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New evidence and information that has become available since the EAs review of consents for the Solent European sites.

Summary

Environment Agency in association with NE completed a Review of Consents (RoC) exercise for the Solent European sites in 2007 which included reviewing whether existing EA permits, including discharge consents, could be affirmed or required modification or revocation in order to comply with the requirements of the Habitats Directive. In the twelve years since that review, new data, evidence and understanding of feature sensitivity has developed which indicate that the impacts of nutrients are still preventing the site meeting its conservation objectives. Those changes are as follows:

1. Updates to Conservation Objectives and Condition Assessments have been published since the RoC (on Designated sites system – see links in section 1 below).
2. New data on water quality and macro algal density is available and shows locations within the European sites with elevated nitrogen concentrations and significant macro algal presence that were previously screened out in the RoC.
3. An appropriate spatial scale is needed to assess impacts on the features. We believe that the Water Framework Directive (WFD) waterbody level is too coarse to adequately identify potential impacts under conditions of large within-site variability.
4. Saltmarsh and eelgrass were not considered to be potentially directly impacted by nutrients in the RoC, but research shows direct sensitivity of these habitats to nutrients. In addition the macro algal densities at which prey availability for Special Protection Area (SPA) birds is affected is now better understood and may be lower than was previously considered.
5. Some intermittent discharges, which were previously screened out, are discharging more frequently and the assumptions concerning their relative contribution to water quality in the SAC may need to be revisited.
6. Fair share was used to determine the level of reductions and whether modification of consent was needed. Requirement for reductions from other sectors were included in these assessments but these have not been secured or implemented. There are concerns over the achievability of these reductions and, therefore, whether there is sufficient certainty that the RoC conclusions continue to prevent the 'restore' conservation objectives from being undermined.

1. European site conservation objectives and condition assessments updated since RoC

Conservation objectives and supplementary advice (on Designated site system - https://designatedsites.naturalengland.org.uk/SiteSearch.aspx) were updated and published in a new format between 2014 and 2018 for the Solent Maritime SAC, Solent and Southampton Water SPA, Chichester and Langstone Harbours SPA and Portsmouth Harbour SPA. These detail the suite of attributes relating to the extent, structure and function of each feature and give targets for each attribute at the site level.

A condition assessment for the Solent Maritime SAC was completed in 2018/19 and is available on the Designated Sites System. Marine Protected Area assessments are based on an assessment of a

sub-set of attributes of each European site feature across the site as a whole. The results are given as the proportion of the feature being in a condition category, for example 50% favourable, 50% unfavourable recovering. This differs from current SSSI condition assessment in which the site is divided into units and the combined condition of all features in each unit is reported. In that case, all features must be favourable for the unit to be so. The spatial scale of reporting on features therefore differs between these two assessments, although both use Common Standards Monitoring (CSM) as the standard and WFD assessment information (where it exists) for the relevant interest features.

The Solent Maritime SAC assessment reports the current condition of the estuary, mudflats & sandflats and sandbanks features as all being 100% unfavourable. The reason for this conclusion is that a number of attributes failed to meet the required targets for the following features including:

- nutrient water quality;
- infaunal quality of the intertidal mud and sand features; and
- extent, distribution, rhizome structure and reproduction and biomass of seagrasses, which could also in part be due to impacts from nutrients.

There are other failing attributes that are not related to nutrients impacts such as toxic contaminants and invasive species.

The Solent Maritime Special Area of Conservation (SAC) has a 'restore' objective for nutrients for the following features:

- Estuaries
- Sandbanks which are slightly covered by seawater all the time
- Mudflats and sandflats not covered by seawater at low tide

This includes the intertidal and subtidal seagrasses sub feature of estuaries, due to dramatic historical loss of seagrass since the 1980s and the presence of ongoing anthropogenic pressure to which seagrass beds are sensitive, including nutrient loading.

Currently the European site condition assessment does not include the saltmarsh feature which has not yet been assessed. However preliminary analysis of data supplied by the Environment Agency highlights there was a loss of extent of saltmarsh across the Solent between 2008 and 2016. Although the cause of this loss it is not known, elevated nutrients can contribute towards the susceptibility of saltmarsh to erosion through effects on plant root growth and the cohesion of mud around the roots (Deegan et al, 2012).

