



ENVIRONMENT
AGENCY

URBAN WASTE WATER TREATMENT & NITRATE DIRECTIVES

Sensitive Areas (eutrophic) and "Polluted Waters" (eutrophic)

Guidance Note on Information Gathering for Future Designation Reviews

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CONTENTS

1.	Introduction	Page 4
2.	General Approach	Page 7
2.1	Evidence to support the identification of waters	Page 7
2.2	Waters to which the monitoring strategy is to be applied	Page 8
2.3	Assessing the impact of qualifying STWs on identified/potential SAs(E)	Page 10
3.	Collecting the data/information	Page 14
3.3	Overlap with other monitoring initiatives	Page 14
3.4	Relative Regional priorities	Page 14
4.	The Proposal Proformas	Page 16
	References.	Page 16

APPENDICES

Appendix One	Data/Information requirements for Running Freshwaters
Appendix Two	Data/Information requirements for Still Freshwaters
Appendix Three	Data/Information requirements for Coastal Waters
Appendix Four	Data/Information requirements for Estuarine Waters
Appendix Five	Proforma examples
Appendix Six	Existing Designations
Appendix Seven	New sites being considered for candidate status in 2001
Appendix Eight	Former HNDA's being considered for candidate status in 2001
Appendix Nine	Glossary of acronyms used

1. INTRODUCTION.

1.1 The intention of this document is to provide guidance for Regions on data/information gathering requirements for the periodic review of waters identified (ie. proposed to be designated) under those provisions of the Urban Waste Water Treatment (UWWT) and Nitrate Directives concerning eutrophication. The document outlines the recommendations of a national working group, convened to consider this matter, and addresses three issues:

- (i) The gathering of evidence to support the identification of a water as being, or at risk of shortly becoming, eutrophic.
- (ii) The identification of categories of waters to which the monitoring strategy should be applied.
- (iii) The question of monitoring to assist in deciding whether nutrient removal at individual qualifying STWs will have an effect upon the level of eutrophication.

The identification, under the two Directives, of waters for reasons other than eutrophication (eg elevated nitrates in ground and surface waters used for drinking water abstraction) is an issue which lies outside the scope of this document.

1.2 Directive provisions.

The provisions of the two Directives, as interpreted in the UK, for waters suffering, or at risk, from eutrophication, may be summarised as follows.

I. UWWT Directive (91/271/EEC).

Waters which are identified as eutrophic, or at risk of shortly becoming so, and which receive "qualifying" (>10,000 pe) STW discharges (either directly or into the upstream catchment), may be put forward as 'Candidate' Sensitive Areas (Eutrophic) and designated as SAs(E) if the DETR agree that a case is proven. The qualifying STWs will need P and/or N removal (as appropriate) to Directive standards within a maximum of 7 years from designation unless it can be demonstrated that such removal, for a particular STW, will have no effect upon the level of eutrophication.

ii. Nitrates Directive (91/676/EEC).

Waters which are identified as eutrophic due to nitrates from agricultural sources, or at risk of shortly becoming so unless protective action is taken, may be put forward as Candidate "Polluted Waters" (Eutrophic) and designated as PWs(E) if the DETR agrees that a case is proven. Areas of land draining to designated waters, and which contribute to their nitrogen pollution, will be designated as Vulnerable Zones. The Agency has

competency to enforce restrictions on agricultural activities in the form of 'Good Agricultural Practice' (GAP) within designated Vulnerable Zones under SI 98/1202, 'The Action Programme for Nitrate Vulnerable Zones (England & Wales) Regulations' which came into force on the 19th of December 1998.

iii. Review of designations (both Directives).

Sensitive Areas, Polluted Waters and Vulnerable Zones are subject to a review process which is conducted at four-yearly intervals. This process has occurred from 1993 onwards. The Environment Agency is expected by the DETR to provide the bulk of the required data/information.

With regard to implications for STWs, nutrient removal for qualifying STWs implicated in reviews of Sensitive Areas must be installed within 7 years of a review. The proviso regarding non-effectiveness of P/N reduction (see 1.2(I)) applies equally here. Nutrients from STW's are controlled only through the requirements of an UWWTD. Designation of a PW(E) under the Nitrate Directive would only require control of agricultural discharges although STW discharges may be considered, and control will be dependent on their contribution to the overall load.

- 1.3 A consistent and considered national approach to the collection and presentation of the evidence to (a) support designation candidates and (b) assess the contribution of individual STWs, is highly desirable. It will assist the Agency's Regions in deciding what monitoring is appropriate under the eutrophication provisions of the two Directives. It should ensure that relevant and adequate information is available during each review, for the EA national panel (*first hurdle*) and the DETR/WO (*second hurdle*) to assess the designation candidates, and reduce the potential for external bodies to question the strength of evidence.

1.4 Impact of STWs.

It will be necessary for tripartite DETR/EA/WSPLC consultations to take place following the final selection of candidate areas for designation. These consultations will involve consideration of the impact of individual qualifying STWs. The UWWTD Directive (Annex II) includes a caveat to the effect that discharges are excepted from the need for nutrient removal if it is shown that such treatment will have no effect on the level of eutrophication. In the past it has proved difficult to make this judgement at many sites and reports on individual areas may necessitate some research or modelling.

However, it is necessary now to incorporate, within the overall strategy, guidance for the next four-yearly review on data gathering to assist in making decisions on the effects of STWs.

1.5 Waters to be targeted.

This document also provides guidance on where to target the data/information gathering. Identifying now the waters to be targeted is necessary to ensure that (a) sufficient data may be collected prior to the next four-yearly review and (b) DETR and other interested parties are aware of potential future designations for costing purposes.

2. GENERAL APPROACH.

2.1 Evidence to support the identification of waters.

2.1.1 The evidence put forward in support of a given candidate water should reflect the provisions of the Directives (91/271/EEC³ and 91/676/EEC⁴) and the DoE Consultation Papers^{1,2}. This Guidance Note should be referred to in conjunction with those documents. To constitute a robust case the evidence must comprise **all** the following elements.

- (a) **General information** about the nature of the proposed area/waters.
- (b) **Chemical** data/information (which must include data for the limiting nutrient).
- (c) **Biological** data/information.
- (d) A demonstration that an "undesirable disturbance" (see UWWT/Nitrate Directive definitions of eutrophication) is occurring (to the quality of the water and the balance of organisms) or may soon occur. Eutrophication is defined within Article 2(11) of 91/271/EEC as '...the enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorous, causing an accelerated growth of algae and higher forms of plant life to produce an *undesirable disturbance* to the balance of organisms present in the water and to the quality of the water concerned'. This definition is transposed in its entirety in SI 94/2841. Eutrophication is defined within Article 2 (I) of 91/676/EEC as '...the enrichment of water by nitrogen compounds, causing an accelerated growth of algae and higher forms of plant life to produce an *undesirable disturbance* to the balance of organisms present in the water and to the quality of the water concerned'. This can most readily be demonstrated through information about adverse effects upon the uses of the waters, but also/alternatively by changes in the ecology. The adverse impact must be attributable to eutrophication (and not, for example, to organic pollution).

Proposed specific data/information requirements for each of the different categories of waters (still freshwaters, running freshwaters, estuaries and coastal waters), expanding upon the finalised criteria in Annex B of the March 1993 Consultation Paper², are laid out in the Appendices to this document. These guidelines also incorporate advice on data gathering to assist in assessing the impact of STWs (see 2.3).

2.1.2 Although it is necessary to make a robust case, it is not essential to collect data/information for every one of the identification criteria listed in the DoE Consultation Paper. Every proposal will be assessed on its merits, as to whether the overall balance of evidence, bearing in mind 2.1.1 above, constitutes a case for designation.

2.1.3 Waters at risk of shortly becoming eutrophic.

The main thrust of this paper is in relation to sites considered to be suffering from the symptoms of eutrophication now. However, there will be some waters, of a more oligotrophic nature, which presently exhibit only the initial symptoms of enrichment, but which may warrant protection for the very reason that they are truly sensitive to, and would rapidly suffer as a result of, accelerated nutrient enrichment. The Directives allow for the designation of such waters and the issue of evidence to support designation must therefore be considered. High conservation status sites (such as SSSI's, SPA's and SAC's) identified under the Habitats Directive (92/42/EEC; SI 94/2716) as part of the Natura 2000 Network, whose plant/animal communities may be damaged by eutrophication, are the most likely candidates. There will be relatively few such sites under UWWTD since P-controlled (inland) oligotrophic waters tend not to receive qualifying STW discharges.

It is proposed that Regions should put forward such cases on the basis of the particular sensitivities of the individual site, consulting as necessary with the relevant conservation body (English Nature or CCW). The task of identifying these waters may overlap with the consideration of any Special Ecosystem proposals⁵ as a water quality objective.

Saline water sites (eg SSSIs or IAMWs) will also need to be considered, as will those saline waters where, under the UWWTD, either HNDA status or Comprehensive Studies showed potential eutrophication effects.

2.2 Waters to which the monitoring strategy is to be applied.

- 2.2.1 It is necessary to identify now the principal waters to which future monitoring for UWWT/NO₃ Directives eutrophication purposes should be applied. This is because the Agency's Regions need to allow three years for data/information gathering to ensure the completion of a good data set. Monitoring programmes for new candidate sites should be initiated in the year immediately following the last review process. Designated SA(E) and PW(E) sites should continue to be monitored monthly in order that future submissions can be made regarding the effects of nutrient removal on eutrophication. In addition, the DETR, MAFF and the WSPLCs need to know where potential future work and money may need to be targeted under the two Directives. The conservation bodies (EN, CCW) are also keen to know where future work will be targeted and to assist the Agency, where appropriate, in making its case.

2.2.2 Basic principles - UWWTD.

Under this Directive, P-controlled or N-controlled waters may be considered for SA(E) status, but only where there is a direct and/or an upstream qualifying STW.

2.2.3 Basic principles - Nitrate Directive.

Under this Directive, the constraint of including only waters receiving qualifying STW discharges does not apply. Any waters (normally saline ones), not necessarily receiving discharges, where the principal source of nitrogen is from agriculture, may be considered for potential identification as PWs(E).

2.2.4 Categories of waters which may be included in forthcoming reviews.

A. Existing Sensitive Areas/Polluted Waters

- i. Sites identified as SAs(E) in any prior review of designations.

- *we must continue to monitor these in order that informed decisions can be made during the four-yearly review regarding both designation status and the impact of nutrient removal (where P-stripping has been installed).*

B. New Sensitive Areas/Polluted Waters

- i. Sites which have been proposed by the Agency as candidates for identification as SAs(E) in the last round, but which the DETR declined to designate, on the grounds of insufficient evidence.

- *these will need to be monitored over the immediate three years subsequent to their failure to be designated, so that robust information is available to the EA in deciding which sites to propose for identification in the next review.*

- ii. Sites initially proposed by the Agency as candidates for identification as SAs(E) or PWs(E) in the last round, but subsequently withdrawn by the Authority on the grounds of insufficient evidence.

- *as for i.*

- iii. Sites proposed by the Agency's Regions as candidates for identification as SAs(E) or PWs(E) in the last round, but rejected by the EA National Panel on the grounds of insufficient evidence.

- *as for i.*

- iv. Sites not proposed as SA(E) or PW(E) candidates for the last round (since insufficient evidence was available to make an assessment), but warranting investigation for the next review.

- *as for i.*

- v. Sites which were formerly designated under the UWWTD as High Natural Dispersion Areas (HNDA's) but which either failed their Comprehensive Study, had their status revoked by the Agency prior to the Governments removal of all HNDA's, or were recommended for increased scrutiny.

see 2.1.3.

The specific waters falling within the above categories, are shown in the Annexes 6-8 to this Guidance Note. The information gathering exercise, described in this Advice Note, is applicable to all the listed waters.

2.3 Assessing the impact of qualifying STWs on identified/potential SAs(E).

2.3.1 Techniques.

Predictive techniques (principally water quality models) are needed which will enable decisions to be made as to whether the UWWTD Annex II *caveat* is applicable ie. whether a given qualifying discharge can be exempted from the need for nutrient removal on the grounds that the treatment would have no effect upon the level of eutrophication. For the first round of designations, some relatively simple modelling was undertaken but, in many instances, this did not lead to a clear case for or against nutrient removal.

Techniques are required which will allow determination of:

- (a) the relative contributions of nutrient from various sources (ie. based upon internal and external loadings), nutrient fate/transport within the water environment and;
- (b) the effects of control measures such as nutrient removal, on nutrient concentrations in receiving waters and their influence on the manifestation of eutrophic effects such as algal proliferation or changes to the macrophyte community.

The former will assist in identifying the key sources for control. For the latter it would be ideal if limiting concentrations for the relevant nutrient could be defined (below which problems would not occur). However, this would seem to be an unrealistic hope, certainly in the case of running freshwaters, estuaries and coastal waters, since there are numerous other factors affecting primary production. For rivers, simple comparisons (eg of macrophyte species and % cover upstream and downstream of STWs) will continue to be useful in demonstrating discharge impact.

When modelling the effects of discharges on nutrient concentrations, models such as SIMCAT and TOMCAT, which are in general Agency use and are well understood, should be used. The requirements of data input to these models should drive the collection of environmental data, helping to ensure a pragmatic collection programme is achieved.

Initial indications, with regard to model availability, are as follows.

i. Still Freshwaters.

A model (Protec II) has been developed which appears to suit our purposes.

ii. Rivers.

The bulk of the discharge assessment work will fall in this category. A number of indices have been developed which allow determination of the impact of nutrient removal upon the biology (algae or macrophytes) of the receiving waters such as Mean Trophic Rank (MTR) or the Trophic Diatom Index (TDI). Models which have been used in support of candidate Sensitive Areas include TOMCAT (Thames Region), TIMCAT (Thames Region), SIMCAT (Anglian Region, Midlands Region) and QUASAR (South West Region). All have been used to determine the impact of treatment upon nutrient concentrations in receiving waters. Such models require river quality and flow plus effluent quality and flow information.

With these it is possible to model the existing situation, based upon real or estimated flow and quality for all significant inputs affecting the SA(E) and then remodel, setting some or all of the qualifying STWs to the concentration or % reduction standards specified in the Directive. This would predict the effects of nutrient removal treatment, at particular STWs, on resultant nutrient concentrations in the receiving waters.

iii. Estuaries and coastal waters.

The situation is broadly similar to that for rivers, however there are water quality models which allow determination of chlorophyll-*a* concentrations in estuaries and enclosed coastal waters (bays) such as ECOS. These principally use information on nutrient loadings. Such models have yet to be developed for many individual UK estuaries and to date have not been widely used for modelling chlorophyll. The methodology behind the determination of coastal eutrophication has been described in detail within the Comprehensive Studies Task Team (CSTT) report, a document produced in order to set up a framework for the scrutiny of less-sensitive areas (HNDA's) under the UWWTD during the 1994 and 1998 designation reviews. The CSTT report includes a section on predicting the trophic state of saline waters, which may be helpful in undertaking assessments.

There will be a need to quantify nutrient (nitrogen) loads to estuaries and coastal waters for both UWWT and Nitrate Directives, to assess the relative contributions from agriculture and STWs. Some project work by WRc/SNIFFER⁸ concerning eutrophication risk assessment has been completed and should provide assistance in this area, though further R&D may need to be considered.

2.3.2 Information gathering requirements.

To a large extent, the level of information required for the modelling will be case specific. Initial modelling runs can be undertaken using estimated (or assumed) figures for effluent nutrient concentrations and flow. Receiving water quality data will be generated from the EA's monitoring to determine whether the waters themselves are eutrophic.

The initial modelling may suffice for some discharges where treatment will clearly have an insignificant effect upon resultant receiving water nutrient concentrations. It will also permit identification of cases where the model is sensitive to effluent quality and where actual effluent data will thus be needed for a robust assessment.

It is necessary to consider now what data collection is required to satisfy (a) future modelling needs and (b) other (less sophisticated) assessments of discharge impact. The following approach is therefore recommended.

(i) Receiving water quality and flow data.

Water quality data, for the relevant indicator parameters, will be generated through Agency monitoring to determine whether the waters themselves are eutrophic. River flow data will also be required. **Guidance on basic monitoring in this context is incorporated within the Appendices. It is anticipated that these data will broadly satisfy model requirements though Regions should extend the monitored parameters as required where specific model needs are known.** The data generated for rivers will also permit less complex assessments of discharge impact, eg upstream/downstream comparisons, which can be equally useful in demonstrating whether a deterioration (in terms of eutrophication) is occurring.

(ii) Effluent nutrient quality and flow details.

These are required to allow an assessment of the relative P or N contribution from qualifying STWs in comparison to other sources including other discharges (trade or sewage), diffuse discharges, and the river load itself.

For STW flow, estimates based upon population or consented dry weather flow should suffice, but as the UWWTD is implemented an increasing number of STW's will have measured data available. Where actual effluent nutrient concentrations are required, it is likely that, for discharges to P-controlled waters, both total P and ortho-P (in the effluent) will be required, and for discharges to N-controlled waters, both total N and TON, to quantify both the potentially and readily available nutrient inputs. A minimum monthly frequency is recommended. However, as discussed above, actual effluent quality data may not be required in all cases. The need to put in place effluent monitoring is less urgent than receiving water monitoring. One or two years effluent data should suffice. **Therefore, until the precise arrangements are resolved, Regions need not put in place additional data collection for nutrients or flow in**

STW effluents. However, Regions should bear in mind the need to complete the major discharge assessment exercise by the end of the third year of data gathering and should therefore begin now to consider model and effluent data requirements. Further advice will be forthcoming in the form of guidance developed to assist the formulation of eutrophication action plans under the Agency's proposed Strategy on Eutrophication.

3. COLLECTING THE DATA/INFORMATION.

3.1 Existing chemical and biological monitoring programmes will need to be reviewed in relation to the requirements laid out in Section 2 and the Appendices. Regions should ideally undertake the review with a view to implementing the programme of data/information gathering in the first year following the prior round of designation. This monitoring may prove to be a long term commitment, since the Directive requirement to review areas/zones every four years is a permanent obligation. The level of monitoring will be reviewed periodically.

3.2 In carrying out the review, Regions should maximise the use of data from their routine monitoring programmes, in order to minimise any extra monitoring burden. Additional monitoring needs should be addressed where possible by supplementing the currently-monitored determinands on the existing sampling routes/points. Creation (or resurrection) of extra sampling points should be minimised although some additional monitoring effort will almost certainly be involved and the DETR has stressed that the monitoring arrangements must be sufficiently robust for all future decisions on eutrophic status to be taken.

The Appendices attempt to strike a balance, within the overall exercise, between the twin purposes of (a) monitoring to support the designation of waters as eutrophic (or at risk) and (b) monitoring to assist in assessing the impact of individual qualifying discharges. Regional staff, in reviewing their monitoring programmes, should undertake the task with these twin aims clearly in mind.

3.3 Overlap with other monitoring initiatives.

There are a number of other monitoring initiatives currently being developed/introduced which involve (sometimes amongst other things) nutrients and related parameters. Examples for inland waters are the various components of the GQA and River Ecosystem (RE) schemes, Blue-Green Algae Action Plans⁶ and the Lake Classification proposals⁷. In saline waters, examples include the LOIS and SONUS studies. In developing this guidance note it is only possible to highlight the issue of overlap. It falls to Regions to rationalise the various requirements within their monitoring programmes. A more holistic review of the monitoring of nutrients and related parameters will be contained within the Agency's proposed Strategy on Eutrophication.

3.4 Relative Regional priorities.

The importance of eutrophication as a water quality issue varies considerably from Region to Region. Within the procedures for proposing (a) waters for designation and

(b) particular STWs for nutrient removal, there is a degree of flexibility for Regions to reflect the relative priority afforded to eutrophication. Whilst any water which clearly meets the criteria should be put forward as a designation candidate, as required by the Directive, the initial selection of candidates will essentially lie with Regions. Furthermore, Regions should bear in mind that, where nutrient removal at a particular STW will have no effect on eutrophication, it is possible to designate the water but not require removal at the works.

- 3.5 This monitoring programme and the complementary R&D work will be reviewed as the work progresses. Once the information has been collected and a designation proposal report produced it will be vetted, by the EA National Panel. The panel will assess and compare each SA(E) and PW(E) proposal and draw up a unified list for submission to the DETR as the Authority's designation candidates. The proposals will be submitted on a revised version of the Environment Agency proforma (see 4). It is anticipated that completion of proformas and assessment by the Agency's National Panel will begin at the start of the fourth year following the last round of designations.
- 3.6 The chemical data sets the scene for whether an area is to be considered as potentially eutrophic in the term of the Government Guidelines¹. However, the judgement on whether the area is eutrophic in the terms of the Directive needs to be based on the, 'undesirable disturbance to the balance of organisms'. It is equally important, therefore, to put in place a programme of biological analysis which gives information on the state of the environment within the Sensitive Area and compares that to a relatively unimpacted area. Both chemical and biological monitoring have roles to play in the designation of Sensitive Areas and must receive equal importance in Regional monitoring programmes.

4. THE PROPOSAL PROFORMAS.

The Appendices to this paper set out the suggested range of data/information required to constitute a robust submission for a proposed eutrophic water/area. The Agency proforma document is the main vehicle by which its proposals are presented to the Department. An additional proforma, Form 'G', has been added in order to allow an assessment of the effects downstream of nutrient removal of a qualifying discharge. This document is set out in Appendix 5.

REFERENCES

- 1 Consultation Paper on Criteria and Procedures for Identifying Sensitive Areas and Less Sensitive Areas (UWWTD) and "Polluted Waters" (Nitrates Directive) in England and Wales. DoE, Welsh Office, MAFF (March 1992).
- 2 Consultation Paper on Methodology for Identifying Sensitive Areas (UWWTD) and Designating Vulnerable Zones (Nitrates Directive) in England and Wales. DoE, Welsh Office, MAFF (March 1993).
- 3 Council Directive of 21 May 1991 concerning urban waste water treatment (91/271/EEC).
- 4 Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC).
- 5 Statutory Water Quality Objectives: Proposed Special Ecosystem Classification for Rivers. Environmental Quality Section, NRA Bristol Office.
- 6 Guidelines for the Development and Implementation of Action Plans to Combat and Review the Incidence of Blue-Green Algal Blooms. Toxic Algae Task Group.
- 7 Lakes - Classification & Monitoring; a strategy for the classification of lakes. Draft R & D Note 286/5/A. (Final report expected soon.) NRA R&D Project 286.
- 8 Eutrophication of Tidal Waters: Classification & Screening Tools. WRC/SNIFFER projects on eutrophication risk assessment (lakes, rivers and tidal waters). Report SR3707,, 1994.
- 9 Comprehensive studies for the purposes of Articles 6 & 8.5 of 91/271/EEC, the Urban Waste Water Treatment Directive. Marine Pollution Monitoring Management Group (MPMMG) Comprehensive Studies Task Team (CSTT). January 1997.
- 10 The Trophic Diatom Index - A User's Manual. Bowburn Consultancy. R & D Technical Report E2. December 1996.

- 11 Mean Trophic Rank: A User's Manual. NERC Institute of Freshwater Ecology IACR Centre for Aquatic Plant Management. R&D Technical Report E38. October 1998.
- 12 The Urban Waste Water Treatment (England & Wales) Regulations - A Guidance Note issued by the Department of the Environment, Transport and the Regions and the Welsh Office. July 1997.

APPENDIX ONE.

EC UWWT & NO₃ DIRECTIVES INFORMATION/DATA IN RELATION TO EUTROPHICATION

Running Freshwaters.

This Appendix must be read in conjunction with Sections 2 & 3 of the Guidance Note.

The following points indicate the level of information which will be required to be gathered for use in future reviews .

1. *General description.*

An outline of the nature of the proposed candidate water will be required (at the time the proforma is completed), including the following points:

- the length of the stretch in km, NGRs/names of start/finish points, and indicating whether the proposed stretch is in the upper/middle/lower reaches.
- local hydrogeology; state whether it is a chalk stream, a clay catchment, an acidic upland stream etc.
- flow regime and depth; state whether it is deep and sluggish, canalised, fast flowing and shallow, etc. Include an estimate of summer retention time, indicating whether the 5 day algal multiplication period may be exceeded.
- comments on whether any significant changes to the nature of the watercourse and the quality regime occur along the proposed stretch. Indicate where and why such changes occur.
- a brief summary of the uses of the watercourse including any conservation status. This should accord with uses identified under the Local Environment Agency Plan (LEAP) (if such a plan has been produced). (See also 6.)
- a MAP showing the stretch, the location of qualifying and other discharges, chemical and biological monitoring points, and other relevant points eg abstractions to water treatment works/reservoirs.

2. *Location of monitoring points.*

Data should be collected at a sufficient number of points along the proposed stretch, to adequately represent the whole length and, particularly for modelling purposes, to demonstrate the impact of major discharges (including trade effluents) to that system.

Data for a monitoring point (or points) upstream of the proposed eutrophic stretch should also be provided, to demonstrate a contrast. Chemical and biological points should coincide where possible (this being essential for DO and chlorophyll-*a* points),

but need not if biological relevance would be compromised.

For chemical sites, the general approach should be as for the GQA scheme, having one point between each major discharge and further points to demonstrate the effects of important tributaries or other significant influences on quality through the stretch. The need to derive nutrient load assessments from the data collected should influence the choice of sites.

For biological sites, the choice of monitoring points for phytoplankton (chlorophyll) should allow for algal doubling times downstream of discharges, and for macrophytes should be aimed at best demonstrating differences (ie change in percentage cover) upstream and downstream of qualifying discharges (see also 5). The site should be relevant to the collection of diatom samples, or if this is not possible should allow for the placing of artificial substrates for diatom attachment.

3. *Time period for data sets.*

Data should be derived from a time period long enough to avoid distortion due to particularly wet or dry years. A minimum of two years data, but preferably a period covering three summers, is recommended.

4. *Chemical parameters.*

A brief description of the parameters considered to be relevant (and less relevant) will be required.

With regard to sampling frequencies, at least 30 samples should be collected over the whole monitoring period. This broadly equates to a monthly frequency. If laboratories other than those of the Agency are used for sample analysis AQC will have to be present.

Data for the following parameters should be collected, if considered relevant, the nutrient data being obligatory. In general, nitrogen is not regarded as a primary controlling factor in freshwater nutrient dynamics:

- (i) Orthophosphate - mean, max, standard deviation, no. of samples.

It is recognised that the loading of phosphorus is determined by total P. However, in most river systems ortho-P will be a good estimate of total P. In terms of identifying problem/priority sites ortho-P is fully adequate and it is also the form specified, for running freshwaters, in the DoE consultation paper.

- (ii) D.O.%SAT - min, max, and no. of samples from spot sampling.
(Daytime/nighttime summer values?).

data from AWQM stations are desirable, to show day/night variations particularly in the summer months.

For each of the above (other than AWQM data), the number of results breaching the DoE criteria (P.30 of Annex B of the 1993 Consultation Paper) will be required.

Graphical and schematic presentations will be required, since these are a considerable help to those assessing the proposals.

5. *Biological evidence.*

- (i) A brief description of the parameters considered to be relevant (and less relevant) will be required. For instance, in the headwaters, macrophyte % cover will normally be an important indicator and planktonic algae (indicated by chlorophyll-*a* data) will be almost absent (due to the flow regime). In deep slow flowing waters, planktonic algae (and hence chlorophyll-*a*) will usually be good indicators and macrophyte cover may be sparse due to the effect of depth on light penetration.
- (ii) Macrophytes (including macrophytic algae).

Macrophyte surveys should be targeted to demonstrate a change in percentage cover and species diversity U/S and D/S of a STW discharging into a proposed SA(E).

High % cover measurements for species indicative of eutrophic conditions, together with low species diversity, may be taken to indicate a eutrophic situation.

A two-tiered survey approach is recommended. At sites where the impact of a discharge has not been identified or if the trophic status is uncertain a general assessment of the area should be made, involving walking the river bank and noting the dominant macrophyte species present. This "look-see" technique should be used to target the sites which require further investigation. Where there is a visible change in the macrophyte community structure U/S and D/S of a discharge, this should be assessed by more intensive surveys, to determine the percentage cover of each species present.

