lange forbindelse mellem Danmark og Sverige, inklusive driftscenteret ved Lernacken i Malmö samt hovedkontoret i Vester Søgade i København.

Miljøredegørelsen redegør for påvirkninger af miljøet i 2003 som følge af:

- Drifts- og vedligeholdsaktiviteter
- Tog- og motorvejstrafikken
- Andre påvirkninger

Miljøpåvirkningerne sammenholdes med tidligere år, og det vurderes, om målsætningerne for 2003 er blevet opnået.

Endvidere opstilles målsætninger for miljøarbejdet i 2004.



## Ledelsens beretning om miljø

Øresundsbro Konsortiets overordnede målsætning er at levere transportydelser og service på en måde, der sikrer en høj grad af kundetilfredshed under hensyntagen til legale bestemmelser, virksomhedens driftsresultat, arbejdsmiljø, trafikikkerhed og det eksterne miljø.

Miljø-, arbejdsmiljø- og sikkerhedsledelse er en integreret del af selskabets ledelsessystem. Såvel internt i selskabet som eksternt over for de entreprenører og leverandører, der arbejder på forbindelsen, stilles der krav om efterlevelse af selskabets miljøkrav. I 2003 blev Øresundsbro Konsortiets kvalitetssystem OPUS certificeret i henhold til ISO 9001:2000 standarden, og der vil i det kommende år blive skabt grundlag for at tage skridtet imod certificering af vores arbejdsmiljø- og miljøledelsessystem, som er integreret i OPUS.

Øresundsbro Konsortiet opnår gennem løbende indsamling af viden om miljøpåvirkningerne fra sin virksomhed et overblik, som gennem opsætning af konkrete miljømål gør det muligt at fokusere på væsentlige miljøpåvirkninger. De fleste miljømål opstillet for 2003 vurderes at være opfyldt, og der er opnået værdifuld erfaring gennem arbejdet med de definerede indsatsområder for 2003. For drifts- og vedligeholdsarbejdet viser resultaterne, at der også i 2004 skal fokuseres på affaldsproduktion og vandforbrug. Samtidig vil vi arbejde på at fastholde øvrige miljøpåvirkninger fra drift og vedligehold på et uændret niveau.

Til trods for et stort forebyggende arbejde har vi desværre ikke helt kunnet undgå arbejdsulykker i 2003. Selv om frekvensen er lav i forhold til andre virksomheder i Danmark og Sverige, fastholder vi den strengest mulige målsætning på dette område, dvs. nul arbejdsulykker.

Vi ønsker, at Øresundsbron og dens nærmeste omgivelser fungerer som en integreret og værdifuld del af Øresundsregionens miljø, såvel over som under vandet. På bropillerne er der under vandlinien etableret tætte bestande af fastsiddende alger og blåmuslinger, som giver grobund for fisk og havfugle. Over vandlinien har vi forsøgt at skabe forudsætninger for ynglende vandrefalk ved at opsætte redekasser på udvalgte bropiller. Endvidere fastholder vi slukning af pylonbelysningen i visse situationer i fuglenes træktid, idet vi mener, at risikoen for fuglekollisioner mod broen er minimeret ved dette tiltag.

Etableringen af dyr og planter på Peberholm fortsætter, og blandt de nytilkomne arter er flere specielle, som på Peberholm finder både plads og ro. Vi har i 2003 af hensyn til naturen indført særlige regler for færdsel på Peberholm i forbindelse med drift og vedligehold.

Vi fortsætter i 2004 med at indsamle viden, som kan anvendes til at optimere indsatsen for miljøet, men som også kan give værdifuld information om miljøpåvirkninger ved etablering af andre store marine anlæg. Der er således opstillet miljømål for 2004 som sigter på, at vi stadig bliver klogere på forbindelsens påvirkning af de nærmeste omgivelser, herunder de havbiologiske forhold, bundens udformning og fuglelivet.

Venlig hilsen



Sven Landelius  
VD, Øresundsbron

# MÅL FOR MILJØINDSATSEN 2004

For at kunne vurdere den overordnede målsætning om at optimere miljøindsatsen og løbende minimere miljøpåvirkningerne, opstilles konkrete mål for miljøarbejdet.

Også for 2004 opstilles en række mål, der ved årets slutning vil gøre det muligt at vurdere, om miljøindsatsen har været effektiv. En række af målene er videreført fra tidligere år, og tilsigter at fastholde status quo.

## Drift og vedligehold

1. 0 miljøuheld i 2004.
2. 0 arbejdsulykker i 2004.
3. Skabe grundlag for en beslutning om certificering af arbejdsmiljø- og miljøledelsessystemet.
4. Optimering af affaldshåndteringen, med henblik på at opnå en bedre sortering og en reduktion af den samlede mængde affald.
5. Registrering og analyse af det faktiske vandforbrug på Lernacken driftscenter, med henblik på en handlingsplan for reduktion heraf.
6. Forbruget af energi, vand og papir skal som minimum fastholdes på det nuværende niveau, med mindre det kan begrundes i hensynet til sikkerhed, arbejdsmiljø eller andre miljøforhold.

## Trafik

7. Akkumuleret frekvens af vejulykker med alvorlig personskade mindre end 0,15 pr. 10 mio. kørte km.
8. Akkumuleret frekvens af vejulykker med dødsfald mindre end 0,25 pr. 100 mio. kørte km.
9. Akkumuleret frekvens af jernbaneulykker med dødsfald mindre end 0,025 pr. 100 mio. km.

## Øvrige påvirkninger

10. Tilsyn og vedligehold med ynglepladser for vandrefalk. Målet er, at ét ynglepar etablerer sig i 2004.
11. Opsætning af siddepæle for overvintrende rovfugle på Peberholm.
12. Inventering af dyre- og plantelivet på Peberholm.
13. Etablering af marint dyre- og planteliv på havbunden langs forbindelsen samt på bropiller og pyloner undersøges og vurderes.

