AARHUS UNIVERSITY
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Application of the Danish EPA's Marine Model Complex and Development of a Method Applicable for the River Basin Management Plans 2021-2027

Water Framework Directive Scenario 1b – One-out-all-out

Miljø- og Fødevareministeriet
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The expert in **WATER ENVIRONMENTS**

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Water Framework Directive Scenario 1b – One-Out-All-Out

Prepared for	Danish EPA (Miljøstyrelsen, Fyn)
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Eelgrass in Kertinge Nor
Photo: Peter Bondo Christensen

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Preface

This report is commissioned and funded by the Danish Environmental Protection Agency (EPA). The data, methods and results included in the report are intended to be an integrated part of the material behind the Danish River Basin Management Plans (RBMP) 2021-2027.

The work reported was managed and performed by DHI and AU/DCE. During the project, a steering committee followed the development, and was involved through dialogue and follow-up on progress, etc. The steering committee consisted of members from the Danish Ministry of Environment and Food (MFVM), the Danish EPA (MST), DHI and AU.

In addition, a follow-up group consisting of members from The Danish Agriculture & Food Council, SEGES, Sustainable Agriculture (BL), the Danish Society for Nature Conservation, the Danish Sports Fishing Association, Danish Fishermen PO (DFPO), the Danish Ports, and KL/municipalities was affiliated with the project. The follow-up group has been continuously informed about the progress of the project at meetings convened by the MFVM.

Choice of methods, data processing, description and presentation of results have been solely AU's and DHI's decision and responsibility. A draft version of this report has been reviewed by MST and the follow-up group.

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1 Introduction

When preparing the Danish River Basin Management Plans 2015-2021 (RMBP 2015-2021), DHI and Aarhus University (AU) developed a number of mechanistic (DHI) and statistical (AU) models that were used for calculating chlorophyll-a target values defining the threshold (GM) between 'Good Ecological Status' (GES) and 'Moderate Ecological Status'. The models were also used for calculating Maximum Allowable Inputs (MAIs) of total nitrogen (N) from Danish catchments based on the GM threshold value and a proxy for eelgrass depth limit. Hence, the development aimed at both the model development and the development of a method for calculating the MAIs.

As part of the political, regulatory package 'The Food and Agriculture Agreement from 2015' an international evaluation of the procedures used in the RBMP 2015-2021 was conducted. The evaluation was finalised autumn 2017 with a report (Herman *et al.* 2017) including a number of recommendations for improving the scientific background behind the RBMP 2021-2027.

To follow up on the international evaluation, the Danish EPA facilitated a range of research and development projects (R&D) projects with the overall aim of developing methods to calculate robust, transparent and differentiated chlorophyll-a reference values (and corresponding GM values) and MAIs in as many water bodies as possible for implementation into the RBMP 2021-2027.

Two central R&D projects relate to the continued model development in the assessment of reference chlorophyll-a values (and corresponding target values) and final MAI calculations. Other projects support different aspects of the final MAI calculations, but here we focus on the following two central R&D projects:

- 'Recommendations for the continued development of models and methods for use in the River Basin Management Plan 2021-2027. Follow-up on the international evaluation of marine models behind the River Basin Management Plan 2015-2021' (Erichsen & Timmermann 2018)
- 'Application of the Danish EPA's Marine Model Complex and Development of a Method Applicable for the River Basin Management Plans 2021-2027'.

The outcome of the above research projects is a set of MAIs based on a range of scenarios reflecting different assumptions regarding future developments in nutrient loading from neighbouring countries and the atmosphere as described in Erichsen *et al.* 2020. These management scenarios are based on assumptions defined by the Danish EPA and they are related to either 1) assumptions regarding international adopted treaties related to nutrient management 2) assumptions regarding future development in land-based loadings from other countries 3) assumptions regarding future development in atmospheric deposition and 4). different levels of compliance with the Water Framework Directive (WFD). In the present technical note, the assumptions behind the Water Framework Directive (WFD) scenario 1b and corresponding results are presented. In the WFD scenario 1b the consequences for MAI of applying the one-out-all-out principle, as stipulated in the WFD, is analysed. This principle states that the ecological status of a water body is determined by the indicator with the lowest classification. The implication of this principle is that MAI for a water body should be determined by the indicator requiring the lowest MAI (highest nutrient reduction) in order to reach GES and not an average of the MAIs for the individual indicators, which is otherwise used (Erichsen *et al.*, 2020).

2 Preconditions for MAI Calculations

The Danish MAIs will, among other things, also depend on future loadings from neighbouring countries and atmospheric N-depositions as described in more detail in Erichsen *et al.* 2020. In addition, some water bodies may also respond to Danish land-based P loadings why one set of Danish land-based N-MAIs corresponds to a set of Danish land-based P-MAIs.

To be able to calculate a set of Danish land-based N-MAIs, we need to make assumptions on future loadings and management strategies from neighbouring countries (management scenarios) as well as assumptions regarding Danish land-based P loadings.

With respect to reductions in neighbouring countries, the Danish EPA has defined a set of prerequisites to be used for constructing management scenarios defining potential developments in future non-Danish land-based loadings and atmospheric deposition. For each scenario, Danish land-based N-MAIs are calculated based on either 0%, 10%, 20%, 30% or 50% Danish land-based P reductions.

In this technical note, we have not assessed whether or not the scenarios defined by the Danish EPA are realistic, or even possible, but solely provided N-MAIs that will ensure target reaching given that the corresponding conditions related to nutrient loading from other countries, atmospheric N deposition and P loading from Danish catchments are fulfilled.

2.1 WFD-Scenario Definitions

As mentioned above, the Danish EPA has defined a set of assumptions regarding nutrient inputs from other countries and the atmosphere to be used as a precondition for the Danish land-based N-MAI calculations. The assumptions are grouped into three management scenarios and one scenario related to the interpretation of the Water Framework Directive (WFD-scenario). The different assumptions are described in general terms in Erichsen *et al.* 2020, whereas the present technical note describes WFD-Scenario 1b in more details (also see 'bold' description below).

2.1.1 WFD-Scenarios

The method for estimating land-based MAIs applicable for RBMP 2021-2027 (Erichsen *et al.* 2020) include averaging between indicators and model-results (statistical and mechanistic model results, respectively). The method aims at estimating an individual N-MAI for each indicator that would bring the indicator from the present status to the boundary between “good” and “moderate” status and it include the system contribution in the calculation of Danish land-based N-MAIs. The system contribution cover delays or lag-time in response, feedback mechanisms, climate changes and uncertainties (see Erichsen *et al.* 2020 for details).

In the WFD-scenarios the implications of the different aspect of the method for calculating MAI are addressed by making scenarios based on:

a) Increasing the likelihood of achieving GES by changing the indicator target values from the good-moderate boundary to a target value between good and high status.

b) One-out-all-out principles. This approach will use average model results per indicator but include the lowest MAI between the two indicators.

c) MAI calculations are performed without taking the system contribution into account.

Based on the different management scenarios (see Erichsen *et al.* (2020) for details) we assume similar averaging in the calculation of the individual MAI-calculations within the Danish RBMP 2021-2027Averaging ensures a more robust estimate of the individual MAIs as it

dampens the effect of extreme values. However, this approach does not comply with the one-out-all-out principle stipulated in the WFD. This principle states that the ecological status of a water body is determined by the indicator with the lowest classification. The implication of this principle is that MAI for a water body should be determined by the indicator requiring the lowest MAI (highest nutrient reduction) in order to reach GES. In WFD scenario 1b we modify the method described in Erichsen *et al.* (2020) by applying the one-out-all-out principle.

For the above three sub-scenarios, the land-based nutrient loadings and atmospheric N depositions will be kept as described in management scenario 1.

2.1.2 Scenario Loadings

The full overview of the scenario reductions applied for WFD-scenario 1b in other countries than Denmark, and atmospheric depositions are summarised in Table 2-1, and explained briefly in the following sections. The data on present-day Danish loadings can be found in *Erichsen & Birkeland 2020a.*

Baltic Sea Action Plan (BSAP)

In Management scenario 1, the land-based nutrient loadings to the Baltic Sea are based on the BSAP. All countries around the Baltic Sea have adopted the BSAP as the regional treaty that governs nutrient reductions to the Baltic Sea. Germany has, however, adopted stricter reductions as part of the German RBMP 2015-2021, and these will be described in the following section.

The BSAP consists of national MAIs including both land-based nutrient loadings of N and P and atmospheric depositions (or Country Allocated Reduction Targets – CART). It is necessary to distinguish between land and atmospheric nutrient loading from other countries than Denmark. In order to split the total nutrient loading from the CART, we used data on land-based nutrient loading on a country-by-country level from 1997-2003. This period is consistent with the BSAP baseline period, and allows us to calculate how much of the baseline nutrient loading for each country derives from land-based sources, and how much is atmospheric deposition. We have then assumed that this relationship is constant under the BSAP future conditions, and calculated the country-specific MAIs by subtracting the atmospheric part from the CART, providing us with information on atmosphere and land-based nutrient loading under the BSAP. This calculation has been done for both total nitrogen and phosphorous.

The present-day average loading (average of 2014-2018 loadings) is then compared to the land-based MAIs within the two basins Baltic Proper (BAP) and Danish Straights (DS) and converted into a need for reduction (in %). This estimation is done excluding Danish land-based loadings, as they are the target of the present exercise.

RBMP 2015-2021

As mentioned above, Germany is the only country (besides Denmark), that has adopted N reductions that are stricter than the CART defined in the BSAP.

According to the German RBMP 2015-2021, nutrient targets for TN are defined as average TN concentrations of 2.6 mg N/l in rivers discharging to the Baltic Sea and 2.8 mg N/l in rivers discharging to the North Sea (COWI 2018). For TP, no new targets have been defined in the RBMP 2015-2021 why German TP concentrations in rivers discharging to the North Sea are similar to present-day TP concentrations, and TP concentrations in rivers discharging to the Baltic Sea follow the reductions determined by BSAP.

Based on Gadegast & Venohr (2015), the average concentration in the rivers discharging to the North Sea was 4.04 mg N/l in 2005 why a change in concentrations to 2.8 mg N/l corresponds to an average reduction of 31% of German land-based N-loads. For comparison, COWI (2018) estimated a reduction need from German rivers of 30-48% based on 2001-2005 loadings. Here we use the 31%, as the data reported in Gadegast & Venohr (2015) also relates to the

reductions used for defining reference loadings from German and Dutch rivers discharging into the German Bight.

The 31% reduction is applied to all German rivers discharging to the North Sea as well as other North Sea rivers (due to lack of knowledge) in the simulations. Applying the same reduction on all North Sea rivers is an assumption; however, as the German rivers are the governing source of nutrients impacting Danish waters, it is considered to be a good assumption.

Concerning concentrations in rivers discharging to the Baltic Sea, COWI (2018) reports a target of 2.6 mg N/l, and according to COWI (2018), this corresponds to a reduction of 44%. For management scenario 1, we adopt this reduction from German rivers discharging to the Baltic Sea.

Allocation of Reductions

To estimate the dose-response, ie. how much the GES indicators respond to a change in nutrient load, we used model simulations based on a 30% nutrient reduction (N or P on land-based, respectively, and atmosphere N load), with the exception of Danish land-based nutrient loadings. These simulations provided us with information on the dose-response for each of the GES indicators for the 30% reduction. Using these results, we can estimate the dose-response to a given reduction in local nutrient loading to the Baltic Proper (BAP) and Danish Straits (DS) depending on the source of the nutrient load and the location of the responding GES indicator.

According to HELCOM (2020), we can allocate reductions from BAP to DS and estimate the resulting dose-response from the above scenarios. However, we will have to assume that the impact from reductions differs between the Danish water bodies, as, eg. German reductions will have a profound impact on Flensburg Fjord, whereas the impact on the Sound is regarded as less profound. Hence, we operate with different reductions depending on the individual water bodies.

Assuming no difference in impact from reductions in BAP and DS, the combination of BSAP and German RBMP 2015-2021 equals a reduction of 4% for TN loadings and 27% for TP loadings.

Assuming difference in impacts as described in HELCOM (2020)[1] the corresponding TN reductions equal a 35% reduction whereas a full impact from German RBMP 2015-2021 equals a reduction of 44%.

As HELCOM (2020) defines a reduced impact from reductions as we move from one water body to another (e.g. from BAP to DS), we need to distribute the above reductions from Germany and other countries. This distribution is done according to Figure 2-1 and Table 2-1.

[1] Here we assume that the difference in %-reductions can be translated into a %-reduction according to HELCOM (2020). In HELCOM (2020) the effects, however, relate to tons of N and P why this is not entirely correct. As we operate in %-reductions this assumption will likely overestimate the effects of the German reductions.

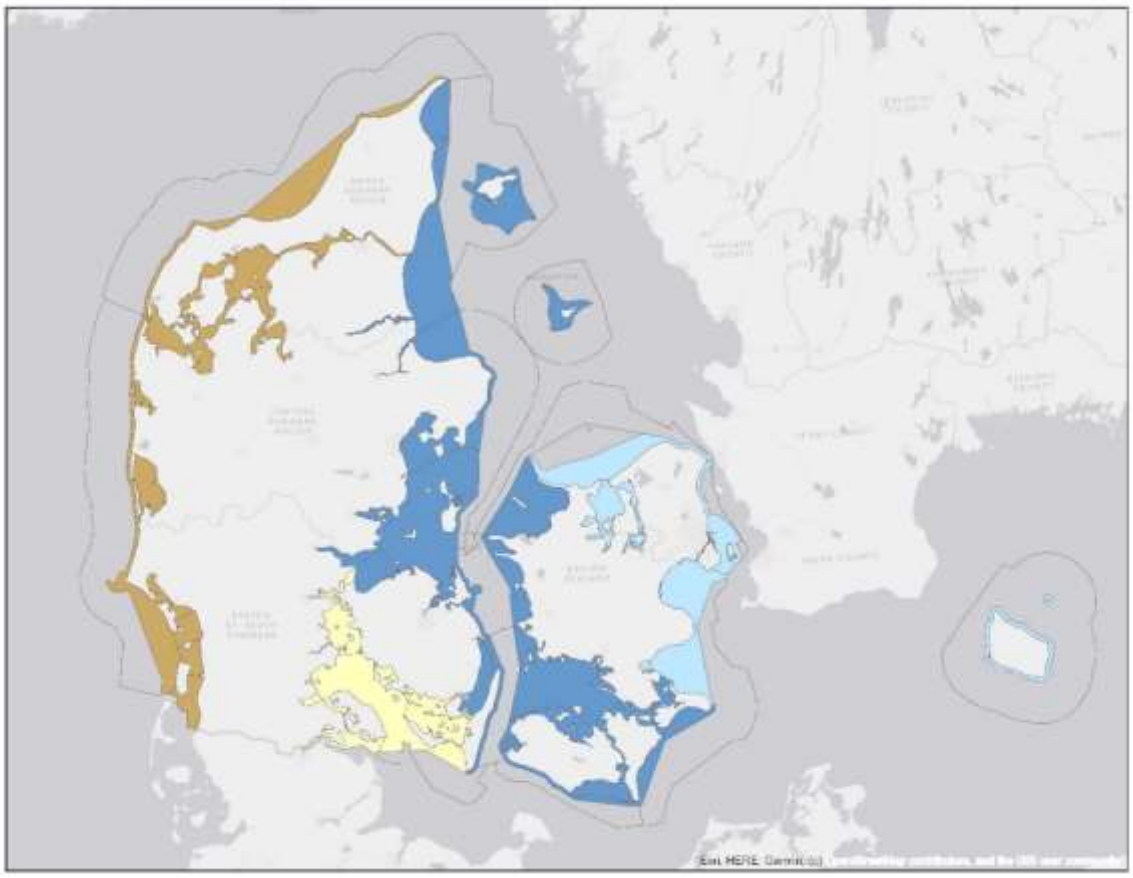

Figure 2-1 Distribution of reductions applied in scenario 1. Nutrient reductions resulting from the German implementation of the RBMP (2015-2021) to the North Sea and Baltic Sea are applied in water bodies marked with brown and yellow, respectively. Nutrient reductions resulting from implementation of the BSAP to the BAP and DS are applied to water bodies marked in light blue. In dark blue areas BSAP reductions to BAP and DS are applied after taking into account effect of transport processes accounted for by the HELCOM (2020) allocation scheme.

NEC-directive

According to Blicher-Mathiesen & Sørensen (2020), the reductions in atmospheric N deposition after full implementation of the NEC-directive altogether amount to 16% or a 10% reduction in 2027, if the different countries' predictions are implemented. The full reduction of 16% is used for management scenarios 1 and 2, whereas the prediction of 10% reduction is used for management scenario 3a (see Erichsen *et al.* 2020 for details).

Data are delivered by AU, and the reductions are resolved on an overall water body scale and implemented in the Danish land-based N-MAIs calculations (see Figure 2-2 for data).

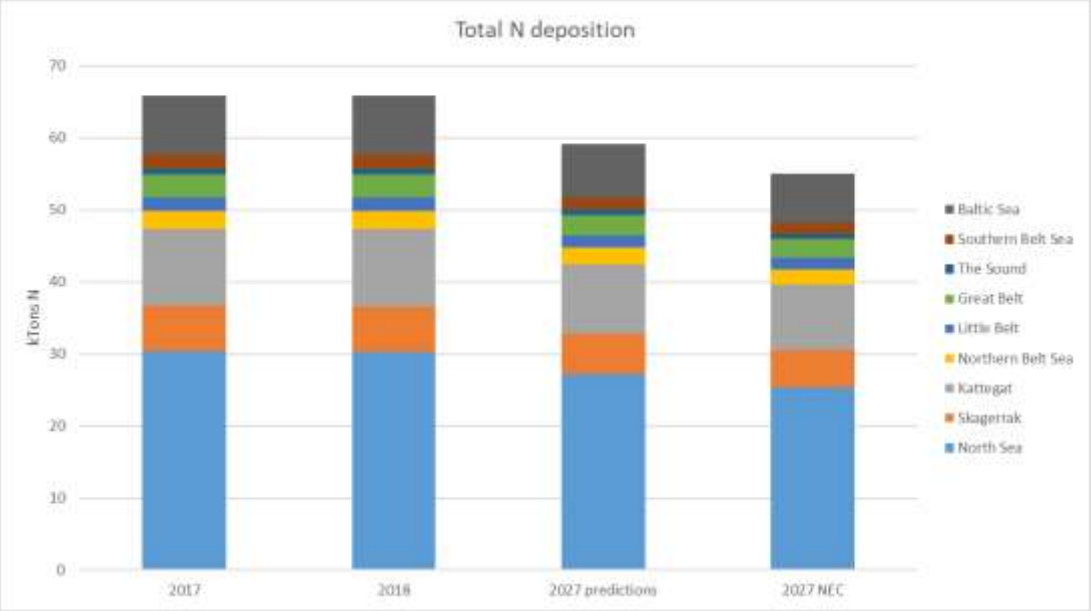

Figure 2-2 Atmospheric N depositions summarised at overall water body level. '2017' and '2018' represent present-day atmospheric N-depositions whereas '2027 NEC' represents agreement behind the directive, and '2027 predictions' represent the different country prognosis.

Table 2-1 Overview of input data used to construct WFD scenario 1b.

Danish water areas affected	N load reduction in WFD scenario 1b. Reductions are in % of current (2014-2018) load	P load reduction applied in WFD scenario 1b. Reductions are in % of current (2014-2018) load	Adopted treaties
Western Baltic Sea (light blue area, Figure 2-1)	4%	27%	Effect of BSAP to DS and BAP
Great belt and Kattegat (dark blue area, Figure 2-1)	35%	27%	Effect of BSAP and German RBMP, using the Helcom allocation scheme
Southern Little Belt (yellow area, Figure 2-1)	44%	27%	Effect of German RBMP
North Sea water bodies and Limfjorden (brown area, Figure 2-1)	31%	0%	Effect of German RBMP
Atmospheric deposition, all Danish water bodies	16%	0%	NEC directive

2.2 Method for calculating Danish N-MAI

Based on the assumed future load reductions from neighbouring countries and atmospheric deposition as described above, N-MAIs from Danish catchments to each of the 109 water bodies is calculated. This is based on the status value of the indicators in each water body, as well as a defined target value (*Erichsen & Birkeland 2020b*). The status values for the two indicators are based on measurements. Target values are defined as a "slight deviation from

reference conditions", where reference conditions refer to a state with minimal human influence. Based on the method described in Erichsen *et al*. (2020), each target value will have a MAI which will support the system to achieve GES.

Since all Danish water bodies are connected to a higher or lesser degree, the reduction needed for a single water body cannot be assessed in isolation. In addition, it is necessary to consider the load reduction requirement estimated for nearby water bodies. To account for connected water bodies, the following scheme was applied:

1) Catchments are assigned to each water body. Local catchments are assigned to the inner part (sub-catchments) of estuaries (upstream water bodies), whereas two or more local catchments (main-catchments) are assigned for downstream water bodies (e.g. the outer part of estuaries) and more open water bodies.

2) Load reductions (in %) for each individual water body are calculated as described in Erichsen *et al.* (2020) and transformed into a N-reduction requirement in tons using the load of the assigned catchment.

3) For up-stream water bodies (with local catchments) the calculated reduction is a minimum requirement that should be obtained independently of downstream waterbody requirements.

4) Reduction requirements for downstream water bodies are corrected, considering any minimum reduction handled by up-stream water bodies.

5) Reduction requirements are transformed into MAIs by subtracting the required load reduction from the average annual load and aggregated to the corresponding local and/or regional catchment.

2.3 Results

Based on the above-described assumption (implementation of the Baltic Sea Action Plan, German nutrient reductions according to RBMP 2015-2021 and reductions in atmospheric N deposition according to the NEC directive) the different reduction requirements and corresponding MAIs are calculated.

The different reduction requirements (%-wise and in actual tons) based on the different indicators and different models are included in Appendices A-E, whereas the aggregated MAIs are reported in Table 2-2.

Table 2-2 Maximum Allowable Nitrogen Inputs (N-MAIs) for Danish water bodies given the implementation of the BSAP, German nutrient reductions according to RBMP 2015-2021 and reductions in atmospheric N deposition according to the NEC directive and aiming at indicator values in the middle between high and good ecological status.
The table shows N-MAIs in tons N per year, where 'main' denotes main-catchment, and 'sub' denotes sub-catchments being part of a main-catchment. The table shows average annual loads as well as N-MAIs calculated for 5 different phosphorus reduction scenarios designated P0, P10, P20, P30 and P50, where phosphorus loadings from Danish catchments are reduced by 0%, 10%, 20%, 30% and 50%, respectively. The column 'aggregated' denotes sub-catchments included in specific MAIs.

No.	Name	Aggregation	Average annual (main)	Average annual (sub)	P0 (main)	P0 (sub)	P10 (main)	P10 (sub)	P20 (main)	P20 (sub)	P30 (main)	P30 (sub)	P50 (main)	P50 (sub)
1	Roskilde Fjord, ydre	1,2		764		428		435		435		443		451
2	Roskilde Fjord, indre	2		388		353		357		361		365		373
6	Nordlige Øresund	6	1,098		1,098		1,098		1,098		1,098		1,098	
16	Korsør Nor	16		40		20		21		23		23		25
17	Basnæs Nor	17		69		35		36		36		36		36
18	Holsteinborg Nor [c)]	18		22		22		22		22		22		22
24	Isefjord, ydre	24,165		899		477		477		477		477		477
25	Skælskør Fjord og Nor	25		44		36		36		37		37		38
28	Sejerø Bugt	28	164		164		164		164		164		164	
29	Kalundborg Fjord	29	69		26a		26a		28		31		38	
34	Smålandsfarvandet, syd [c)]	34	523		523		523		523		523		523	
35	Karrebæk Fjord	35		1,272		738		801		852		916		1,018
36	Dybsø Fjord	36		61		61		61		61		61		61
37	Avnø Fjord	37		238		133		140		145		150		159
38	Guldborgsund [c)]	38	419		419		419		419		419		419	

No.	Name	Aggregation	Average annual (main)	Average annual (sub)	P0 (main)	P0 (sub)	P10 (main)	P10 (sub)	P20 (main)	P20 (sub)	P30 (main)	P30 (sub)	P50 (main)	P50 (sub)
44	Hjelm Bugt	44	91		91		91		91		91		91	
45	Grønsund	45	278		136		136		136		136		136	
46	Fakse Bugt	46,47	509		424		428		433		437		443	
47	Præstø Fjord	47		208		123		127		131		135		143
48	Stege Bugt [c)]	48,49	259		248		248		248		248		249	
49	Stege Nor	49		24		12		13		13		13		13
56	Østersøen, Bornholm	56	860		184a		184a		184a		184a		184a	
57	Østersøen, Christiansø	57	3		0a		0a		0a		0a		0a	
59	Nærå Strand	59		98		22a		29		35		42		59
62	Lillestrand	62		11		5		5		5		5		5
68	Lindelse Nor	68		50		50		50		50		50		50
72	Kløven	72		43		43		43		43		43		43
74	Bredningen	74		128		42a		49		54		59		68
80	Gamborg Fjord	80		80		65		65		65		65		65
82	Aborg Minde Nor	82		152		34b		34b		34b		34a		64
83	Holckenhavn Fjord	83		290		81a		87		98		110		133
84	Kerteminde Fjord	84,85		50		31		31		31		31		31
85	Kertinge Nor	85		24		14		14		15		15		16
86	Nyborg Fjord	83,86		308		100		106		117		129		152

No.	Name	Aggregation	Average annual (main)	Average annual (sub)	P0 (main)	P0 (sub)	P10 (main)	P10 (sub)	P20 (main)	P20 (sub)	P30 (main)	P30 (sub)	P50 (main)	P50 (sub)
87	Helnæs Bugt	87		216		67a		67a		67a		67a		67a
89	Lunkebugten	89		16		5a		5a		5a		5a		5a
90	Langelandssund	83,86,89,90	768		548		554		566		577		583	
92	Odense Fjord, ydre	92,93		1,358		624		650		689		727		792
93	Odense Fjord, Seden Strand	93		1,288		554		580		618		657		721
95	Storebælt SV	95	188		41a		41a		41a		41a		41a	
96	Storebælt NV	96, 84, 85	227		39a		39a		39a		39a		39a	
101	Genner Bugt	101		35		13a		13a		13a		13a		13a
102	Åbenrå Fjord	102		130		59a		59a		59a		59a		59a
103	Als Fjord	103,104,105		269		78a		78a		78a		78a		78a
104	Als Sund	104		68		68		68		68		68		68
105	Augustenborg Fjord	105		62		62		62		62		62		62
106	Haderslev Fjord	106		239		105		108		108		110		112
107	Juvre Dyb	107		349		119a		119a		119a		119a		119a
108	Avnø Vig	108		60		24		27		30		32		38
109	Hejlsminde Nor	109		138		61		71		80		90		108
110	Nybøl Nor	110		66		44		45		46		47		51
111	Lister Dyb	111		2,155		948		1,013		1,099		1,164		1,314
113	Flensborg Fjord, indre	113		51		19a		19a		19a		19a		20a

No.	Name	Aggregation	Average annual (main)	Average annual (sub)	P0 (main)	P0 (sub)	P10 (main)	P10 (sub)	P20 (main)	P20 (sub)	P30 (main)	P30 (sub)	P50 (main)	P50 (sub)
114	Flensborg Fjord, ydre	110,113,114		219		164		165		166		168		172
119	Vesterhavet, syd	119, 107, 111, 121, 120	8,538		2,962		3,027		3,113		3,265		3,928	
120	Knudedyb	120		2,910		844		844		844		844		1,426
121	Grådyb	121		2,920		847		847		847		934		1,577
122	Vejle Fjord, ydre	122,123		968		484		484		494		503		523
123	Vejle Fjord, indre	123		561		466		472		477		488		500
124	Kolding Fjord, indre	124		493		217a		227		237		256		291
125	Kolding Fjord, ydre	124,125		528		252a		262a		272a		280a		280a
127	Horsens Fjord, ydre	127,128		833		450		450		458		458		466
128	Horsens Fjord, indre	128		782		407		407		407		414		414
129	Nissum Fjord, ydre	129,131,130		2,412		934		1,079		1,182		1,279		1,447
130	Nissum Fjord, mellem	130,131		2,083		696		750		875		1,021		1,271
131	Nissum Fjord, Felsted Kog	131		1,938		662b		698a		911a		1,124		1,512
132	Ringkøbing Fjord	132		4,748		1,709a		1,947a		2,184a		2,421a		3,893
133	Vesterhavet, nord	133,129,130 ,131, 132	7,237		2,720		3,103		3,443		3,777		5,418	
136	Randers Fjord, indre	136		2,925		1,492a		1,492a		1,579		1,755		2,135
137	Randers Fjord, ydre	136,137		3,078		1,515		1,515		1,601		1,785		2,155

No.	Name	Aggregation	Average annual (main)	Average annual (sub)	P0 (main)	P0 (sub)	P10 (main)	P10 (sub)	P20 (main)	P20 (sub)	P30 (main)	P30 (sub)	P50 (main)	P50 (sub)
138	Hevring Bugt	138, 137, 136	3,235		1,556		1,556		1,758		1,943		2,312	
139	Anholt [c)]	139	9		9		9		9		9		9	
140	Djursland Øst	140	856		497		497		497		497		497	
141	Ebeltoft Vig [c)]	141	14		14		14		14		14		14	
142	Stavns Fjord	142		5		3		3		3		3		4
144	Knebel Vig	144		18		11		11		11		11		11
145	Kalø Vig	144,145		190		182		182		182		182		182
146	Norsminde Fjord	146		140		47a		57		73		88		118
147	Århus Bugt og Begtrup Vig	144,145,147	656		637		643		643		643		643	
154	Kattegat Læsø [c)]	154	78		78		78		78		78		78	
157	Bjørnholms Bugt, Riisgårde Bredning, Skive Fjord og Lovns Bredning	157,158		3,632		981a		981a		981a		981a		1,199
158	Hjarbæk Fjord	158		1,795		431		467		503		557		664
159	Mariager Fjord, indre	159		516		83		88		93		98		113
160	Mariager Fjord, ydre	159,160		963		520		535		540		545		560
165	Isefjord, indre	165		812		390		390		390		390		390
200	Kattegat Nordsjælland	1,2,24,165,200	1,857		631a		631a		631a		631a		631a	
201	Køge Bugt	201	1,109		732		743		754		765		787	

