

Lakes theme plan

Developing a strategic approach to lake restoration for England's Natura 2000 sites

'Improvement Programme for England's Natura 2000 Sites – Planning for the Future'



Preface

IPENS and theme plans

The Improvement Programme for England's Natura 2000 sites ([IPENS](#)), supported by European LIFE+ funding, is enabling Natural England, the Environment Agency, and other key partners to plan what, how, where and when to target their efforts on Natura 2000 sites and the areas surrounding them. As part of the IPENS programme, Site Improvement Plans (SIPs) and themed action plans have been developed. SIPs provide an overview of the issues affecting features at the site level and the actions required to address them. Theme plans are high-level plans which aim to improve the way in which we manage a range of key issues on the Natura 2000 site series as a whole. Theme plans can provide an over-arching direction, recommendations or outline approaches to achieve target conservation status of Natura 2000 sites in England, to complement work already underway on individual sites. The plans do not have a legal status and do not constitute a systematic evidence review, but are based on evidence and expert opinion. They are to inform action and initiatives of Natural England and its partners to help achieve the objectives of Natura 2000. It is anticipated that Natural England and others, working with stakeholder and partners, will all play a role in implementing theme plans. In the process of developing the theme plans Natural England has approached key partners and delivery bodies to seek input and agreement on the roles in delivering the improvements, although in some cases these discussions have not yet been concluded. Recommended actions and next steps identified in the theme plans are not necessarily committed or resourced but aimed at informing future resource decisions. Implementation of the theme plan recommendations will be via local prioritised delivery plans and coordinated through the IPENS After-Life Steering group, working with national and local delivery partner organisations.

Audience

The Lakes Theme Plan is aimed at those organisations that play a key role in taking forward the actions identified in this plan, in particular (but not exhaustively) Defra, Natural England, Environment Agency, National Parks, other delivery partners e.g. NGOs and lake focused landscape-scale partnerships.

Executive summary

A diversity of lakes is found within England's Natura 2000 series – 185 lakes occur across 23 Special Areas of Conservation (SACs) and 24 Special Protection Areas (SPAs). A high proportion of Natura 2000 lakes particularly SACs are in unfavourable, no change or declining condition. The restoration of this habitat type has been identified as a priority for the Improvement Programme for England's Natura 2000 Sites (IPENS) project to address. The Water Framework Directive includes specific requirements to meet the ecological and water quality objectives of Natura 2000 lakes within set timescales.

Key Issues

The primary reason for unfavourable condition is habitat degradation due to eutrophication. The restoration of lakes is strongly dependent on catchment based sources of nutrient enrichment being effectively controlled. The current lack of progress in adequately reducing catchment sources of pollution represents the most significant barrier to restoring lake habitat, including progressing in-lake restoration work which may be required. There is a need to identify Natura 2000 lakes where the use of existing mechanisms is unlikely to adequately address diffuse and non-diffuse pollution to achieve the water quality required for favourable condition. Other pressures experienced by lakes include

- imbalances in fish communities;
- hydrological issues ranging from over-drainage to the impacts of abstraction; and
- invasive non-native species of which New Zealand Pygmyweed, *Crassula helmsii*, is the most frequently reported.

Challenges

Whilst Lake Restoration plans are being developed for many Natura 2000 lakes, the interventions required are often costly, technically challenging, and take a long time to have effect. The main factors that restrict lake restoration measures from being undertaken include:

- The availability of sustained funding (high cost per unit area compared with other habitats).
- Expert and specialist capacity at the local level.
- Long-term commitment of effort and resources required to achieve successful restoration.
- