Appendix 1.

Detailed Justification for not achieving good status by 2015

Information taken from River Basin Management Plan Thames River Basin District, Annex E: Actions appraisal and justifying objectives (Environment Agency 2009c)

Reference	C2a
Element predicted not to achieve good by 2015	Priority substances, priority hazardous substances and specific pollutants
Reason for failure	Unknown - reasons for failure unknown
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible: cause of adverse impact unknown

Justification for alternative objective

The source of the substance causing the failure is unknown

Chemicals are released into the environment from a wide range of sources including urban and agricultural land use, industry, domestic release to sewers, mines, ports and harbours. For water bodies where the sources of the pollution is not known, or not known in sufficient detail to be able to identify and appraise measures (including identification of the site or activity who is responsible for causing the pollution), it is technically infeasible to identify and implement additional measures, and achieve the objective by 2015.

For over 20 years we have routinely (usually annually) assessed compliance with water quality standards (such as those for the Dangerous Substances and Freshwater Fish Directives) and tried to identify the activities releasing the substances and causing the failure of the standards. We use a number of different approaches to do this including routine and investigative monitoring, modelling, and site inspections. Despite this, the sources of some of these old failures remains unknown.

In 2008 and 2009 we assessed compliance with the new standards for priority substances, priority hazardous substances and specific pollutants. Where these substances did not have standards under the old directives, or where the standards for the water framework directive are tighter than before, we have identified many new failures.

We have produced and consulted on (in conjunction with the draft river basin management plans) national pollution reduction plans for all the priority and priority hazardous substances and 6 specific pollutants. These identify potential point, diffuse and historical sources of these substances but their significance varies locally and in the time available, we have not been able to identify specific sources and their relative contributions for each of the new failures. An extended deadline for achieving good ecological and/or chemical status is therefore required.

Investigation type

Investigate cause of failure

Example of investigation
Potential point, diffuse and historical sources are set out in national pollution reduction plans (PRPs) for all the priority and priority hazardous substances and 6 specific pollutants. The significance of these and any locally relevant sources will be assessed through additional monitoring or modelling (e.g. using SIMCAT models) to identify and apportion causes of failure. This will allow appropriate measures to be targeted for implementation in this or subsequent river basin management planning cycles.
Possible future measures
Possible future measures will depend on the substance in question and the sources that contribute to the failure. Measures which could be appropriate for individual substances are set out in the PRPs. Measures may include control at source (e.g. through additional marketing and use restrictions); additional regulatory controls on point sources, including sewage treatment works, industrial emissions and action to address discharges from abandoned mines; actions to address diffuse sources, e.g. pollution prevention (through local education campaigns, voluntary initiatives and the adoption of best practice methodologies), extension of schemes such as England Catchment Sensitive Farming Delivery Initiative and the Voluntary Initiative for pesticides, and additional controls on dredging to reduce releases of TBT from contaminated sediments.
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
"Measures that are likely to be technically infeasible or disproportionately expensive will depend on the substance in question and the source of that substance. The PRPs include an evaluation of the technical feasibility and costs associated with available and potential measures, which is based a range of supporting information, e.g. the preliminary cost effectiveness analysis (pCEA). This illustrates that some measures will be more useful in the first river basin management planning cycle than others. For example, it is feasible and relatively cost effective to investigate the concentration of lead in leachate from landfill sites and remediate where necessary (estimated at £5 million per tonne lead removed); it is neither feasible nor cost effective to replace all domestic lead pipes to prevent leaching into the sewerage system (£54 – 136 million per tonne lead removed). It should also be noted that some substances, e.g. cadmium are naturally occurring and complete elimination from all surface waters will not be possible. Furthermore, in some exceptional circumstances where water bodies are severely impacted by a legacy of metal mining, it may be technically infeasible or disproportionately expensive to restore metal concentrations to a level that approaches the standard due to the nature of the metal sources.

Reference	A1a, DO1a, PH1a, T1a
Element predicted not to achieve good by 2015	A1a = Ammonia DO1a = Dissolved Oxygen PH1a = pH T1a = Temperature
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits

Justification for alternative objective

There is not high confidence that the standard is failed

For these water bodies we do not have the statistical confidence that the standard is failed; the water body may be compliant. Without confidence in a failure we cannot reliably consider sources and measures. To do so would mean a significant risk of wasted investment on measures in already compliant water bodies. In the first cycle we will carry out further investigations to confirm any failure with certainty, identify sources and appraise additional measures. Where possible additional measures will be implemented.