No.	Name	Aggregation	Average annual (main)	Average annual (sub)	P0 (main)	P0 (sub)	P10 (main)	P10 (sub)	P20 (main)	P20 (sub)	P30 (main)	P30 (sub)	P50 (main)	P50 (sub)
204	Jammerland Bugt og Musholm Bugt	204	1,327		531		531		531		544		544	
206	Smålandsfarvandet, åbne del	16,17,18,25,35,36,37,206	2,014		1,314		1,387		1,444		1,514		1,629	
207	Nakskov Fjord	207		454		358		363		367		367		376
208	Femerbælt	207,208,209	1,530		1,201		1,205		1,210		1,210		1,219	
209	Rødsand og Bredningen	209		521		286		286		286		286		286
212	Fåborg Fjord	212		30		11		11		11		11		11
214	Det sydfynske Øhav	68,72,212,214	633		177a		177a		177a		177a		177a	
216	Lillebælt, syd	87,101,102,103,104,105,110,113,114,216	1,309		458a		458a		458a		458a		458a	
217	Lillebælt Bredningen	74,82,106,108,109,217	956		327a		327a		327a		327a		327a	
219	Århus Bugt, syd, Samsø og Nordlige Bælthav	59,62,92,93,127,128,142,146,219	2,810		794a		794a		794a		794a		794a	
221	Skagerrak	221	1,423		1,423		1,423		1,423		1,423		1,423	
222	Kattegat Ålborg Bugt [c)]	222,159,160	2,026		1,583		1,598		1,603		1,608		1,623	
224	Nordlige Lillebælt	122,123,224	1,588		397a		397a		397a		397a		397a	
225	Nordlige Kattegat Ålbæk Bugt	225	706		706		706		706		706		706	

No.	Name	Aggregation	Average annual (main)	Average annual (sub)	P0 (main)	P0 (sub)	P10 (main)	P10 (sub)	P20 (main)	P20 (sub)	P30 (main)	P30 (sub)	P50 (main)	P50 (sub)
231	Lillebælt Snævringen	231,124,125,80	789		259		259		259		259		259	
232	Nissum Bredning	232	880		299a		299a		317a		325a		361a	
233	Kaas Bredning og Venø Bugt	232,233		1,955		802		958		1,114		1,271		1,436
234	Løgstør Bredning	157,158,234, 233, 236		4,336		1,951a		1,951a		1,951a		1,951a		1,951a
235	Nibe Bredning og Langerak	157, 158, 233, 234, 235, 236, 238	11,064		6,005		6,005		6,005		6,005		6,209	
236	Thisted Bredning	236		1,091		273a		273a		273a		273a		273
238	Halkær Bredning	238		620		114b		114		114		114a		316
	Danish N-load (National MAI)		58,100		29,252		29,820		30,561		31,359		34,453	

a) Truncated at land-based reference N-load for one indicator

b) Truncated at land-based reference N-load for two indicators

c) Chlorophyll-a and light GM target obtained based on measurement (and independent of reductions from neighbouring countries or atmospheric depositions

2.4 Closing Remarks

The estimated Maximum Allowable Nitrogen Input (N-MAI) to Danish water bodies presented in this report is based on the preconditions that the BSAP, the RBMP 2015-2021, and the NEC directive will be fully implemented. These treaties have been adopted but not yet fully implemented. These assumptions, which have not been assessed as part of this study, are accepted as preconditions.

If the preconditions are fulfilled, and the MAI for Danish water bodies is reached by the end of 2027, all Danish water bodies will most likely not have reached Good Ecological Status (GES) as defined in the WFD. This is because:

- The MAI estimation is based on the depth of light as a proxy for the indicator eelgrass depth limit. Hence, even if light has reached the target value, recovery of eelgrass after light improvements may take years to decades. In addition, other factors, such as sediment suitability, lack of seedlings, etc., may delay or prevent eelgrass recovery.

- With the given preconditions in management scenario 1, one or both of the indicators (chlorophyll-a and light) may not reach the target value despite reductions from Danish catchments. In these situations, the reduction requirement for that indicator is cut off/truncated at the reference loading. A cut-off at reference loading indicates that due to the scenario and associated preconditions, a specific MAI for that water body that ensures GES cannot be obtained, and administrative choices have to be made, like applying an average reduction from neighbouring water bodies, reductions to down-stream water bodies or a general MAI (kg/ha) for those water bodies. However, the implication is that GES for both indicators cannot be expected in these water bodies, even if MAI is obtained.

- The method is not based on the one-out-all-out principle as required in the WFD, but on an average of two indicators. Hence, it is expected that both indicators will be as close to the target value as possible, but one will theoretically be above and one below the target value.

- In this management scenario, we are using the boundary between good and moderate status as the target value for each of the indicators. Due to uncertainties, there is a 50% chance that the indicator value will end in good status and a 50% chance that the indicator value will end in moderate status, if MAI for that indicator is reached, assuming the measured indicator follows a symmetrical distribution.

- As some ecosystems respond with significant time-lags to changes in loadings, it will take years before the full environmental effects of nutrient reductions can be observed. Hence, reaching MAI will provide the conditions for obtaining GES but the achievement of GES will likely be delayed.

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Appendix A – Maximum Allowable Nitrogen Inputs (N-MAIs) based on WFD scenario 1b and assuming 0% reduction in Danish land-based P-loads

Table A- 1 Water body-specific MAIs based on the two individual indicators chlorophyll-a (Chl-a) and light penetration depth (light) estimated from statistical models (STAT) and mechanistic models (MEK), respectively.
The table shows both the individual calculations and the averaged water-specific MAIs (without any aggregation) and the corresponding need for reduction in %. The data in this table are based on WFD scenario 1b and Danish land-based P-reductions set at 0%.

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
1	Roskilde Fjord,ydre	1,2	764			651	431	651	431	431	44
2	Roskilde Fjord, indre	2	388	388		388	354	388	354	354	9
6	Nordlige Øresund	6	1,098			1,098	1,098	1,098	1,098	1,098	0
16	Korsør Nor	16	40			40	21	40	21	21	49
17	Basnæs Nor	17	69			69	35	69	35	35	49
18	Holsteinborg Nor	18	22			22	22	22	22	22	0
24	Isefjord, ydre	24,165	899	504	606	545	636	525	621	525	42
25	Skælskør Fjord og Nor	25	44			36	37	36	37	36	18
28	Sejerø Bugt	28	164			164	164	164	164	164	0
29	Kalundborg Fjord	29	69	13	42	39	69	26	56	26	62
34	Smålandsfarvandet, syd	34	523			523	523	523	523	523	0
35	Karrebæk Fjord	35	1,272			1,272	742	1,272	742	742	42
36	Dybsø Fjord	36	61			61	61	61	61	61	0
37	Avnø Fjord	37	238			238	134	238	134	134	44
38	Guldborgsund	38	419			419	419	419	419	419	0
44	Hjelm Bugt	44	91			91	91	91	91	91	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
45	Grønsund	45	278			278	136	278	136	136	51
46	Fakse Bugt	46,47	510			438	509	438	509	438	14
47	Præstø Fjord	47	208			144	123	144	123	123	41
48	Stege Bugt	48,49	259			259	259	259	259	259	0
49	Stege Nor	49	24			18	12	18	12	12	48
56	Østersøen, Bornholm	56	859			184	860	184	860	184	79
57	Østersøen, Christiansø	57	3			0	3	0	3	0	97
59	Nærå Strand	59	98			24	22	24	22	22	77
62	Lillestrand	62	11			8	5	8	5	5	56
68	Lindelse Nor	68	50			50	50	50	50	50	0
72	Kløven	72	43			43	43	43	43	43	0
74	Bredningen	74	128			47	42	47	42	42	67
80	Gamborg Fjord	80	80			66	80	66	80	66	18
82	Aborg Minde Nor	82	152			34	34	34	34	34	78
83	Holckenhavn Fjord	83	290			81	121	81	121	81	72
84	Kerteminde Fjord	84,85	50			31	50	31	50	31	39
85	Kertinge Nor	85	24	23		23	14	23	14	14	42
86	Nyborg Fjord	83,86	308			154	277	154	277	154	50
87	Helnæs Bugt	87	216			67	216	67	216	67	69

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
89	Lunkebugten	89	16			5	16	5	16	5	68
90	Langelandssund	83,86,89,90	768			581	768	581	768	581	24
92	Odense Fjord, ydre	92,93	1,358	836	1,223	986	1,127	911	1,175	911	33
93	Odense Fjord, Seden Strand	93	1,288		690	1,288	406	1,288	548	548	57
95	Storebælt SV	95	188			41	188	41	188	41	78
96	Storebælt NV	96, 84, 85	227			38	227	38	227	38	83
101	Genner Bugt	101	35			13	25	13	25	13	62
102	Åbenrå Fjord	102	130	59		59	106	59	106	59	55
103	Als Fjord	103,104,105	269			67	269	67	269	67	75
104	Als Sund	104	68			68	68	68	68	68	0
105	Augustenborg Fjord	105	62	62		62	62	62	62	62	0
106	Haderslev Fjord	106	239			107	160	107	160	107	56
107	Juvre Dyb	107	349			119		119		119	66
108	Avnø Vig	108	60			32	24	32	24	24	60
109	Hejlsminde Nor	109	138			127	61	127	61	61	56
110	Nybøl Nor	110	66			44	55	44	55	44	33
111	Lister Dyb	111	2,155			947		947		947	56
113	Flensborg Fjord, indre	113	51	19		19	51	19	51	19	63
114	Flensborg Fjord, ydre	110,113,114	219	219		219	219	219	219	219	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
119	Vesterhavet, syd	119, 107, 111, 121, 120	8,538			3,934		3,934		3,934	54
120	Knudedyb	120	2,910	841		841		841		841	71
121	Grådyb	121	2,920			842		842		842	71
122	Vejle Fjord, ydre	122,123	968			480	968	480	968	480	50
123	Vejle Fjord, indre	123	561	532	451	530	479	531	465	465	17
124	Kolding Fjord, indre	124	493	188		246	283	217	283	217	56
125	Kolding Fjord, ydre	124,125	528			278	400	278	400	278	47
127	Horsens Fjord, ydre	127,128	833			508	449	508	449	449	46
128	Horsens Fjord, indre	128	782			405	447	405	447	405	48
129	Nissum Fjord, ydre	129,131,130	2,412			1,357	1,018	1,357	1,018	1,018	58
130	Nissum Fjord, mellem	130,131	2,083			898	602	898	602	602	71
131	Nissum Fjord, Felsted Kog	131	1,938	1,938		662	662	1,300	662	662	66
132	Ringkøbing Fjord	132	4,747		1,679	4,748	1,761	4,748	1,720	1,720	64
133	Vesterhavet, nord	133,129,130 ,131, 132	7,237			7,237		7,237		7,237	0
136	Randers Fjord, indre	136	2,925	2,925	1,477	2,925	1,477	2,925	1,477	1,477	49
137	Randers Fjord, ydre	136,137	3,078	3,078	1,196	3,078	1,196	3,078	1,196	1,196	61
138	Hevring Bugt	138, 137, 136	3,235		3,235	3,235	3,235	3,235	3,235	3,235	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
139	Anholt	139	9			9	9	9	9	9	0
140	Djursland Øst	140	856			493	856	493	856	493	42
141	Ebeltoft Vig	141	14			14	14	14	14	14	0
142	Stavns Fjord	142	5			5	3	5	3	3	39
144	Knebel Vig	144	18			11	18	11	18	11	39
145	Kalø Vig	144,145	190	190	190	190	190	190	190	190	0
146	Norsminde Fjord	146	140			140	47	140	47	47	67
147	Århus Bugt og Begtrup Vig	144,145,147	656	631	656	636	656	634	656	634	3
154	Kattegat Læsø	154	78			78	78	78	78	78	0
157	Bjørnholms Bugt, Riisgårde Bredning, Skive Fjord og Lovns Bredning	157,158	3,632			992	1,572	992	1,572	992	73
158	Hjarbæk Fjord	158	1,795			426	649	426	649	426	76
159	Mariager Fjord, indre	159	516			84	201	84	201	84	84
160	Mariager Fjord, ydre	159,160	963			784	516	784	516	516	46
165	Isefjord, indre	165	812	379		396	812	387	812	387	52
200	Kattegat Nordsjælland	1,2,24,165,200	1,857			1,857	629	1,857	629	629	66
201	Køge Bugt	201	1,109	836		973	729	905	729	729	34
204	Jammerland Bugt og Musholm Bugt	204	1,327			1,327	532	1,327	532	532	60

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
206	Smålandsfarvandet, åbne del	16,17,18,25,35,36,37,206	2,014			2,014	1,699	2,014	1,699	1,699	16
207	Nakskov Fjord	207	454			450	360	450	360	360	21
208	Femerbælt	207,208,209	1,530			1,468	1,530	1,468	1,530	1,468	4
209	Rødsand og Bredningen	209	521			284	359	284	359	284	45
212	Fåborg Fjord	212	30			11	30	11	30	11	64
214	Det sydfynske Øhav	68,72,212,214	633	176	451	176	529	176	490	176	72
216	Lillebælt, syd	87,101,102,103,104,105,110,113,114,216	1,309			462	1,309	462	1,309	462	65
217	Lillebælt Bredningen	74,82,106,108,109,217	956	276		371	956	323	956	323	66
219	Århus Bugt, syd, Samsø og Nordlige Bælthav	59,62,92,93,127,128,142,146,219	2,810			626	2,810	626	2,810	626	78
221	Skagerrak	221	1,423			1,423		1,423		1,423	0
222	Kattegat Ålborg Bugt	222,159,160	2,026			2,026	2,026	2,026	2,026	2,026	0
224	Nordlige Lillebælt	122,123,224	1,588			389	1,588	389	1,588	389	75
225	Nordlige Kattegat Ålbæk Bugt	225	706			706	706	706	706	706	0
231	Lillebælt Snævringen	231,124,125,80	789		222	182	439	182	331	182	77

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
232	Nissum Bredning	232	880	297	604	297	762	297	683	297	66
233	Kaas Bredning og Venø Bugt	232,233	1,955			1,457	802	1,457	802	802	59
234	Løgstør Bredning	157,158,234, 233, 236	6,502			1,980	3,642	1,980	3,642	1,980	70
235	Nibe Bredning og Langerak	157, 158, 233, 234, 235, 236, 238	11,064		9,773	2,984	9,774	2,984	9,773	2,984	73
236	Thisted Bredning	236	1,091			269	488	269	488	269	75
238	Halkær Bredning	238	620			114	114	114	114	114	82

Appendix B – Maximum Allowable Nitrogen Inputs (N-MAIs) based on WFD scenario 1b and assuming 10% reduction in Danish land-based P-loads

Table B- 1 Water body-specific MAIs based on the two individual indicators chlorophyll-a (Chl-a) and light penetration depth (light) estimated from statistical models (STAT) and mechanistic models (MEK), respectively.
The table shows both the individual calculations and the averaged water-specific MAIs (without any aggregation) and the corresponding need for reduction in %. The data in this table are based on WFD scenario 1b and Danish land-based P-reductions set at 10%.

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
1	Roskilde Fjord,ydre	1,2	764			651	435	651	435	435	43
2	Roskilde Fjord, indre	2	388	388		388	358	388	358	358	8
6	Nordlige Øresund	6	1,098			1,098	1,098	1,098	1,098	1,098	0
16	Korsør Nor	16	40			40	22	40	22	22	46
17	Basnæs Nor	17	69			69	36	69	36	36	48
18	Holsteinborg Nor	18	22			22	22	22	22	22	0
24	Isefjord, ydre	24,165	899	525	623	545	637	535	630	535	40
25	Skælskør Fjord og Nor	25	44			37	38	37	38	37	17
28	Sejerø Bugt	28	164			164	164	164	164	164	0
29	Kalundborg Fjord	29	69	13	48	39	69	26	59	26	62
34	Smålandsfarvandet, syd	34	523			523	523	523	523	523	0
35	Karrebæk Fjord	35	1,272			1,272	800	1,272	800	800	37
36	Dybsø Fjord	36	61			61	61	61	61	61	0
37	Avnø Fjord	37	238			238	139	238	139	139	41
38	Guldborgsund	38	419			419	419	419	419	419	0
44	Hjelm Bugt	44	91			91	91	91	91	91	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
45	Grønsund	45	278			278	136	278	136	136	51
46	Fakse Bugt	46,47	510			439	509	439	509	439	14
47	Præstø Fjord	47	208			146	127	146	127	127	39
48	Stege Bugt	48,49	259			259	259	259	259	259	0
49	Stege Nor	49	24			18	13	18	13	13	47
56	Østersøen, Bornholm	56	859			184	860	184	860	184	79
57	Østersøen, Christiansø	57	3			0	3	0	3	0	97
59	Nærå Strand	59	98			29	29	29	29	29	70
62	Lillestrand	62	11			8	5	8	5	5	55
68	Lindelse Nor	68	50			50	50	50	50	50	0
72	Kløven	72	43			43	43	43	43	43	0
74	Bredningen	74	128			50	48	50	48	48	62
80	Gamborg Fjord	80	80			66	80	66	80	66	18
82	Aborg Minde Nor	82	152			34	34	34	34	34	78
83	Holckenhavn Fjord	83	290			87	132	87	132	87	70
84	Kerteminde Fjord	84,85	50			31	50	31	50	31	39
85	Kertinge Nor	85	24	24		23	14	23	14	14	40
86	Nyborg Fjord	83,86	308			159	280	159	280	159	48
87	Helnæs Bugt	87	216			67	216	67	216	67	69

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
89	Lunkebugten	89	16			5	16	5	16	5	68
90	Langelandssund	83,86,89,90	768			581	768	581	768	581	24
92	Odense Fjord, ydre	92,93	1,358	836	1,223	996	1,162	916	1,192	916	33
93	Odense Fjord, Seden Strand	93	1,288		690	1,288	478	1,288	584	584	55
95	Storebælt SV	95	188			41	188	41	188	41	78
96	Storebælt NV	96, 84, 85	227			38	227	38	227	38	83
101	Genner Bugt	101	35			13	25	13	25	13	62
102	Åbenrå Fjord	102	130	59		59	106	59	106	59	55
103	Als Fjord	103,104,105	269			67	269	67	269	67	75
104	Als Sund	104	68			68	68	68	68	68	0
105	Augustenborg Fjord	105	62	62		62	62	62	62	62	0
106	Haderslev Fjord	106	239			108	161	108	161	108	55
107	Juvre Dyb	107	349			119		119		119	66
108	Avnø Vig	108	60			34	27	34	27	27	55
109	Hejlsminde Nor	109	138			138	71	138	71	71	49
110	Nybøl Nor	110	66			45	56	45	56	45	32
111	Lister Dyb	111	2,155			1,017		1,017		1,017	53
113	Flensborg Fjord, indre	113	51	19		19	51	19	51	19	63
114	Flensborg Fjord, ydre	110,113,114	219	219		219	219	219	219	219	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
119	Vesterhavet, syd	119, 107, 111, 121, 120	8,538			3,934		3,934		3,934	54
120	Knudedyb	120	2,910	841		841		841		841	71
121	Grådyb	121	2,920			842		842		842	71
122	Vejle Fjord, ydre	122,123	968			487	968	487	968	487	50
123	Vejle Fjord, indre	123	561	546	465	531	480	539	472	472	16
124	Kolding Fjord, indre	124	493	200		251	294	225	294	225	54
125	Kolding Fjord, ydre	124,125	528			278	406	278	406	278	47
127	Horsens Fjord, ydre	127,128	833			516	454	516	454	454	46
128	Horsens Fjord, indre	128	782			407	450	407	450	407	48
129	Nissum Fjord, ydre	129,131,130	2,412			1,444	1,103	1,444	1,103	1,103	54
130	Nissum Fjord, mellem	130,131	2,083			993	745	993	745	745	64
131	Nissum Fjord, Felsted Kog	131	1,938	1,938		662	698	1,300	698	698	64
132	Ringkøbing Fjord	132	4,747		1,679	4,748	2,242	4,748	1,961	1,961	59
133	Vesterhavet, nord	133,129,130 ,131, 132	7,237			7,237		7,237		7,237	0
136	Randers Fjord, indre	136	2,925	2,925	1,477	2,925	1,477	2,925	1,477	1,477	49
137	Randers Fjord, ydre	136,137	3,078	3,078	1,392	3,078	1,392	3,078	1,392	1,392	55
138	Hevring Bugt	138, 137, 136	3,235		3,235	3,235	3,235	3,235	3,235	3,235	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
139	Anholt	139	9			9	9	9	9	9	0
140	Djursland Øst	140	856			493	856	493	856	493	42
141	Ebeltoft Vig	141	14			14	14	14	14	14	0
142	Stavns Fjord	142	5			5	3	5	3	3	39
144	Knebel Vig	144	18			11	18	11	18	11	39
145	Kalø Vig	144,145	190	190	190	190	190	190	190	190	0
146	Norsminde Fjord	146	140			140	58	140	58	58	59
147	Århus Bugt og Begtrup Vig	144,145,147	656	656	656	636	656	646	656	646	2
154	Kattegat Læsø	154	78			78	78	78	78	78	0
157	Bjørnholms Bugt, Riisgårde Bredning, Skive Fjord og Lovns Bredning	157,158	3,632			992	1,801	992	1,801	992	73
158	Hjarbæk Fjord	158	1,795			465	756	465	756	465	74
159	Mariager Fjord, indre	159	516			88	237	88	237	88	83
160	Mariager Fjord, ydre	159,160	963			823	597	823	597	597	38
165	Isefjord, indre	165	812	379		396	812	387	812	387	52
200	Kattegat Nordsjælland	1,2,24,165,200	1,857			1,857	629	1,857	629	629	66
201	Køge Bugt	201	1,109	853		991	740	922	740	740	33
204	Jammerland Bugt og Musholm Bugt	204	1,327			1,327	535	1,327	535	535	60

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
206	Smålandsfarvandet, åbne del	16,17,18,25,35,36,37,206	2,014			2,014	1,699	2,014	1,699	1,699	16
207	Nakskov Fjord	207	454			452	363	452	363	363	20
208	Femerbælt	207,208,209	1,530			1,468	1,530	1,468	1,530	1,468	4
209	Rødsand og Bredningen	209	521			284	359	284	359	284	45
212	Fåborg Fjord	212	30			11	30	11	30	11	64
214	Det sydfynske Øhav	68,72,212,214	633	176	454	176	529	176	492	176	72
216	Lillebælt, syd	87,101,102,103,104,105,110,113,114,216	1,309			462	1,309	462	1,309	462	65
217	Lillebælt Bredningen	74,82,106,108,109,217	956	276		371	956	323	956	323	66
219	Århus Bugt, syd, Samsø og Nordlige Bælthav	59,62,92,93,127,128,142,146,219	2,810			626	2,810	626	2,810	626	78
221	Skagerrak	221	1,423			1,423		1,423		1,423	0
222	Kattegat Ålborg Bugt	222,159,160	2,026			2,026	2,026	2,026	2,026	2,026	0
224	Nordlige Lillebælt	122,123,224	1,588			389	1,588	389	1,588	389	75
225	Nordlige Kattegat Ålbæk Bugt	225	706			706	706	706	706	706	0
231	Lillebælt Snævringen	231,124,125,80	789		260	182	439	182	350	182	77

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
232	Nissum Bredning	232	880	302	639	297	866	300	752	300	66
233	Kaas Bredning og Venø Bugt	232,233	1,955			1,519	960	1,519	960	960	51
234	Løgstør Bredning	157,158,234, 233, 236	6,502			1,980	3,866	1,980	3,866	1,980	70
235	Nibe Bredning og Langerak	157, 158, 233, 234, 235, 236, 238	11,064		9,987	3,574	10,441	3,574	10,214	3,574	68
236	Thisted Bredning	236	1,091			269	508	269	508	269	75
238	Halkær Bredning	238	620			114	119	114	119	114	82

Appendix C – Maximum Allowable Nitrogen Inputs (N-MAIs) based on WFD scenario 1b and assuming 20% reduction in Danish land-based P-loads

Table C- 1 Water body-specific MAIs based on the two individual indicators chlorophyll-a (Chl-a) and light penetration depth (light) estimated from statistical models (STAT) and mechanistic models (MEK), respectively.
The table shows both the individual calculations and the averaged water-specific MAIs (without any aggregation) and the corresponding need for reduction in %. The data in this table are based on WFD scenario 1b and Danish land-based P-reductions set at 20%.

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
1	Roskilde Fjord,ydre	1,2	764			651	438	651	438	438	43
2	Roskilde Fjord, indre	2	388	388		388	361	388	361	361	7
6	Nordlige Øresund	6	1,098			1,098	1,098	1,098	1,098	1,098	0
16	Korsør Nor	16	40			40	23	40	23	23	43
17	Basnæs Nor	17	69			69	36	69	36	36	48
18	Holsteinborg Nor	18	22			22	22	22	22	22	0
24	Isefjord, ydre	24,165	899	546	638	545	637	546	638	546	39
25	Skælskør Fjord og Nor	25	44			37	40	37	40	37	16
28	Sejerø Bugt	28	164			164	164	164	164	164	0
29	Kalundborg Fjord	29	69	16	53	39	69	27	61	27	60
34	Smålandsfarvandet, syd	34	523			523	523	523	523	523	0
35	Karrebæk Fjord	35	1,272			1,272	857	1,272	857	857	33
36	Dybsø Fjord	36	61			61	61	61	61	61	0
37	Avnø Fjord	37	238			238	144	238	144	144	39
38	Guldborgsund	38	419			419	419	419	419	419	0
44	Hjelm Bugt	44	91			91	91	91	91	91	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
45	Grønsund	45	278			278	136	278	136	136	51
46	Fakse Bugt	46,47	510			441	509	441	509	441	14
47	Præstø Fjord	47	208			149	131	149	131	131	37
48	Stege Bugt	48,49	259			259	259	259	259	259	0
49	Stege Nor	49	24			18	13	18	13	13	47
56	Østersøen, Bornholm	56	859			184	860	184	860	184	79
57	Østersøen, Christiansø	57	3			0	3	0	3	0	97
59	Nærå Strand	59	98			35	41	35	41	35	64
62	Lillestrand	62	11			8	5	8	5	5	54
68	Lindelse Nor	68	50			50	50	50	50	50	0
72	Kløven	72	43			43	43	43	43	43	0
74	Bredningen	74	128			54	55	54	55	54	58
80	Gamborg Fjord	80	80			66	80	66	80	66	18
82	Aborg Minde Nor	82	152			34	34	34	34	34	78
83	Holckenhavn Fjord	83	290			98	143	98	143	98	66
84	Kerteminde Fjord	84,85	50			31	50	31	50	31	39
85	Kertinge Nor	85	24	24		23	15	23	15	15	37
86	Nyborg Fjord	83,86	308			164	285	164	285	164	47
87	Helnæs Bugt	87	216			67	216	67	216	67	69

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
89	Lunkebugten	89	16			5	16	5	16	5	68
90	Langelandssund	83,86,89,90	768			581	768	581	768	581	24
92	Odense Fjord, ydre	92,93	1,358	836	1,223	1,006	1,196	921	1,210	921	32
93	Odense Fjord, Seden Strand	93	1,288		690	1,288	549	1,288	619	619	52
95	Storebælt SV	95	188			41	188	41	188	41	78
96	Storebælt NV	96, 84, 85	227			38	227	38	227	38	83
101	Genner Bugt	101	35			13	25	13	25	13	62
102	Åbenrå Fjord	102	130	59		59	106	59	106	59	55
103	Als Fjord	103,104,105	269			67	269	67	269	67	75
104	Als Sund	104	68			68	68	68	68	68	0
105	Augustenborg Fjord	105	62	62		62	62	62	62	62	0
106	Haderslev Fjord	106	239			109	162	109	162	109	55
107	Juvre Dyb	107	349			119		119		119	66
108	Avnø Vig	108	60			36	30	36	30	30	50
109	Hejlsminde Nor	109	138			138	80	138	80	80	42
110	Nybøl Nor	110	66			46	58	46	58	46	30
111	Lister Dyb	111	2,155			1,089		1,089		1,089	49
113	Flensborg Fjord, indre	113	51	19		19	51	19	51	19	63
114	Flensborg Fjord, ydre	110,113,114	219	219		219	219	219	219	219	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
119	Vesterhavet, syd	119, 107, 111, 121, 120	8,538			3,934		3,934		3,934	54
120	Knudedyb	120	2,910	841		841		841		841	71
121	Grådyb	121	2,920			842		842		842	71
122	Vejle Fjord, ydre	122,123	968			495	968	495	968	495	49
123	Vejle Fjord, indre	123	561	561	478	532	481	547	479	479	15
124	Kolding Fjord, indre	124	493	222		256	304	239	304	239	52
125	Kolding Fjord, ydre	124,125	528			278	414	278	414	278	47
127	Horsens Fjord, ydre	127,128	833			525	457	525	457	457	45
128	Horsens Fjord, indre	128	782			409	454	409	454	409	48
129	Nissum Fjord, ydre	129,131,130	2,412			1,562	1,187	1,562	1,187	1,187	51
130	Nissum Fjord, mellem	130,131	2,083			1,146	884	1,146	884	884	58
131	Nissum Fjord, Felsted Kog	131	1,938	1,938		662	908	1,300	908	908	53
132	Ringkøbing Fjord	132	4,747		1,679	4,748	2,721	4,748	2,200	2,200	54
133	Vesterhavet, nord	133,129,130 ,131, 132	7,237			7,237		7,237		7,237	0
136	Randers Fjord, indre	136	2,925	2,925	1,588	2,925	1,588	2,925	1,588	1,588	46
137	Randers Fjord, ydre	136,137	3,078	3,078	1,587	3,078	1,587	3,078	1,587	1,587	48
138	Hevring Bugt	138, 137, 136	3,235		3,235	3,235	3,235	3,235	3,235	3,235	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
139	Anholt	139	9			9	9	9	9	9	0
140	Djursland Øst	140	856			493	856	493	856	493	42
141	Ebeltoft Vig	141	14			14	14	14	14	14	0
142	Stavns Fjord	142	5			5	3	5	3	3	37
144	Knebel Vig	144	18			11	18	11	18	11	39
145	Kalø Vig	144,145	190	190	190	190	190	190	190	190	0
146	Norsminde Fjord	146	140			140	73	140	73	73	48
147	Århus Bugt og Begtrup Vig	144,145,147	656	656	656	636	656	646	656	646	2
154	Kattegat Læsø	154	78			78	78	78	78	78	0
157	Bjørnholms Bugt, Riisgårde Bredning, Skive Fjord og Lovns Bredning	157,158	3,632			992	2,019	992	2,019	992	73
158	Hjarbæk Fjord	158	1,795			508	862	508	862	508	72
159	Mariager Fjord, indre	159	516			94	271	94	271	94	82
160	Mariager Fjord, ydre	159,160	963			870	672	870	672	672	30
165	Isefjord, indre	165	812	379		396	812	387	812	387	52
200	Kattegat Nordsjælland	1,2,24,165,200	1,857			1,857	629	1,857	629	629	66
201	Køge Bugt	201	1,109	870		1,009	751	940	751	751	32
204	Jammerland Bugt og Musholm Bugt	204	1,327			1,327	537	1,327	537	537	60

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
206	Smålandsfarvandet, åbne del	16,17,18,25,35,36,37,206	2,014			2,014	1,699	2,014	1,699	1,699	16
207	Nakskov Fjord	207	454			454	366	454	366	366	19
208	Femerbælt	207,208,209	1,530			1,468	1,530	1,468	1,530	1,468	4
209	Rødsand og Bredningen	209	521			284	359	284	359	284	45
212	Fåborg Fjord	212	30			11	30	11	30	11	64
214	Det sydfynske Øhav	68,72,212,214	633	176	458	176	529	176	493	176	72
216	Lillebælt, syd	87,101,102,103,104,105,110,113,114,216	1,309			462	1,309	462	1,309	462	65
217	Lillebælt Bredningen	74,82,106,108,109,217	956	276		371	956	323	956	323	66
219	Århus Bugt, syd, Samsø og Nordlige Bælthav	59,62,92,93,127,128,142,146,219	2,810			626	2,810	626	2,810	626	78
221	Skagerrak	221	1,423			1,423		1,423		1,423	0
222	Kattegat Ålborg Bugt	222,159,160	2,026			2,026	2,026	2,026	2,026	2,026	0
224	Nordlige Lillebælt	122,123,224	1,588			389	1,588	389	1,588	389	75
225	Nordlige Kattegat Ålbæk Bugt	225	706			706	706	706	706	706	0
231	Lillebælt Snævringen	231,124,125,80	789		298	182	439	182	369	182	77

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
232	Nissum Bredning	232	880	331	673	297	880	314	776	314	64
233	Kaas Bredning og Venø Bugt	232,233	1,955			1,583	1,118	1,583	1,118	1,118	43
234	Løgstør Bredning	157,158,234, 233, 236	6,502			1,980	4,091	1,980	4,091	1,980	70
235	Nibe Bredning og Langerak	157, 158, 233, 234, 235, 236, 238	11,064		10,199	4,200	11,064	4,200	10,632	4,200	62
236	Thisted Bredning	236	1,091			269	528	269	528	269	75
238	Halkær Bredning	238	620			114	209	114	209	114	82

Appendix D – Maximum Allowable Nitrogen Inputs (N-MAIs) based on WFD scenario 1b and assuming 30% reduction in Danish land-based P-loads

Table D- 1 Water body-specific MAIs based on the two individual indicators chlorophyll-a (Chl-a) and light penetration depth (light) estimated from statistical models (STAT) and mechanistic models (MEK), respectively.
The table shows both the individual calculations and the averaged water-specific MAIs (without any aggregation) and the corresponding need for reduction in %. The data in this table are based on WFD scenario 1b and Danish land-based P-reductions set at 30%.

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
1	Roskilde Fjord,ydre	1,2	764			651	442	651	442	442	42
2	Roskilde Fjord, indre	2	388	388		388	365	388	365	365	6
6	Nordlige Øresund	6	1,098			1,098	1,098	1,098	1,098	1,098	0
16	Korsør Nor	16	40			40	23	40	23	23	41
17	Basnæs Nor	17	69			69	36	69	36	36	48
18	Holsteinborg Nor	18	22			22	22	22	22	22	0
24	Isefjord, ydre	24,165	899	569	654	545	638	557	646	557	38
25	Skælskør Fjord og Nor	25	44			37	41	37	41	37	15
28	Sejerø Bugt	28	164			164	164	164	164	164	0
29	Kalundborg Fjord	29	69	23	59	39	69	31	64	31	55
34	Smålandsfarvandet, syd	34	523			523	523	523	523	523	0
35	Karrebæk Fjord	35	1,272			1,272	912	1,272	912	912	28
36	Dybsø Fjord	36	61			61	61	61	61	61	0
37	Avnø Fjord	37	238			238	149	238	149	149	37
38	Guldborgsund	38	419			419	419	419	419	419	0
44	Hjelm Bugt	44	91			91	91	91	91	91	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
45	Grønsund	45	278			278	136	278	136	136	51
46	Fakse Bugt	46,47	510			442	509	442	509	442	13
47	Præstø Fjord	47	208			151	136	151	136	136	35
48	Stege Bugt	48,49	259			259	259	259	259	259	0
49	Stege Nor	49	24			19	13	19	13	13	46
56	Østersøen, Bornholm	56	859			184	860	184	860	184	79
57	Østersøen, Christiansø	57	3			0	3	0	3	0	97
59	Nærå Strand	59	98			42	53	42	53	42	57
62	Lillestrand	62	11			8	5	8	5	5	53
68	Lindelse Nor	68	50			50	50	50	50	50	0
72	Kløven	72	43			43	43	43	43	43	0
74	Bredningen	74	128			59	62	59	62	59	54
80	Gamborg Fjord	80	80			66	80	66	80	66	18
82	Aborg Minde Nor	82	152			41	34	41	34	34	78
83	Holckenhavn Fjord	83	290			110	155	110	155	110	62
84	Kerteminde Fjord	84,85	50			31	50	31	50	31	39
85	Kertinge Nor	85	24	24		23	15	23	15	15	35
86	Nyborg Fjord	83,86	308			169	288	169	288	169	45
87	Helnæs Bugt	87	216			67	216	67	216	67	69

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
89	Lunkebugten	89	16			5	16	5	16	5	68
90	Langelandssund	83,86,89,90	768			581	768	581	768	581	24
92	Odense Fjord, ydre	92,93	1,358	836	1,223	1,015	1,231	926	1,227	926	32
93	Odense Fjord, Seden Strand	93	1,288		690	1,288	620	1,288	655	655	49
95	Storebælt SV	95	188			41	188	41	188	41	78
96	Storebælt NV	96, 84, 85	227			38	227	38	227	38	83
101	Genner Bugt	101	35			13	25	13	25	13	62
102	Åbenrå Fjord	102	130	59		59	106	59	106	59	55
103	Als Fjord	103,104,105	269			67	269	67	269	67	75
104	Als Sund	104	68			68	68	68	68	68	0
105	Augustenborg Fjord	105	62	62		62	62	62	62	62	0
106	Haderslev Fjord	106	239			110	163	110	163	110	54
107	Juvre Dyb	107	349			119		119		119	66
108	Avnø Vig	108	60			39	32	39	32	32	46
109	Hejlsminde Nor	109	138			138	90	138	90	90	35
110	Nybøl Nor	110	66			48	59	48	59	48	28
111	Lister Dyb	111	2,155			1,163		1,163		1,163	46
113	Flensborg Fjord, indre	113	51	19		19	51	19	51	19	63
114	Flensborg Fjord, ydre	110,113,114	219	219		219	219	219	219	219	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
119	Vesterhavet, syd	119, 107, 111, 121, 120	8,538			3,934		3,934		3,934	54
120	Knudedyb	120	2,910	841		841		841		841	71
121	Grådyb	121	2,920			930		930		930	68
122	Vejle Fjord, ydre	122,123	968			503	968	503	968	503	48
123	Vejle Fjord, indre	123	561	561	492	533	481	547	487	487	13
124	Kolding Fjord, indre	124	493	248		261	315	254	315	254	48
125	Kolding Fjord, ydre	124,125	528			278	420	278	420	278	47
127	Horsens Fjord, ydre	127,128	833			535	462	535	462	462	45
128	Horsens Fjord, indre	128	782			411	458	411	458	411	47
129	Nissum Fjord, ydre	129,131,130	2,412			1,736	1,272	1,736	1,272	1,272	47
130	Nissum Fjord, mellem	130,131	2,083			1,430	1,019	1,430	1,019	1,019	51
131	Nissum Fjord, Felsted Kog	131	1,938	1,938		906	1,115	1,422	1,115	1,115	42
132	Ringkøbing Fjord	132	4,747		1,679	4,748	3,197	4,748	2,438	2,438	49
133	Vesterhavet, nord	133,129,130 ,131, 132	7,237			7,237		7,237		7,237	0
136	Randers Fjord, indre	136	2,925	2,925	1,768	2,925	1,768	2,925	1,768	1,768	40
137	Randers Fjord, ydre	136,137	3,078	3,078	1,779	3,078	1,779	3,078	1,779	1,779	42
138	Hevring Bugt	138, 137, 136	3,235		3,235	3,235	3,235	3,235	3,235	3,235	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
139	Anholt	139	9			9	9	9	9	9	0
140	Djursland Øst	140	856			493	856	493	856	493	42
141	Ebeltoft Vig	141	14			14	14	14	14	14	0
142	Stavns Fjord	142	5			5	3	5	3	3	37
144	Knebel Vig	144	18			11	18	11	18	11	39
145	Kalø Vig	144,145	190	190	190	190	190	190	190	190	0
146	Norsminde Fjord	146	140			140	88	140	88	88	37
147	Århus Bugt og Begtrup Vig	144,145,147	656	656	656	636	656	646	656	646	2
154	Kattegat Læsø	154	78			78	78	78	78	78	0
157	Bjørnholms Bugt, Riisgårde Bredning, Skive Fjord og Lovns Bredning	157,158	3,632			992	2,230	992	2,230	992	73
158	Hjarbæk Fjord	158	1,795			555	966	555	966	555	69
159	Mariager Fjord, indre	159	516			100	305	100	305	100	81
160	Mariager Fjord, ydre	159,160	963			926	741	926	741	741	23
165	Isefjord, indre	165	812	379		396	812	387	812	387	52
200	Kattegat Nordsjælland	1,2,24,165,200	1,857			1,857	629	1,857	629	629	66
201	Køge Bugt	201	1,109	888		1,027	762	958	762	762	31
204	Jammerland Bugt og Musholm Bugt	204	1,327			1,327	540	1,327	540	540	59

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
206	Smålandsfarvandet, åbne del	16,17,18,25,35,36,37,206	2,014			2,014	1,699	2,014	1,699	1,699	16
207	Nakskov Fjord	207	454			454	369	454	369	369	19
208	Femerbælt	207,208,209	1,530			1,468	1,530	1,468	1,530	1,468	4
209	Rødsand og Bredningen	209	521			284	359	284	359	284	45
212	Fåborg Fjord	212	30			11	30	11	30	11	64
214	Det sydfynske Øhav	68,72,212,214	633	176	461	176	529	176	495	176	72
216	Lillebælt, syd	87,101,102,103,104,105,110,113,114,216	1,309			462	1,309	462	1,309	462	65
217	Lillebælt Bredningen	74,82,106,108,109,217	956	276		371	956	323	956	323	66
219	Århus Bugt, syd, Samsø og Nordlige Bælthav	59,62,92,93,127,128,142,146,219	2,810			626	2,810	626	2,810	626	78
221	Skagerrak	221	1,423			1,423		1,423		1,423	0
222	Kattegat Ålborg Bugt	222,159,160	2,026			2,026	2,026	2,026	2,026	2,026	0
224	Nordlige Lillebælt	122,123,224	1,588			389	1,588	389	1,588	389	75
225	Nordlige Kattegat Ålbæk Bugt	225	706			706	706	706	706	706	0
231	Lillebælt Snævringen	231,124,125,80	789		335	182	439	182	387	182	77

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
232	Nissum Bredning	232	880	361	707	297	880	329	793	329	63
233	Kaas Bredning og Venø Bugt	232,233	1,955			1,650	1,276	1,650	1,276	1,276	35
234	Løgstør Bredning	157,158,234, 233, 236	6,502			1,980	4,314	1,980	4,314	1,980	70
235	Nibe Bredning og Langerak	157, 158, 233, 234, 235, 236, 238	11,064		10,410	4,865	11,064	4,865	10,737	4,865	56
236	Thisted Bredning	236	1,091			269	547	269	547	269	75
238	Halkær Bredning	238	620			114	298	114	298	114	82

Appendix E – Maximum Allowable Nitrogen Inputs (N-MAIs) based on WFD scenario 1b and assuming 50% reduction in Danish land-based P-loads

Table E- 1 Water body-specific MAIs based on the two individual indicators chlorophyll-a (Chl-a) and light penetration depth (light) estimated from statistical models (STAT) and mechanistic models (MEK), respectively.
The table shows both the individual calculations and the averaged water-specific MAIs (without any aggregation) and the corresponding need for reduction in %. The data in this table are based on WFD scenario 1b and Danish land-based P-reductions set at 50%.

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
1	Roskilde Fjord,ydre	1,2	764			651	450	651	450	450	41
2	Roskilde Fjord, indre	2	388	388		388	373	388	373	373	4
6	Nordlige Øresund	6	1,098			1,098	1,098	1,098	1,098	1,098	0
16	Korsør Nor	16	40			40	25	40	25	25	36
17	Basnæs Nor	17	69			69	37	69	37	37	47
18	Holsteinborg Nor	18	22			22	22	22	22	22	0
24	Isefjord, ydre	24,165	899	614	685	545	639	580	662	580	36
25	Skælskør Fjord og Nor	25	44			38	43	38	43	38	13
28	Sejerø Bugt	28	164			164	164	164	164	164	0
29	Kalundborg Fjord	29	69	38	69	39	69	38	69	38	45
34	Smålandsfarvandet, syd	34	523			523	523	523	523	523	0
35	Karrebæk Fjord	35	1,272			1,272	1,015	1,272	1,015	1,015	20
36	Dybsø Fjord	36	61			61	61	61	61	61	0
37	Avnø Fjord	37	238			238	158	238	158	158	33
38	Guldborgsund	38	419			419	419	419	419	419	0
44	Hjelm Bugt	44	91			91	91	91	91	91	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
45	Grønsund	45	278			278	136	278	136	136	51
46	Fakse Bugt	46,47	510			445	509	445	509	445	13
47	Præstø Fjord	47	208			157	144	157	144	144	31
48	Stege Bugt	48,49	259			259	259	259	259	259	0
49	Stege Nor	49	24			19	13	19	13	13	44
56	Østersøen, Bornholm	56	859			184	860	184	860	184	79
57	Østersøen, Christiansø	57	3			0	3	0	3	0	97
59	Nærå Strand	59	98			59	76	59	76	59	40
62	Lillestrand	62	11			8	5	8	5	5	51
68	Lindelse Nor	68	50			50	50	50	50	50	0
72	Kløven	72	43			43	43	43	43	43	0
74	Bredningen	74	128			68	75	68	75	68	47
80	Gamborg Fjord	80	80			66	80	66	80	66	18
82	Aborg Minde Nor	82	152			69	64	69	64	64	58
83	Holckenhavn Fjord	83	290			134	177	134	177	134	54
84	Kerteminde Fjord	84,85	50			31	50	31	50	31	39
85	Kertinge Nor	85	24	24		23	16	23	16	16	31
86	Nyborg Fjord	83,86	308			179	296	179	296	179	42
87	Helnæs Bugt	87	216			67	216	67	216	67	69

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
89	Lunkebugten	89	16			5	16	5	16	5	68
90	Langelandssund	83,86,89,90	768			581	768	581	768	581	24
92	Odense Fjord, ydre	92,93	1,358	836	1,223	1,036	1,300	936	1,262	936	31
93	Odense Fjord, Seden Strand	93	1,288		690	1,288	761	1,288	725	725	44
95	Storebælt SV	95	188			41	188	41	188	41	78
96	Storebælt NV	96, 84, 85	227			38	227	38	227	38	83
101	Genner Bugt	101	35			13	25	13	25	13	62
102	Åbenrå Fjord	102	130	59		59	106	59	106	59	55
103	Als Fjord	103,104,105	269			67	269	67	269	67	75
104	Als Sund	104	68			68	68	68	68	68	0
105	Augustenborg Fjord	105	62	62		62	62	62	62	62	0
106	Haderslev Fjord	106	239			112	166	112	166	112	53
107	Juvre Dyb	107	349			119		119		119	66
108	Avnø Vig	108	60			45	38	45	38	38	37
109	Hejlsminde Nor	109	138			138	108	138	108	108	22
110	Nybøl Nor	110	66			51	62	51	62	51	23
111	Lister Dyb	111	2,155			1,318		1,318		1,318	39
113	Flensborg Fjord, indre	113	51	21		19	51	20	51	20	61
114	Flensborg Fjord, ydre	110,113,114	219	219		219	219	219	219	219	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
119	Vesterhavet, syd	119, 107, 111, 121, 120	8,538			3,934		3,934		3,934	54
120	Knudedyb	120	2,910	2,026		841		1,433		1,433	51
121	Grådyb	121	2,920			1,576		1,576		1,576	46
122	Vejle Fjord, ydre	122,123	968			519	968	519	968	519	46
123	Vejle Fjord, indre	123	561	561	519	535	483	548	501	501	11
124	Kolding Fjord, indre	124	493	314		271	335	293	335	293	41
125	Kolding Fjord, ydre	124,125	528			278	433	278	433	278	47
127	Horsens Fjord, ydre	127,128	833			553	468	553	468	468	44
128	Horsens Fjord, indre	128	782			414	466	414	466	414	47
129	Nissum Fjord, ydre	129,131,130	2,412			2,412	1,437	2,412	1,437	1,437	40
130	Nissum Fjord, mellem	130,131	2,083			2,083	1,281	2,083	1,281	1,281	39
131	Nissum Fjord, Felsted Kog	131	1,938	1,938			1,516	1,938	1,516	1,516	22
132	Ringkøbing Fjord	132	4,747		3,616	4,748	4,142	4,748	3,879	3,879	18
133	Vesterhavet, nord	133,129,130 ,131, 132	7,237			7,237		7,237		7,237	0
136	Randers Fjord, indre	136	2,925	2,925	2,126	2,925	2,126	2,925	2,126	2,126	27
137	Randers Fjord, ydre	136,137	3,078	3,078	2,160	3,078	2,160	3,078	2,160	2,160	30
138	Hevring Bugt	138, 137, 136	3,235		3,235	3,235	3,235	3,235	3,235	3,235	0

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
139	Anholt	139	9			9	9	9	9	9	0
140	Djursland Øst	140	856			493	856	493	856	493	42
141	Ebeltoft Vig	141	14			14	14	14	14	14	0
142	Stavns Fjord	142	5			5	4	5	4	4	35
144	Knebel Vig	144	18			11	18	11	18	11	39
145	Kalø Vig	144,145	190	190	190	190	190	190	190	190	0
146	Norsminde Fjord	146	140			140	118	140	118	118	16
147	Århus Bugt og Begtrup Vig	144,145,147	656	656	656	636	656	646	656	646	2
154	Kattegat Læsø	154	78			78	78	78	78	78	0
157	Bjørnholms Bugt, Riisgårde Bredning, Skive Fjord og Lovns Bredning	157,158	3,632			1,185	2,626	1,185	2,626	1,185	67
158	Hjarbæk Fjord	158	1,795			666	1,168	666	1,168	666	63
159	Mariager Fjord, indre	159	516			115	369	115	369	115	78
160	Mariager Fjord, ydre	159,160	963			963	866	963	866	866	10
165	Isefjord, indre	165	812	379		396	812	387	812	387	52
200	Kattegat Nordsjælland	1,2,24,165,200	1,857			1,857	629	1,857	629	629	66
201	Køge Bugt	201	1,109	923		1,064	784	993	784	784	29
204	Jammerland Bugt og Musholm Bugt	204	1,327			1,327	546	1,327	546	546	59

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
206	Smålandsfarvandet, åbne del	16,17,18,25,35,36,37,206	2,014			2,014	1,699	2,014	1,699	1,699	16
207	Nakskov Fjord	207	454			454	375	454	375	375	17
208	Femerbælt	207,208,209	1,530			1,468	1,530	1,468	1,530	1,468	4
209	Rødsand og Bredningen	209	521			284	359	284	359	284	45
212	Fåborg Fjord	212	30			11	30	11	30	11	64
214	Det sydfynske Øhav	68,72,212,214	633	176	468	176	529	176	498	176	72
216	Lillebælt, syd	87,101,102,103,104,105,110,113,114,216	1,309			462	1,309	462	1,309	462	65
217	Lillebælt Bredningen	74,82,106,108,109,217	956	276		371	956	323	956	323	66
219	Århus Bugt, syd, Samsø og Nordlige Bælthav	59,62,92,93,127,128,142,146,219	2,810			626	2,810	626	2,810	626	78
221	Skagerrak	221	1,423			1,423		1,423		1,423	0
222	Kattegat Ålborg Bugt	222,159,160	2,026			2,026	2,026	2,026	2,026	2,026	0
224	Nordlige Lillebælt	122,123,224	1,588			389	1,588	389	1,588	389	75
225	Nordlige Kattegat Ålbæk Bugt	225	706			706	706	706	706	706	0
231	Lillebælt Snævringen	231,124,125,80	789		409	182	439	182	424	182	77

No.	Name	Aggregation	Average annual N-load	Chl-a (STAT)	Light (STAT)	Chl-a (MEK)	Light (MEK)	N-MAI (STAT)	N-MAI (MEK)	Avg. MAI	Avg. reduction [%]
232	Nissum Bredning	232	880	427	775	297	880	362	827	362	59
233	Kaas Bredning og Venø Bugt	232,233	1,955			1,791	1,591	1,791	1,591	1,591	19
234	Løgstør Bredning	157,158,234, 233, 236	6,502			1,980	4,758	1,980	4,758	1,980	70
235	Nibe Bredning og Langerak	157, 158, 233, 234, 235, 236, 238	11,064		10,827	6,332	11,064	6,332	10,946	6,332	43
236	Thisted Bredning	236	1,091			271	586	271	586	271	75
238	Halkær Bredning	238	620			316	475	316	475	316	49