SPA condition assessments have yet to be completed but some of the features of the SAC are also supporting habitats for the SPA and therefore the same standards will apply. WEBs alerts indicates that several of the bird features (and the total waterbird assemblage) are declining with site specific reasons likely to be a contributory factor (Frost et al, 2019). The cause of these declines are unknown but there has been a sharp decline in shelduck (a feature of Chichester and Langstone Harbours SPA); research has found the foraging ability of this species is likely to be affected by algal mats (Soulsby et al, 1982).

2. New evidence and data collected since the RoC

Additional macroalgal and water quality data has been collected by EA since the RoC. These data, as reflected in the underlying SSSI condition assessments available on the Designated Sites System show locations within the European sites with elevated nitrogen concentrations and significant macro algal presence than were previously screened out in the RoC. These additional locations include Western Yar, Bembridge Harbour (SPA only), Wootton Creek (SPA only) and part of Southampton Water. The RoC for the SAC and SPAs only considered the Hamble, Portsmouth Harbour, Medina Estuary, Newtown Harbour, Chichester Harbour and Langstone Harbour as having significant macro algal impacts and therefore these were the only parts of the site included for nutrient impacts in the Appropriate Assessments (AA) and stage 4 site action plans.

The new macroalgal data is also relevant to those areas that were previously considered in RoC as the assessment of the significance of macroalgal cover/density and the modelling of the impact of discharges was in many areas based on limited macro algal data, sometimes a single survey

3. Spatial extent of assessment

Water Framework Directive standards relating to good ecological status are used as the generic/default target for water quality attributes in NE conservation advice for coastal and estuarine waters. The adoption of this as a generic standard was based on sensitivity assessments for features and assumes the relevant standards are met in the location of the feature. However, WFD is reported at the waterbody level which depending on the size and within waterbody variability, may not be at a relevant spatial scale for specific locations of site features. As the WFD does not require all areas of a waterbody to meet the target levels, the use of these assessments as a proxy for water quality will not be sufficiently robust in all cases.

In terms of assessing the water quality impacts and any potential changes required to enable the site features to become favourable, it is therefore important to do this at a spatial scale or resolution appropriate for each feature. In RoC, the conclusions (and therefore recommendations for any improvement actions) were drawn from data assessed at the waterbody scale. The modelling for RoC however, provided more detailed data for areas within the waterbodies, which showed significant variability in algal density within the waterbody and that changes to discharges in 4 out of the 5 water bodies assessed for the SAC showed significant spatial variation in the algal density reductions that could be achieved. This additional detail was not subsequently used to inform recommendations for actions. As an example; in Chichester Harbour the upper parts of the estuary are particularly important for roosting and feeding birds and saltmarsh, however averaging macroalgal densities across the whole site in the RoC masked the fact that macroalgal densities are at levels that are likely to impact the features of the site in these locations (the Chichester Harbour Condition review report will be published in early 2020).

Therefore for the features in those areas of the Solent European sites where there is evidence for spatial variability, assessment at the water body scale does not provide adequate resolution to be

confident that they will be sufficiently restored to achieve favourable conservation status as defined by the conservation objectives.

4. **New research on nutrient impacts on saltmarsh, seagrasses and invertebrate populations**

The RoC considered, that saltmarsh vegetation was not sensitive to changes in nutrient concentrations, the only potential impact examined was via smothering from growth of macro algae on the saltmarsh. Therefore the RoC assessment for nutrient impacts focused on the assessment of macro algal mats and the meeting of macro algal targets. Research as outlined in more detail below shows that there can be direct impacts from nitrogen on saltmarsh features and eelgrass [1].This will require consideration alongside any further assessment of the effect of macro algae smothering these habitats.

In the UK a comprehensive review of eelgrass is found in the Life Funded UK Marine SAC project. This gives a summary of the impacts of information on eelgrass beds including a review of impacts from nutrient enrichment: stating that nutrient enrichment is "*more often cited as a major cause of decline, or lack of recovery, of Zostera beds*". The project identifies five mechanisms for nutrient enrichment to impact eelgrass beds:

- Metabolic imbalance by high internal nitrate concentrations (including reduced internal carbon available)
- Increased susceptibility to wasting disease (linked to the reduced phenolic compounds due to lowered internal carbon)
- Increased growth of epiphytic algae (smothering and reduced light)
- Smothering or shading by excessive growth of macroalgae
- Shading by phytoplankton blooms or other turbidity

Eelgrass is not only sensitive at lower concentrations of nitrogen than those that result in excessive opportunistic macroalgae (e.g. <0.5mg/l nitrogen tidally averaged has been shown to result in loss) but also to different forms of nitrogen than are currently used in WFD and RoC assessments. Eelgrass preferentially takes up organic forms of nitrogen over inorganic, though it is vulnerable to both.