It is disproportionately expensive to implement further measures at this time. An extended deadline for achieving good ecological status is therefore required. One of the main sources of ammonia is discharges from municipal sewage treatment works. These works can also discharge significant loads of organic material that can result in a reduction in dissolved oxygen levels in receiving water bodies. Removing ammonia and organic material from sewage is expensive requiring structural changes to the works and ongoing operational costs for energy, maintenance and the disposal of sludge. The preliminary cost effectiveness analysis estimated that to put additional treatment capacity on all sewage treatment works for water bodies at risk of not achieving WFD standards would cost £304 to £848 million/year depending on how much ammonia was removed. Even where the need to control ammonia is confirmed, there is still a significant risk that removing ammonia from sewage treatment works is disproportionately expensive because of the balance of costs and benefits (see tables reference A5c). Of the 34 cases assessed, 21 were assessed as being not justified because of the unfavourable balance of costs, benefits and other impacts. Actions are in most instances expensive and need to be justified in terms of addressing real failures.

As part of the recent review of water prices for the water industry (PR09), we looked for cases where, irrespective of compliance with established environmental standards, further improvements to the quality of discharges would deliver local benefits sufficient to justify the costs of improvement. One case was found. This is in the Thames RBD where 5 sewage works will be improved for the benefit of the

Thames Estuary.

There are no ongoing actions in or upstream of the water body that are estimated to bring improvements in the status in this water body.

Investigation type

Investigate to confirm failure and/or impact

Example of investigation

Additional monitoring to confirm status and the need to take additional action.

Monitoring and modelling work to identify the relative sources of ammonia, dissolved oxygen, pH or temperature in the catchment.

If the need for additional action is confirmed, identification of the most cost effective combination of measures necessary to achieve good ecological status.

Possible future measures

Possible future measures will depend on confirmation of being at less than good status and the identification of sources that contribute to this status. If the need to take additional action and the sources are confirmed, further measures (subject to further assessment of cost, benefits and other impacts) will be implemented. These measures may include additional regulatory controls on point sources, including sewage treatment works and storm sewage discharges; actions to address diffuse sources, e.g. extension of schemes such as England Catchment Sensitive Farming Delivery Initiative, better targeting of agri-environment schemes, pollution prevention (through the adoption of best practice methodologies, local education campaigns and voluntary initiatives); control at source (e.g. through additional use restrictions).

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

It will be disproportionately expensive to install ammonia removal technology on all municipal sewage treatment works in England and Wales.

It is likely that installing additional ammonia removal technology on many works will be disproportionately expensive. To reduce ammonia to 1 mg/l at all works where this may be necessary would cost £848 million/year across England and Wales.

Reference	HT1a
Element predicted not to achieve good by 2015	Hydrology
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits

Justification for alternative objective

Low confidence that abstraction is adversely affecting ecological status

It is disproportionately expensive to require changes to the current abstraction regime at this time because our risk assessment (Environmental Flow Indicator threshold compliance) shows that there is only low confidence that abstraction pressure is adversely affecting ecological status.

The freshwater flow regime is a supporting element in classification. Freshwater flow condition limits have been developed as a screening tool to indicate the level of freshwater inflow below which Good Ecological Status may not be supported. Where we have low confidence that abstraction pressure is adversely affecting ecology, further studies are required to understand the relationship between flow and ecological status before we can attribute the failure in ecological status to abstraction pressures. Until this link is sufficiently established for a water body, there is a significant risk that there will be either no or low benefits from taking remedial action to improve flows.

In such cases these low expected benefits contrast to potential very high costs of remedial measures. Water is abstracted from the environment to provide drinking water supplies and for use by industry. Where abstractions need to be reduced to improve the flow regime in the environment, alternative abstraction sources need to be developed. Developing new abstractions is very expensive; costing from £1.5m to £7m to provide a single mega-litre of water each day.

The only practicable lower-cost actions to reduce the impact of abstraction are those that reduce water demand and promote efficient use. In catchments subject to significant abstraction pressures, these are either already in place or will be put in place under this RBMP.

Investigation type

investigate to confirm failure and/or impacts

Example of investigation
Desk studies to review the hydrological condition. Where required, monitoring and modelling to assess the water body specific impacts of abstraction pressures on ecological status. This work will include investigation of the hydrological impacts of abstraction, the flow requirements to support Good Ecological Status and the feasibility of measures to deliver these flow requirements.
Possible future measures
Possible future measures include reduction in abstraction licence quantities, restrictions on abstraction during particular months, and the imposition of conditions on licences, such as Hands-Off flow constraints. The costs and benefits of measures will, however, need to be considered.
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
It is likely that reduction in abstraction to meet flow condition limits in all inflowing water bodies will be disproportionately expensive, due to the potential impacts on public water supply and other water users. The preliminary cost effectiveness analysis identified that costs to reduce or relocate abstraction may be in the order of £1.5m - £7m per Ml/d of abstraction. In regions where demand for water is high relative to resources, it may not be feasible to locate alternative sources for drinking water without causing deterioration in other water bodies.

Reference	M3a to M3h
Element predicted not to achieve good by 2015	Morphology
Reason for failure	M3a = Confirmed - physical modification flood protection M3b = Confirmed - physical modification urbanisation M3c = Confirmed - physical modification land drainage M3d = Confirmed - physical modification water storage and supply (including for power generation) M3e = Confirmed - physical modification ports and harbours M3f = Confirmed - physical modification flood and coastal erosion protection M3g = Confirmed - physical modification inland navigation M3h = Confirmed - physical modification recreation
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible: no known technical solution

Justification for alternative objective

Technical solutions to address the ecological impact caused by the physical modification are under development and their effectiveness is not yet known

There is a known morphological pressure (a physical modification) and an observed biological impact but uncertainty surrounds the effectiveness of the measure(s) available to reduce that impact.

There are a range of morphological improvement measures available to mitigate and reduce biological impacts from physical modification. However, we do not always have a high level of confidence in the outcome and effectiveness of these improvement measures in relation to the specific biological quality elements. Many of the morphological improvement measures are yet to be proven in terms of their effect on biology at the water body scale. Similarly, the effectiveness of morphological improvement measures across differing environmental conditions, for example, different river types, remains unknown.

A programme of research is underway to improve our confidence in the applicability, feasibility and success of a range of morphological improvement measures. Extending the deadline for achieving objectives will allow time to complete these investigations to confirm the effectiveness of morphological improvement measures.

For artificial and heavily modified water bodies, mitigation measures have been identified as necessary in order to achieve GEP. The feasibility of these measures

requires further examination. Mitigation measures defined from the ecological potential classification process are derived from a generic list that deals with pressures and impacts on a broad scale. To ensure that the measures are technically feasible in each individual water body, local conditions and requirements must be considered. Mitigation measures must also be looked at in combination to identify their effect where there are multiple pressures and impacts present in the water body.

Investigation type

Investigate feasibility of measures

Example of investigation

Where we have low confidence in how effective the morphological improvement measures are in bringing biological improvements, further investigations are underway. Investigations are taking the form of catchment trials, testing of measures and monitoring the success of measures in bringing biological improvements.

The biological improvement brought about by morphological improvement measures in some water bodies may be different where different physical conditions prevail. Certain measures may be effective in some water bodies and not others. The above trials and investigations will help determine situations in which specific measures are likely to be applicable and suitable.

Possible future measures

Once investigations have established the effect of morphological improvement measures this will inform the choice of measure to be implemented in order to meet WFD objectives. Some possible measures are listed below:

- Removal of barriers to fish passage.
- River enhancement/restoration schemes
- Restoration of natural flows through habitat management & removal of impediments to flow.
- Revised sediment management strategies
- More widespread use of Sustainable Drainage Systems.
- Codes of Practice / General Binding Rules for operational activities/boat traffic.
- Opportunistic habitat enhancements on the back of capital and maintenance works

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wholesale restoration or removal of flood and coastal defences, and other engineered or reinforced channels.
- Removal of major infrastructure, bridges and culverts under buildings.
- Hull design or other modifications to vessels.
- Measures which are not proven to be technically successful or applicable at the scale or under the conditions of particular water bodies
- Removal of all barriers to migration

Reference	MS (Morphology Sensitive)
Element predicted not to achieve good by 2015	Biological elements
Reason for failure	Various pressures and sources
Alternative objective	Not applicable
Reason for alternative objective	Not required

Why a justification for alternative objective is not required

Biological element not included in classification

Some biological elements are identified as being sensitive to morphological pressures. The specific elements vary depending on the water body type:

- rivers = fish, macroinvertebrates and macrophytes
- lakes = macrophytes
- Trac waters = seagrass, fish and benthic invertebrates

As these elements are sensitive to morphological pressures, it is difficult to determine whether these biological elements in Artificial and Heavily Modified Water Bodies are at less than good status due to the effects of morphological changes alone or also the impacts from other pressures.