The timing of surveys will vary between the Regions because of local factors affecting macrophyte growth. Surveys should not take place following river dredging or weed cutting. A minimum of two full surveys should take place in any one of the first three years up to the next round of designations, together with one survey in each of the other two years. Therefore a minimum of four surveys should be carried out at each site over the data gathering period.

For sites which merit further intensive investigation, the Mean Trophic Rank (MTR) has been developed in order to express the impact of eutrophication in terms of a biotic score based on the macrophyte community. This system is particularly responsive to changes in phosphate at concentrations of 1 mg l⁻¹ or below. Macrophyte surveys conducted for the purposes of calculating MTR should be

(iii) Diatoms

Sampling frequency

Information obtained from the composition of the diatom community can be used to aid interpretation of:

- the state of the river upstream of the candidate SA(E) with respect to inorganic nutrients and organic pollution
- the presence or absence of changes in floral composition downstream of a qualifying discharge
- whether this change can be attributed to nutrients alone or some other component of the discharge, and
- whether or not nutrient removal is likely to lead to floristic change downstream of a qualifying discharge

- Sampling frequency should be as for the chemical parameters ie. monthly.

Locations should be those where algal blooms are anticipated to occur and should coincide with those for DO % Saturation.

- (v) For fauna (invertebrates and fish), supporting information should be presented if this is considered to assist in demonstrating effects of eutrophication. No additional data collection should be initiated for the purposes of this exercise.
- (vi) The above will need to be backed up by statements about effects upon river biology eg. changes to diversity, abundance, community structure etc. Significant algal blooms (particularly blue-greens) and their persistence should be investigated and documented, as should any extreme events eg fish kills due to DO depletion.
- (vii) Photographic evidence will be particularly valuable in demonstrating algal/macrophyte cover and in contrasting sites upstream and downstream of STWs. Graphical and schematic presentations, will be required, since these are a considerable help to those assessing the proposals.

6. *Demonstration of an undesirable disturbance.*

For a water to qualify as eutrophic, as defined in the Directive, it is necessary to demonstrate that an "undesirable disturbance" is occurring to the balance of organisms and the quality of water. In Section 5 (Biological Evidence) the need to document the ecological effects of eutrophication ie. upon diversity, abundance and community structure is stressed. This information is extremely valuable in demonstrating an "undesirable disturbance". Similarly, for the Chemical Parameters (Section 4), low dissolved oxygen levels would be a relevant indicator.

In addition, statements regarding any adverse effects upon the recognised river uses of the stretch eg. abstractions, fisheries, amenity etc, attributable to eutrophication problems, should be compiled. These should accord with the content of any LEAP for the catchment. Details of relevant complaints (including the reasons for them) from water companies, industry, anglers and angling associations, canoeists, conservation bodies, members of the public etc, are useful in this regard and should therefore be recorded. Press cuttings are also a potentially valuable source of supportive evidence. The need to undertake weed clearance to avoid flooding or permit navigation is another factor worthy of mention in this context.

Any conservation status (eg SSSI, SAC, or SPA within the Natura 2000 Network) should be highlighted, particularly if that status is considered to be dependant upon the trophic state of the water and/or suffering due to accelerated nutrient inputs and/or if the stretch may fall within the Special Ecosystem Use-Class of the SWQO system. Regions are encouraged to liaise with English Nature/CCW in assessing effects upon sites of conservation interest eg SSSI rivers, in order best to maximise the available information regarding these sites.

In order to constitute an undesirable disturbance, it is not necessary for there to be adverse effects in terms of all the factors (chemistry, biology, river uses and conservation

status). Weight of evidence in each case will be assessed on its merits.

7. *River flow data.*

These should be collected at relevant gauging stations to permit determination of loadings.

Where there is no gauging station at a point of interest, then flow will need to be estimated, or spot flow measurements taken.

APPENDIX TWO.

EC UWWT & NO₃ DIRECTIVES INFORMATION/DATA IN RELATION TO EUTROPHICATION

Still Freshwaters.

This Appendix must be read in conjunction with Sections 2 & 3 of the Guidance Note.

The following points indicate the level of information which will be required to be gathered for use in future reviews.

1. *General description.*

An outline of the nature of the proposed candidate water and its catchment will be required, including the following points:

- the extent of the proposed area/water.
- for lakes, comments on the natural trophic status and major influences upon this.
- depth and whether stratification occurs.
- for raw water reservoirs, a brief description of the water supply scheme, indicating the main raw water inputs to the reservoir, the main influences on trophic status, and also comments upon whether phosphorus reduction measures (eg. ferric dosing), or other methods of alleviating the effects of eutrophication (eg. destratification), have been implemented.
- whether the water body has been identified for development of a Blue-Green Algae Action Plan.
- an estimate of retention time.
- a brief indication of the uses of the water body including any conservation status. This should accord with uses identified under the Local Environment Agency Plan (LEAP) (if such a plan has been produced).
- a MAP showing the proposed SA/PW, the location of qualifying and other discharges, chemical and biological monitoring points, and other relevant points eg. abstractions to water treatment works.

2. *Location of monitoring points.*

Data should be collected for sufficient points within the proposed SA/PW to adequately represent the whole water body and assess the effects of major inputs. The quality of

water at abstraction points (to WTW) is also normally of interest. Sampling from boats should be minimised, eg. if suitable jetties or other structures are present. Data collected from abstraction points by the Water Company can be utilised, provided that it is pre-treatment and the Region is satisfied with the AQC record of the Company.

3. *Time period for data sets.*

Data should be derived from a time period long enough to avoid distortion due to particularly wet or dry years. A minimum of two years data, but preferably a period covering three summers, is recommended.

4. *Chemical parameters.*

Data for the following parameters should be collected. In general, nitrogen is not regarded as a primary controlling factor in freshwater nutrient dynamics:

(i) Total phosphorus - mean, max, standard deviation, no. of samples.

At least 30 samples should be collected over the whole monitoring period. This broadly equates to a monthly frequency. If laboratories other than those of the Agency are used for sample analysis AQC will have to be present.

(ii) Dissolved Oxygen.

For water bodies which stratify, data from the epilimnion and hypolimnion, to demonstrate the extent of surface supersaturation and deep-water oxygen depletion, are desirable. Two sets of data per summer should suffice for establishing whether stratification occurs.

(iii) Water clarity

Secchi disc transparency - mean, max, min, no of samples, should be gathered where feasible, ideally at monthly sampling frequency. Extra monitoring effort should be minimised eg Water Companies may be a useful source of data.

For each of the above (other than DO), the number of results breaching the DoE criteria (P.29 of Annex B of the 1993 Consultation Paper) will be required.

Graphical and schematic presentations will be required, since these are a considerable help to those assessing the proposals.

5. *Biological evidence.*

- (I) General. A description of the parameters considered to be relevant (and less relevant) will be required. The dominant algal species and the changing assemblages from spring through to autumn are normally an important indicator of trophic status. A summary will be required regarding biological effects attributable to eutrophication eg changes in algal (or macrophyte) diversity, abundance, species composition etc.

The occurrence of algal blooms, in particular, should be documented including their type(s) (especially blue-greens) and whether they are sustained. If the water body is identified for development of Blue-Green Algae Action Plan, in accordance with the Toxic Algal Task Group's guidelines⁶, then details of the reasons for identification (the derivation of the priority score) should be provided.

Any extreme events such as fish kills due to DO depletion should also be recorded. Effects upon macrophytes, invertebrates and fish species should be noted if it is considered that these assist in demonstrating the effects of eutrophication.

- (ii) Chlorophyll-*a* - mean, max, no. of samples.

A monthly sampling frequency is recommended. Individual measurements from the summer months are useful, to assist in demonstrating whether algal blooms are sustained.

- (iii) Photographic evidence should be gathered if this will assist in demonstrating an "undesirable disturbance" eg blue-green algal scums.

Graphical and schematic presentations will be required, since these are a considerable help to those assessing the proposals.

6. *Demonstration of an undesirable disturbance.*

For a water body to qualify as eutrophic, as defined in the Directive, it is necessary to demonstrate that an "undesirable disturbance" is occurring to the balance of organisms and the quality of water. In Section 5 (Biological Evidence) the need to document the ecological effects of eutrophication ie upon diversity, abundance and community structure is stressed, as is the need to highlight blue-green algal problems. Such information is extremely valuable in demonstrating an "undesirable disturbance".

In addition, statements regarding any adverse effects upon the recognised uses of the water body eg water supply abstractions, fisheries, amenity etc, attributable to eutrophication problems, should be compiled. These should accord with the content of any LEAP for the catchment. Details of relevant complaints (including the reasons for them) from water companies, industry, angling associations, windsurfers/yachtsmen, canoeists, conservation bodies, members of the public etc, are useful in this regard and should therefore be recorded. Details of closures or restrictions on amenity usage due to

blue-green algae are a good example of relevant information in this respect and should therefore be documented.

Any conservation status (eg SSSI) should be highlighted, particularly if that status is considered to be dependant upon the trophic state of the water body and/or suffering due to accelerated nutrient inputs. Regions are encouraged to liaise with English Nature/CCW in assessing effects upon sites of conservation interest eg SSSI lakes, in order best to maximise the available information regarding these sites.

In order to constitute an undesirable disturbance, it is not necessary for there to be adverse effects in terms of all the factors (chemistry, biology, water uses and conservation status). The weight of evidence in each case will be assessed on its merits.

APPENDIX THREE.

EC UWWT & NO₃ DIRECTIVES INFORMATION/DATA IN RELATION TO EUTROPHICATION

Coastal Waters.

This Appendix must be read in conjunction with Sections 2 & 3 of the Guidance Note.

1. *Agency monitoring strategy for coastal waters.*

The Environment Agency will continue to examine coastal waters which are considered at risk of eutrophication. The main body of the Agency's marine monitoring will be that conducted under the National Marine Pollution (NMP) scheme, which will be used to detect temporal trends in selected determinands. Considerable national & international R&D has been carried out (JONUS, LOIS) and is still being undertaken (SONUS). The UK is now a contracted party to the OSPAR Strategy to Combat Eutrophication and as such will be conducting a *screening procedure* (on the basis of existing data) in order to decide which waters will require the application of a *comprehensive procedure*.

2. *Location of monitoring points and parameters of interest.*

2.1 It is recommended that a primarily observational approach is adopted, with the aim of establishing the occurrence of exceptional nuisance algal blooms, the duration of blooms, excessive macro-algal growths, or other evidence of undesirable disturbances.

2.2 This should be undertaken at existing monitoring points (notably those for bathing waters and shellfish waters). Those saline waters where either HNDA status or Comprehensive Studies showed potential eutrophication effects should be monitored in the period preceeding the 2001 revue (these areas are listed in Appendix Eight). All EC bathing waters are monitored weekly, May to September inclusive, as part of the National Marine Algal Bloom Monitoring Programme. On occasions where algal blooms are seen to be present, samples should be taken for cell counts and chlorophyll-*a* concentration (the parameters with numeric indicator values in the DoE consultation paper). Monthly summer sampling for these parameters is recommended for sites where regular "significant blooms" occur and consideration should be given to remote sensing surveys, from aircraft, at such sites to determine spatial distribution of blooms and evidence of impact. "Significant blooms" have been defined in the National Marine Algal Bloom Monitoring Programme as blooms causing significant accumulations of algal material on beaches and which have led, or may lead, to public concern or complaints.

2.3 All reports of undesirable disturbances attributable to algal blooms should be investigated and records collated. This will include disturbance such as excessive scum

and foam on water and on beaches, and benthic invertebrate, shellfish, and fish mortalities not associated with organic pollution. Historic data/records should also be presented where supportive.

- 2.4 Shorelines should be examined in summer (June - August) to establish the presence of excessive growth of macro-algae (*Enteromorpha spp.* and *Ulva spp.*) in areas where there are known problems. Excessive growth would be areas of greater than 10 hectares in which the average algal cover exceeds 25%. In such areas quantitative information on % cover should be collected for three summers.
- 2.5 Winter nutrients should be determined on three occasions, between December and February each year, to determine the degree of hypernutrification at those coastal sites identified under this monitoring exercise. Analyse for TON and NH_3 , to establish levels of dissolved available inorganic nitrogen, and for nitrite. The current CSTT advice⁹ when assessing for hypernutrification is that, 'Hypernutrification exists when Winter values of nutrient concentrations.....significantly exceed 12 mmol DAIN m^{-3} in the presence of at least 0.2 mmol DAIP m^{-3} .
- 2.6 Data collected for other purposes, which may assist in the assessment of eutrophication, should be collated for use in this exercise.

3. *General description.*

For sites where evidence is considered sufficient to put the waters forward as a designation candidate, an outline of the nature of the proposed eutrophic water should be given, including the following points:

- the extent of the area/water and a brief description of the oceanography.
- comments on whether any significant changes to the quality regime of the waters occur within the proposed stretch of coastline. Indicate where and why such changes occur.
- a map showing the SA[E]/PW[E], the location of qualifying (and other significant) discharges (if applicable), chemical and biological monitoring points, and any other relevant features.
- details of any significant designations or interests in relation to other environmental initiatives eg SSSI, Important Area of Marine Wildlife, proposed SAC under Habitats and Species Directive, OSPAR site etc.
- photographic evidence of algal blooms and/or scums and wildlife mortality would be a great help in demonstrating an, 'undesirable disturbance'.

APPENDIX FOUR.

EC UWWT & NO₃ DIRECTIVES INFORMATION/DATA IN RELATION TO EUTROPHICATION

Estuaries.

This Appendix must be read in conjunction with Sections 2 & 3 of the Guidance Note.

1. *Comments on the proposed strategy for estuarine waters.*

There are some 178 estuaries in England and Wales. Many of these have little potential for eutrophication problems to manifest themselves. Sites considered to be low risk in this respect are those with flushing times of less than 1-2 weeks (since algal populations do not have time to develop), and those where the suspended solids content is high (and light penetration is therefore poor). The current definition within England & Wales of an estuary for the purposes of the Urban Waste Water Treatment Directive is, '...an inlet of the sea bounded by a line between such topographical features as define the seaward boundary of the estuary'.

Estuaries are complex systems within which it is difficult to pinpoint any one discharge as contributing to eutrophication and as such require extensive modelling. Major investment on sewage treatment has been undertaken, and considerable national/international R&D (JONUS, LOIS, SONUS) is already in hand or has been completed for many of the principal waters where additional investigation appears warranted. However, estuaries are of a more individual nature than coastal waters, being heavily influenced by local factors. The level of resources employed should therefore reflect Regional priorities, with more effort being targeted to the obvious cases such as sites identified as problem or potential problem areas under the OSPAR Strategy to Combat Eutrophication.

Two alternative approaches are recommended, basic screening studies or purposeful monitoring. The choice should lie with Regions and reflect the balance of evidence of undesirable disturbances. There is no simple trigger parameter by which the choice of approach can be made since the factors influencing primary production in estuaries are numerous and complex.

Where existing evidence or levels of monitoring are sparse or inconclusive then the screening studies should be adopted as the first stage, moving on to purposeful monitoring where warranted (see below). For OSPAR sites, or other estuaries where further investigation is considered warranted, then the purposeful monitoring approach should be adopted from the start. It is recommended that to warrant undertaking the purposeful monitoring, the estuary should be suffering from clearly recognised problems attributable to eutrophication. Examples include algal blooms of a particularly unusual scale or large blooms persisting from spring through to autumn, deterioration of shellfisheries, widespread public complaints about scums on water and

beaches, or excessive growths of macro-algae.

2. *Basic screening studies.*

- 2.1 These involve a primarily observational approach, with the aim of establishing the occurrence of exceptional nuisance algal blooms, the duration of blooms, excessive macro-algal growths, or other evidence of undesirable disturbances. This should be carried out at existing monitoring points. Where estuaries contain EC bathing waters, the approach outlined in 2.2 of Appendix Three should be followed. Those saline waters where either HNDA status or Comprehensive Studies showed potential eutrophication effects should be monitored in the period preceeding the 2001 revue (these areas are listed in Appendix Eight).
- 2.2 All reports of undesirable disturbances attributable to algal blooms should be investigated and records collated. This will include disturbance such as excessive scum and foam on water and on beaches, and benthic invertebrate, shellfish, and fish mortalities not associated with organic pollution.
- 2.3 Shorelines should be examined in summer (June - August/September) to establish the presence of excessive growth of macro-algae (*Enteromorpha spp.* and *Ulva spp.*) in areas where there are known problems. Excessive growth would be areas of greater than 10 hectares (and greater than 25% of the available intertidal area) in which the average algal cover exceeds 25%.
- 2.4 Analysis for chlorophyll-*a* concentration should be undertaken on samples taken for other purposes where it is believed that such data may be relevant.

3. *Purposeful monitoring.*

3.1 **Estuaries where phytoplankton growth is significant.**

Where the observational approach and/or historic monitoring indicate a clear problem with undesirable disturbances, the aim of the exercise must then be to confirm whether the estuary is suffering from eutrophication and to determine whether **agriculture** and/or qualifying STWs inputs are important influences on trophic status.

Given the individual nature of estuaries it is not considered feasible to lay down precise monitoring requirements which will be suitable to each case. The design of an appropriate monitoring regime must therefore be, to a great extent, a Regional matter and should be greatly influenced by the requirements of the specific model which will be needed to assess nutrient (ie nitrogen) loadings and the effects of control measures (actual or potential) upon the biological disturbances. Full scale water quality models are likely to be required for the affected estuaries.

The monitoring exercise is likely to require boat-based surveys, though in some estuaries it may be practical to sample from jetties, bridges, headlands, marinas etc.

Consideration should also be given to the use of remote sensing surveys from aircraft to determine spatial distribution of blooms and evidence of impact.

Winter nutrient data will almost certainly be required, eg three occasions between December and February each year to determine the degree of hypereutrophication, analysing for TON and NH_3 , to establish levels of dissolved available inorganic nitrogen, and for nitrite. In addition, summer nutrients, chlorophyll-*a* and cell counts (the latter two having numeric threshold values in the DoE Consultation Paper) are likely to be required.

All reports of undesirable disturbances attributable to algal blooms should continue to be investigated and records collated. This will include disturbance such as excessive scum and foam on water and on beaches, and benthic invertebrate, shellfish, and fish mortalities not associated with organic pollution. Where estuaries contain EC bathing waters, the approach outlined in 2.2 of Appendix Three should be followed.

3.2 Estuaries where macro-algal growth is significant.

Shorelines should continue to be examined in summer (June - August/September) to establish the presence of excessive growth of macro-algae (*Enteromorpha spp.* and *Ulva spp.*) in areas where there are known problems. Excessive growth would be areas of greater than 10 hectares (and greater than 25% of the available intertidal area) in which the average algal cover exceeds 25%. In such areas photographic evidence and quantitative information on % cover should be collected for three summers. Infra-red false colour aerial surveys should be used.

Winter nutrients should be determined on three occasions between December and February each year to determine the degree of hypereutrophication. Analyse for TON and NH_3 , to establish levels of dissolved available inorganic nitrogen, and for nitrite.

All reports of undesirable disturbances attributable to eutrophication should continue to be investigated and records collated. This will include disturbance such as excessive scum and foam on water and on beaches, and benthic invertebrate, shellfish, and fish mortalities not associated with organic pollution.

Appropriate nutrient budget models will need to be developed for these estuaries. However, it is to be emphasised that modelling should be used to support any evidence made on the basis of physical and chemical measurements of water quality.

4. General description.

For sites where evidence is considered sufficient to put the waters forward as a designation candidate, an outline of the nature of the proposed eutrophic water should be given, including the following points:

- the extent of the area/water.

- comments on whether any significant changes to the quality regime of the waters occur within the estuary. Indicate where and why such changes occur.
- a map showing the SA[E]/PW[E], the location of qualifying (and other significant) discharges (if applicable), chemical and biological monitoring points, and any other relevant features.
- details of any significant designations or interests in relation to other environmental initiatives eg SSSI, SAC, or SPA under the Habitats Directive, Important Area of Marine Wildlife, OSPAR site etc.
- photographic evidence would greatly assist the designation of a Sensitive Area.

APPENDIX FIVE.

EC UWWT & NO₃ DIRECTIVES SAMPLE PROFORMAS

Ref. Code

EC URBAN WASTE WATER TREATMENT & NITRATE DIRECTIVES

Candidate Sensitive Area [Eutrophic] / Polluted Waters [Eutrophic]

FORM A: COVER SHEET

(use for all types of SA/EI/PW/EI)

- 1) Name of regulator:
(see note 1 on guidance sheet)
- 2) Candidate name:
- 3) Main river catchment:
(see note 2 on guidance sheet)
- 4) Location & extent of candidate:
(map should be included, see note 3 on guidance sheet)
- 5) Type of candidate *(tick box)*:

Still freshwater	<input type="checkbox"/>
Running freshwater	<input type="checkbox"/>
Estuary	<input type="checkbox"/>
Coastal	<input type="checkbox"/>
- 6) Is the candidate:

Sensitive Area [Eutrophic]	<input type="checkbox"/>
Polluted Water [Eutrophic]	<input type="checkbox"/>
Sensitive Area [Nitrate]	<input type="checkbox"/>

(see note 4 on the guidance sheet for definitions)

- 7) Is the candidate:

Eutrophic now ☐

At risk of becoming eutrophic ☐

(see note 5 on guidance sheet for definitions)

8) Was the candidate :

Designated as an SA[E] ☐

Withdrawn/not designated due to insufficient evidence ☐

Not proposed ☐

9) Summary of qualifying discharges (ie greater than p.e 10,000 - *see note 6 on guidance sheet*)

Name of discharge	Direct/Indirect	NGR	Population Equivalent	Current level of treatment
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Now progress to the relevant form for the Sensitive Area, also submitting a form F for each qualifying discharge

Form B - Running Freshwaters

Form C - Still Waters

Form D - Estuarine

Form E - Coastal

Form F - Effects of nutrient removal at qualifying discharge

Ref. Code

EC URBAN WASTE WATER TREATMENT & NITRATE DIRECTIVES

Candidate Sensitive Area [Eutrophic] / Polluted Waters [Eutrophic]

FORM B: RUNNING FRESHWATERS - Information & Data

- 1) Candidate name
- 2) Extent of SA[E]/PW[E]

Start point

Start NGR

End point

End NGR

Length

km
- 3) Attach map showing SA[E]/PW[E] and locations of chemical sample points, biological sample points, any qualifying discharges and other significant discharges.
- 4) Local hydrogeology (*eg. chalk stream*)
- 5) Description of flow regime and depth. (*eg. sluggish, canalised, shallow*)

What is summer retention time in days (if known)?

- 6) Summary of main uses and designations (*tick boxes, see note 7 on the guidance sheet*)

Potable water supply (direct to treatment)		Spray irrigation	
Potable water supply (via impoundment)		Livestock watering	
EC Surface Water Abstraction Directive		EC Freshwater Fish Directive stretch	
Salmonid fishery		High amenity	
Cyprinid fishery		Medium amenity	
Industrial water supply		Low amenity	

Other uses or designations : (*specify*)

7) If watercourse has conservation status provide details (*see guidance note 8*) :

8) What chemical data are available ?
(*tick boxes if evidence is supplied - see guidance note 9*)

Orthophosphate	<input type="checkbox"/>
Chlorophyll a	<input type="checkbox"/>
Dissolved oxygen	<input type="checkbox"/>
DO (continuous monitoring)	<input type="checkbox"/>

9) What biological data are available ?
(*tick boxes if evidence is supplied - see guidance note 10*)

Algal blooms	<input type="checkbox"/>
Macrophyte % cover	<input type="checkbox"/>
Mean Trophic Rank (MTR)	<input type="checkbox"/>
Trophic Diatom Index (TDI)	<input type="checkbox"/>
Invertebrates / fish	<input type="checkbox"/>
Photographs	<input type="checkbox"/>

10) Which of the DoE numeric criteria are exceeded?

Orthophosphate	<input type="checkbox"/>
Chlorophyll a	<input type="checkbox"/>
Dissolved oxygen	<input type="checkbox"/>

11) Other evidence of adverse effects (*see guidance note 11*)

-
- 12) Executive summary of the chemical, biological and other evidence illustrating eutrophication in the SA[E]/PW[E] *(see note 12 in the guidance sheet)*.

- 13) Summary of eutrophication control measures (in progress and/or planned) if any, for the candidate area. *(see note 13 on the guidance sheet)*.

- 14) If the SA[E]/PW[E] has previously been designated, is there any evidence to suggest that its status has changed (eg. it is no longer eutrophic) or that the control measures have been effective?

Ref. Code

EC URBAN WASTE WATER TREATMENT & NITRATE DIRECTIVES

Candidate Sensitive Area [Eutrophic] / Polluted Waters [Eutrophic]

FORM C: STILL FRESHWATERS - Information and data

- 1) Candidate name
- 2) Extent of SA[E]/PW[E]:

Surface area ha

Approx depth m (mean) m (max)
- 3) Attach map showing SA[E]/PW[E] and locations of chemical sample points, biological sample points, any qualifying discharges and other significant discharges.
- 4) Approx. water retention time days
- 5) Does stratification occur? (*tick if yes*) ☐

If yes, describe:

- 6) Summary of main uses and designations (*tick boxes*)

Angling	<input type="checkbox"/>	Recreation & tourism	<input type="checkbox"/>
Water contact sport	<input type="checkbox"/>	Amenity	<input type="checkbox"/>
Irrigation	<input type="checkbox"/>	Public water supply	<input type="checkbox"/>
Fish Farm	<input type="checkbox"/>	Industrial water supply	<input type="checkbox"/>

Other uses and designations : (*specify - see guidance note 14*)

- 7) If water body has conservation status provide details (*see guidance note 15*) :

- 8) For water reservoirs for potable supply, give a brief description of the water supply scheme, the main raw water inputs and whether phosphorus reduction measures have been implemented (eg. ferric dosing)

- 9) What chemical data are available ?
(*tick boxes if evidence is supplied - see guidance note 16*)

Total phosphorus	<input type="checkbox"/>
Chlorophyll a	<input type="checkbox"/>
Dissolved Oxygen	<input type="checkbox"/>
Water clarity	<input type="checkbox"/>

- 10) What biological data are available ?
(*tick boxes if evidence is supplied - see guidance note 17*)

Algae	<input type="checkbox"/>
Blue Green Algae	<input type="checkbox"/>
Macrophytes	<input type="checkbox"/>
Diatoms	<input type="checkbox"/>
Invertebrates / Fish	<input type="checkbox"/>
Photographs	<input type="checkbox"/>

- 11) Has a Blue Green Algae action plan has been developed (*see guidance note 18*):

- 12) Which of the DoE numeric criteria are exceeded?

Total phosphorus	<input type="checkbox"/>
Chlorophyll a	<input type="checkbox"/>
Secchi disc transparency	<input type="checkbox"/>

13) Other evidence of adverse effects (*see guidance note 19*)

14) Executive summary of the chemical, biological and other evidence illustrating eutrophication in the SA[E]/PW[E] (*see guidance note 20*)

15) Summary of eutrophication control measures (already in progress and/or already planned) if any, for the Candidate Area. (*see guidance note 21*)

16) If the SA[E]/PW[E] has previously been designated, is there any evidence to suggest that its status has changed (eg. it is no longer eutrophic) or that the control measures have been effective?

Ref. Code

EC URBAN WASTE WATER TREATMENT & NITRATE DIRECTIVES
Candidate Sensitive Area [Eutrophic] / Polluted Waters [Eutrophic]

FORM D: ESTUARINE WATERS - Information & Data

- 1) Candidate name
- 2) Extent of SA[E]/PW[E]

Start point
Start NGR

End point
End NGR

Length km
- 3) Attach map showing SA[E]/PW[E] and locations of chemical sample points, biological sample points, any qualifying discharges and any other significant discharges.
- 4) Approximate retention/ flushing time days
- 5) Brief description of geomorphological nature of estuary (*eg. broad and flat, deep and fjord-like, salinity regime, stratification etc*)
- 6) Summary of main uses and designations (*tick boxes*)

Amenity		Boating	
Watersports		OSPAR potential problem area	
EC Bathing Water		Angling	
Commercial fishery		Designated EC Shellfish Water	
Designated EC Shellfish Harvesting Area		Non - designated shellfish harvesting area	

Other designations and uses (*specify - see guidance note 22*)

- 7) If watercourse has conservation status provide details (*see guidance note 23*) :

-
-
- 8) What chemical data are available ?
(tick boxes if evidence is supplied - see guidance note 24)

Dissolved available inorganic
phosphorus (DAIP) ☐

Dissolved available inorganic
nitrogen (DAIN) ☐

Chlorophyll a ☐

Cell counts ☐

- 9) What biological / observational data are available ?
(tick boxes if evidence is supplied - see guidance note 25)

Macroalgae ☐

Planktonic algal blooms ☐

Sh'lfish/inverteb./fish mort. ☐

Appearance of scum/foam ☐

Photographs ☐

- 10) Which of the DoE numeric criteria are exceeded?

Chlorophyll a ☐

C e l l counts ☐

- 11) Other evidence of adverse effects (see guidance note 26)

- 12) Executive summary of the chemical, biological and other evidence illustrating eutrophication in the SA[E]/PW[E] (see note 27 in the guidance sheet).

-
-
-
-
-
-
-
-
-
-
- 13) Summary of eutrophication control measures (already in progress and/or already planned) if any, for the candidate area. *(see note 28 on the guidance sheet).*

-
-
-
-
-
-
-
-
-
-
- 14) If the SA[E]/PW[E] has previously been designated, is there any evidence to suggest that its status has changed (eg. it is no longer eutrophic) or that the control measures have been effective?

Ref. Code

**EC URBAN WASTE WATER TREATMENT & NITRATE DIRECTIVES.
Candidate Sensitive Area [Eutrophic] / Polluted Waters [Eutrophic]**

FORM E: COASTAL WATERS - Information & Data

1) Candidate name

2) Extent of SA[E]/PW[E]

Define approximate area of coastal water using 4 grid references

NGR 1

NGR 2

NGR 3

NGR 4

Approximate area ha

3) Attach map showing the SA[E]/PW[E] and locations of chemical sample points, biological sample points, any qualifying discharges and any other significant discharges.

4) Brief description of the oceanography of the area

5) Summary of main uses and designations (*tick boxes*)

Amenity		Boating	
Watersports		OSPAR potential problem area	
EC Bathing Water		Angling	
Commercial fishery		Designated EC Shellfish Water	
Designated EC Shellfish Harvesting Area		Non - designated shellfish harvesting area	

Other designations and uses (*specify - see guidance note 22*)

6) If water body has conservation status provide details (*see guidance note 23*) :

-
-
-
- 7) What chemical data is available ?
(tick boxes if evidence is supplied - see guidance note 24)

Dissolved available inorganic phosphorus (DAIP)	<input type="checkbox"/>
Dissolved available inorganic nitrogen (DAIN)	<input type="checkbox"/>
Chlorophyll a	<input type="checkbox"/>
Cell counts	<input type="checkbox"/>

- 8) What biological/ observational data is available ?
(tick boxes if evidence is supplied - see guidance note 25)

Macroalgae	<input type="checkbox"/>
Planktonic algal blooms	<input type="checkbox"/>
Shellfish/Invertebrate/Fish mortality	<input type="checkbox"/>
Appearance of scum/foam	<input type="checkbox"/>
Photographs, media clips, public complaints	<input type="checkbox"/>

- 9) Which DETR numeric criteria are exceeded?

Chlorophyll a	<input type="checkbox"/>
Cell counts	<input type="checkbox"/>

Which CSTT hypernutrification criteria are exceeded?

DAIN	<input type="checkbox"/>
DAIP	<input type="checkbox"/>

- 10) Other evidence of adverse effects (see guidance note 26)

- 11) Executive summary of the chemical, biological and other evidence illustrating eutrophication in the SA[E]/PW[E] (see note 27 in the guidance sheet).

- 12) Summary of eutrophication control measures (already in progress and/or already planned) if any, for the candidate area. *(see note 28 on the guidance sheet)*

- 13) If the SA[E]/PW[E] has previously been designated, is there any evidence to suggest that its status has changed (eg. it is no longer eutrophic) or that the control measures have been effective?

Ref. No.

EC URBAN WASTE WATER TREATMENT & NITRATE DIRECTIVES

Candidate Sensitive Area [Eutrophic] / Polluted Waters [Eutrophic]

FORM F: PREDICTED EFFECTS OF NUTRIENT REMOVAL AT QUALIFYING DISCHARGE

Name of qualifying discharge (> 10,000 PE)	Direct/Indirect (see guidance note 29)	NGR	Population Equivalent	Current level of treatment

1) Name of Candidate Sensitive Area [Eutrophic] / Polluted Water [Eutrophic]

2) Type of candidate (*tick box*):

Still freshwater ☐

Running freshwater ☐

Estuary ☐

Coastal ☐

3) Summarise the evidence of the impact of the discharge (eg compare chemical and biological data upstream and downstream of the sewage discharge - *see guidance note 30*)

4) Summarise the results of any nutrient removal modelling or other impact

assessments carried out for this discharge or, if relevant, for the whole catchment. *(see guidance note 31)*

- 5) Do the benefits of nutrient removal at the qualifying discharge depend on nutrient removal at other discharges? *(see guidance note 32)*

- 6) Conclusions on impact of discharge and predicted effects of nutrient removal *(see guidance note 33)*.

Ref. No.

EC URBAN WASTE WATER TREATMENT & NITRATE DIRECTIVES

Candidate Sensitive Area [Eutrophic] / Polluted Waters [Eutrophic]

FORM G: ACTUAL EFFECTS OF NUTRIENT REMOVAL AT QUALIFYING DISCHARGE

Name of qualifying discharge (> 10,000 PE)	Direct/Indirect (see guidance note 29)	NGR	Population Equivalent	Current level of treatment

1) Name of Candidate Sensitive Area [Eutrophic] / Polluted Water [Eutrophic]

2) Type of candidate (*tick box*):

Still freshwater ☐

Running freshwater ☐

Estuary ☐

Coastal ☐

3) Summarise the evidence of the impact of the nutrient removal (eg compare chemical and biological data upstream and downstream of the sewage discharge)

4) Are the benefits of nutrient removal at the qualifying discharge dependent on nutrient removal at other discharges?

5) Conclusions on effects of nutrient removal.

GUIDANCE NOTE: - SA[E]/PW[E] FORMS (A,B,C,D,E,F & G)

This guidance note is intended to help Regions provide information in a consistent format to the National Panel on Candidate Sensitive Areas [Eutrophic] under the UWWT Directive and Polluted Water [Eutrophic] under the Nitrates Directive. This note and the forms to which it refers, have been based upon, and should be read in conjunction with, the guidance previously published as Annex 6 to Part I of the manual "Environment Agency Programme for the Monitoring of Water Quality" and the DoE Consultation paper of March 1993.

Forms A-E

Forms A-E are to be used for giving evidence of eutrophication within candidate Sensitive Areas [Eutrophic] or Polluted Waters [Eutrophic]. They are intended to act as a guide and to ensure that suitable information is provided in as concise a manner as possible.

Form A should be completed for all types of SA[E]/PW[E]. Additionally, Form B should be completed if the SA[E]/PW[E] is a Running Freshwater, Form C for a Still Water, Form D for an Estuarine Water or Form E for a Coastal Waters.

Supporting evidence should be attached to Forms B, C, D or E with a summary of that evidence completed on the form. Answers to questions on the forms should include reference to where relevant information can be found within the supporting evidence (for example "See p5 of attached report"). Photographic evidence should be supplied wherever possible. Photographs should be clearly marked with the Reference code (described below), the date and sample point. Raw data should only be appended if it is considered to be absolutely necessary.

Form F

This form should be used to present the information used to determine whether nutrient removal at individual qualifying sewage works will have an effect on the level of eutrophication. Use one sheet for every qualifying discharge and attach supporting evidence if necessary.

Form F should include an assessment of the impact of the discharge in chemical and biological terms by comparing upstream with downstream, to determine whether the discharge is having an impact. The results of any modelling or other assessments carried out into the potential benefits of nutrient removal for the discharge should also be summarised on Form F. If there are a number of discharges and modelling has been carried out on a whole catchment basis, then this should be made clear and the results included only on the first form F for that SA[E]/PW[E].

Form G

Form G should include an assessment of the effects of nutrient removal from relevant qualifying discharges within a designated Sensitive Area (Eutrophic) by comparing upstream with downstream and current with historic data to determine whether the action has had an impact

General information

The Ref. code in the top right hand corner of each form is for identification. It should consist of two letters indicating the Region (see below) followed by a three digit number eg. AN001 etc. For one candidate area the same number should be entered on the cover sheet (Form A) and forms B-G.

Environment Agency Region codes:

North West	NW
North East	NE
Midlands	MD
Anglian	AN
Thames	TH
Southern	SO
South West	SW
Welsh	WE

FORM A - COVER SHEET

- Note 1** Enter name of regulator and operational unit (e.g. Environment Agency, Anglian Region, Central Area).
- Note 2** Enter name of the main river catchment (if relevant) in which the SA[E]/PW[E] is located (e.g. for the River Ouzel candidate SA[E], the main river catchment is the River Great Ouse).
- Note 3** An appropriate scale map should be attached which clearly shows the location of the SA[E]/PW[E] within its catchment. Enter a brief description of the extent of the SA[E]/PW[E].
- Note 4** PW[E] will generally apply to estuarine or coastal areas where nitrate is the limiting nutrient. Where there are qualifying discharges to the area, the PW[E] will also have SA[E] candidate status.
- Note 5** Although most candidate SA[E]/PW[E]'s will be suffering symptoms of eutrophication now, the Directive also allows the designation of water bodies which warrant special protection because they would rapidly suffer as a result of accelerated nutrient enrichment. These are SA[E]/PW[E]'s "at risk" of becoming eutrophic.
- Note 6** List all qualifying (greater than 10,000 population equivalent) sewage treatment works, giving the name of each STW, whether it discharges direct to the SA[E]/PW[E] or affects the SA[E]/PW[E] indirectly, the National Grid Reference of the outfall, the population equivalent and the current level of treatment (ie primary, secondary or tertiary).

FORM B - RUNNING FRESHWATERS

Note 7 *In categorising into High, Moderate or Low Amenity, consider the extent the water is used for recreational purposes, the type of recreational uses, the proximity of housing and the importance of nature conservation. "Other" uses should include NVZ, and statutory or local, proposed or actual conservation status, SSSI, SAC, etc.*

Note 8 *Indicate the type of conservation status and give reasons for it.*

Note 9 *Chemical data*

Include summary statistics for each determinand, listing at least the following information: sample point reference number; number of samples; mean, standard deviation, max and min. concentrations; number of samples exceeding numeric DoE criteria:

Phosphorus: Annual ave. orthophosphate > 100µg/l

*Chlorophyll a: Annual ave. chlorophyll a > 25µg/l
Maximum chlorophyll a > 100µg/l*

Dissolved oxygen : Daytime > 150%

Ensure that the sampling points have been shown on the maps provided in answer to question 3. An example of table layout is given below (also include units). Graphical representation of spatial and temporal trends should also be included.

For Chlorophyll 'a', individual measurements from the summer months are useful to demonstrate whether algal blooms are sustained.

If it is believed that the SA[E]/PW[E] is nitrogen limited then include data for nitrate.

Sample point	year	number of samples	mean	SD	max	min	number of samples exceeding the DoE criteria

Note 10 *Biological data*

• *if algal blooms have been investigated include details of species diversity and biomass composition.*

• *where biological surveys have been undertaken include a brief description of the standard method of survey used and quality assurance*

implemented.

- *survey locations must be clearly identified together with their relation to the SA[E]/PW[E] and qualifying discharges. Large scale maps should be included which clearly show survey locations.*

- *there will be a number of sets of survey results for each location (maximum of 4 over 3 years). The data should be presented as individual surveys and not averaged.*

- *it is recommended that total percentage cover and Mean Trophic Rank are the principal data presented. MTR must only be calculated on data from 100m survey lengths. Graphical presentation of the data is recommended.*

- *a brief commentary for each survey site, U/S-D/S surveys or SA[E]/PW[E] as appropriate) discussing the survey results and their relevance should be included.*

Note 11 *Provide evidence of adverse effects upon the recognised river uses and designations of the stretch indicated in question 6 (eg abstractions, fisheries, amenity etc). Include details of any exceedences of standards under the Freshwater Fish or Surface Water Abstraction Directives due to eutrophication. Also include effects on flooding, any need to undertake weed clearance and effects on conservation status. Documented complaints from water companies, industry, anglers, canoeists, conservation bodies, members of the public etc. should also be attached.*

Note 12 *This should be concise and summarise the biological, chemical and other evidence for eutrophication, making reference to DoE criteria (not only numeric criteria).*

Note 13 *List eutrophication control initiatives such as P stripping at STW's.*

FORM C - STILL FRESHWATERS

Note 14 *"Other" uses should include NVZ, and statutory or local, proposed or actual conservation status, SSSI, RAMSAR, etc.*

Note 15 *Indicate the type of conservation status and give reasons for it.*

Note 16 *Chemical data: include summary statistics for each determinand listing at least the following information: sample point reference number; number of samples; mean, standard deviation, max and min. concentrations; number of samples exceeding numeric DoE criteria:*

Phosphorus: Annual ave. (geo. mean) total phosphorus > 50µg/l

Chlorophyll a: Peak chlorophyll a > 30µg/l

*Water clarity: Annual ave. (geo. mean) Secchi disc transparency < 3m
due to algal biomass (water colour predominantly green)*

Ensure that the sampling points have been shown on the maps provided in answer to question 3. An example of table layout is given below (also include units). Graphical representation of spatial and temporal trends should also be included.

For DO, include DO readings from the epilimnion and hypolimnion to demonstrate the extent of deep water oxygen depletion. For Chlorophyll 'a', individual measurements from the summer months are useful to demonstrate whether algal blooms are sustained.

Sample point	year	number of samples	mean	SD	max	min	number of samples exceeding the DoE criteria

Note 17 *Biological data: detail dominant algal species and the changing assemblages from spring to autumn and summarise the biological effects attributable to eutrophication.*

Note 18 *Indicate whether a Blue Green Algae Action Plan has been developed and detail reasons why it was required and its recommendations. Include information regarding the types of algal bloom and whether they were sustained.*

Note 19 *Provide evidence of adverse effects upon the recognised uses and designations of the water body indicated in question 6. Include details of any exceedences of standards under the Freshwater Fish and Surface*

Water Abstraction Directives due to eutrophication. Also include any need to undertake weed clearance and effects on conservation status. Documented complaints from water users such as anglers, canoeists, conservation bodies, members of the public etc. should also be attached.

Note 20 *This should be concise and summarise the biological, chemical and other evidence for eutrophication, making reference to DoE criteria (not only numeric criteria).*

Note 21 *List eutrophication control initiatives if any.*

FORM D - ESTUARINE WATERS and FORM E - COASTAL WATERS

Note 22 *"Other" uses should include NVZ, statutory and local, proposed or actual conservation status, Important Area of Marine Wildlife, SSSI, SAC, etc.*

Note 23 *Indicate the type of conservation status and give reasons for it.*

Note 24 *Chemical data*

Include summary statistics for each determinand, listing at least the following information: sample point reference number; number of samples; mean, standard deviation, max and min. concentrations; number of samples exceeding numeric DoE criteria:

Chlorophyll a: around 10µg/l in algal blooms

Algal biomass: bloom densities of 5 x 10⁵ cells/l. No nutrient-limited decline.

(For Coastal Waters only the number of samples exceeding Comprehensive Studies Task Team (CSTT) standards indicating hypernutrification should also be stated:

DAIN: >12 mmol/ m³ in winter

DAIP: >0.2 mmol/ m³ in winter

Hypernutrification should not be seen as a problem in itself. It will cause harmful effects only if a substantial proportion of these nutrients is converted into planktonic algae or into seaweed - see CSTT report for further guidance).

Ensure that sampling points have been shown on the maps provided in answer to question 3. An example of table layout is given below (also include units). Graphical representation of spatial and temporal trends should also be included.

For Chlorophyll 'a', individual measurements from the summer months are useful to demonstrate whether algal blooms are sustained.

Sample point	year	number of samples	mean	SD	max	min	number of samples exceeding the DoE criteria

Note 25 *Biological/observational data*

If biological surveys have been undertaken:

- *include a brief description of the standard method of survey used and quality assurance implemented.*
- *identify survey locations in relation to the SA[E]/PW[E] and qualifying discharges. Large scale maps should be included which clearly show survey locations.*
- *present data as individual surveys, not averaged.*
- *Include information regarding the types of algal bloom and whether they were sustained.*
- *Evidence of excessive growth of macroalgae should be recorded, where the DoE criteria have been met ie areas greater than 10ha (and greater than 25% of the available intertidal area) in which the average algal cover exceeds 25%.*

Observational evidence:

- *photographic evidence should be included wherever possible*
- *length of duration and severity of scum/foam events should be noted*
- *data from remote sensing surveys can be presented in a visual form*

Note 26 *Provide evidence of adverse effects upon the recognised uses and designations of the water body indicated in question 6 (for estuarine) or question 5 (for coastal). Include details of any exceedences of standards under relevant EC Directives due to eutrophication. Also include any effects on conservation status. Documented complaints from water users such as industry, anglers, conservation bodies, members of the public etc. should also be attached. Any evidence of PSP or DSP in local shellfish beds should also be referred to.*

Note 27 *This should be concise and summarise the biological, chemical and other evidence for eutrophication, making reference to DoE criteria (not only numeric criteria).*

Note 28 *List eutrophication control initiatives such as N stripping at STW's.*

FORM F - EFFECTS OF NUTRIENT REMOVAL AT QUALIFYING DISCHARGE

- Note 29** *Indicate whether the discharge is directly into the candidate SA[E]/PW[E] or is outside the candidate area but has an indirect effect on the water quality*
- Note 30** *Give summary details of chemical and biological surveys carried out to assess the impact of the discharge. Cross reference to any data previously cited under forms B/C/D/E. Give an idea of the proximity of the sample points to the discharge (the sample point locations can be shown on the detailed map accompanying the candidate sensitive area form B/C/D/E). Photographic evidence should be attached where available.*
- Note 31** *State which nutrients were modelled, what type of model was used, how many years data were used, and what the results showed. STW flow can be estimated from population equivalent or consented dry weather flow. Where actual effluent nutrient concentrations are required, for P-controlled waters both total P and ortho P should be considered, and for N-controlled waters both TON and total N should be considered, to quantify both the potentially and readily available nutrient inputs.*
- Note 32** *Indicate the relative contributions of nutrient from other discharges or diffuse sources. Where the situation is complicated indicate whether nutrient removal at this discharge alone would be effective or whether a reduction in eutrophication would depend on nutrient removal at other qualifying discharges.*
- Note 33** *An assessment should be made as to whether nutrient removal at this works would result in a reduction in eutrophication, based on the available evidence. If there is not a clear case either way, this should be stated as a conclusion.*