The picture for saltmarsh is more complex as the vulnerability to nitrogen impacts changes with other stressors such as coastal processes ie saltmarshes that are subject to multiple synergistic impacts are less resilient to the same input of nitrogen. At the time of the RoC it was considered that saltmarshes were unlikely to be particularly sensitive to changes in water quality due to nutrient enrichment other than possible smothering effects from the growth of macroalgae.The root shoot imbalance caused by nitrogen in such impacted systems leads to the long term loss of saltmarsh (Deegan et al, 2012). . It is unclear from the literature what level of nitrogen is appropriate for saltmarsh in such circumstances nor how this relates to nutrient enrichment and macroalgae. Recent saltmarsh surveys of Chichester harbour (NE in prep, available early 2020) have shown that the saltmarsh is declining in the Solent and they are vulnerable to smothering of macroalgae both

[1] The eelgrass is a typical species (See SAC conservation objective) for both the SAC intertidal feature and the estuaries feature. Eelgrass is also explicitly mentioned on the SAC citation.

from growth on the saltmarsh and also through deposition on the strand line; the latter was not assessed in RoC. In addition there maybe synergistic impacts where high nutrient loading suppresses root growth and leads to plants being more susceptible to erosion from changes in coastal processes.

To take into account the differing nutrient impacts across all features. We advise that all of these different elements need to be taken into account in any assessment rather than being based purely on macroalgal biomass.

With respect to impacts on the SPA features, recent work has also highlighted the importance of considering not just the community changes in benthic invertebrates but also the size of preferred bird species prey items. At macroalage densities above 800 gm^2 there is evidence for increases in the relative abundance of smaller sized invertebrates this has the effect of reducing the amount of available energy (Thornton, 2016)

5. **New evidence on impacts from intermittent discharges**

During the RoC all intermittent discharges were ruled out as having no likely significant effect as they were:

- Not considered unsatisfactory in the Asset Management Plan (AMP) process or they were considered they should not be overflowing or extremely infrequently,
- At a distance from the site which, if overflowing infrequently, would not have a significant contribution.

However new experience since the RoC, has indicated that there are intermittent discharges that are overflowing frequently. This would suggest that the assumptions at RoC concerning their relative contribution to water quality in the SAC may need to be revisited.

6. **RoC conclusions around using fair share**

Recognising that EA is undertaking a more substantial review of the fair share (polluter pays) approach to which NE has been invited to contribute, there are some specific issues to consider in respect of its application to the Solent SAC RoC assessment. There are several interrelated aspects around the use of the concept of ‘fair share’ which raises questions as to whether there is sufficient certainty that the RoC conclusions continue to prevent the ‘restore’ conservation objectives from being undermined. Part of this is understanding the latest situation with regards to how much of the background actually comes from wider Solent sources and how take account of the contribution from offshore sources (outside the Solent).

The decisions for RoC were (for most waterbodies in Solent SAC / SPA) based on discharges making a 'fair share' reduction according to the source apportionment data at the time. The RoC recognised that the actions required on the discharges alone will not achieve the required reductions for the site to be restored and that additional action on the other sources will be required to do this. Action on agriculture is recommended but not as yet secured or shown to be achievable. Many of the identified actions on the discharges have now taken place and the actual effects from these may be

captured in the more recent monitoring data, although lags in ecological responses are likely. It is now possible to better understand what actions would be required by the other diffuse sectors, whether these are achievable, and therefore whether taking a fair share approach will actually enable the site to achieve the relevant water quality targets over the long term, or whether further reductions may be needed to discharges to prevent the 'restore' conservation objectives from being undermined.

For the Hamble waterbody the final option that was agreed did not meet the fair share reduction for discharges and there were other options considered that could have further reduced the point source contribution so that it was closer to delivering fair share (but still not meet it). An assessment is needed over any further reductions required from discharges to this part of the site to ensure the 'restore' conservation objectives are not undermined by those discharges.

Given developments since RoC in the way fair share methodology is applied, especially in the absence of clear N and P targets for some parts of this site at that time, we suggest that it would be appropriate to review the consistency in its application in this case.

All these factors around the use and application of fair share could influence the STW headroom available for growth and the potential options available to enable growth into the future.

References

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