Where indicated by the use of this decision code, these elements have therefore not been included in the classification or objective setting processes for the Artificial and Heavily Modified Water Bodies concerned. In these instances, the status of the morphology-sensitive biological element can not lead to an alternative objective being set.

Investigation type

Not applicable

Example of investigation

Not applicable

Possible future measures

If these morphology-sensitive biological elements are at less than good status in an Artificial or Heavily Modified water body, other drivers may well require action to be taken to improve their status. For example if the water body has a protected area designation.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Not applicable

Reference	P1o, N1o
Element predicted not to achieve good by 2015	P1o = Phosphate or Total Phosphorus N1o = Dissolved Inorganic Nitrogen
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits

Justification for alternative objective

There is not sufficient weight of evidence to confirm the need to control eutrophication risk

Guidance on river basin management planning issued by Defra and Welsh Assembly Government requires that for failures of nutrient standards that the biology is truly impacted when considering the case for improvement actions. For these water bodies biological data for nutrient sensitive elements is suggesting good or better status so there is low certainty that there is a risk of eutrophication even though nutrients are exceeding the standard. Where we are not confident of failing good status we would not use regulatory powers to pursue costly site specific measures on the grounds that we would only anticipate low or uncertain benefits which would not be proportionate to the costs.

It is disproportionately expensive to implement further measures at this time. An extended deadline for achieving good ecological status is therefore required. The major source of phosphorus is discharges from municipal sewage treatment works. Removing phosphorus from sewage is expensive (8 to 7408 £/kg of P removed depending on the size of the works and the treatment technology used) requiring structural changes to the works and ongoing operational costs for chemicals, energy and sludge disposal. Even where the need to control the risk of eutrophication is confirmed, there is still a significant risk that removing phosphorus from sewage treatment works is disproportionately expensive because of the balance of costs and benefits (see tables reference P5c). Of the 51 cases assessed, 15 were assessed as being not justified because of the unfavourable balance of costs, benefits and other impacts.

Investigation type

Investigate to confirm failure and/or impact

Example of investigation

Investigate reasons for conflicting evidence between nutrient status and biology. This could lead to a review of the appropriateness of the nutrient standard for the site

/ type. Site would also be kept under review against risk of deterioration.

Possible future measures

Ban on phosphorus in detergents.

The major sources of nutrients are discharges from sewage treatment works and agricultural activities. If the need to take additional action and the sources of the nutrient are confirmed, further measures (subject to further assessment of cost, benefits and other impacts) will be implemented.

Examples of such measures include additional regulatory controls on point sources, including sewage treatment works and storm sewage discharges; actions to address diffuse sources, e.g. extension of schemes such as England Catchment Sensitive Farming Delivery Initiative, pollution prevention (through the adoption of best practice methodologies, local education campaigns and voluntary initiatives); control at source (e.g. through additional use restrictions).

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Sewage treatment works discharges:
It will be disproportionately expensive to install phosphorus removal technology on all municipal sewage treatment works in England and Wales. To do so would cost up to £6billion and result in benefits of approximately £2billion. Removing phosphorus requires more energy and so has a carbon impact. Depending on the size of the works and the treatment technology used it is estimated that 16-1426 tonnes of additional carbon are produced per tonne of phosphorus removed.

It is likely that installing phosphorus removal technology on many of the works serving less than 250 people will be disproportionately expensive. It cost between 157-7408 £/kg to remove phosphorus from these size works.

Agricultural activities:
• Wide scale reversion of arable land to low intensity pasture over large parts of England and Wales
• Wide scale reversion of agricultural land to woodland over large parts of England and Wales
• Wide scale reduction in livestock densities (cattle, sheep and pigs) over large parts of England and Wales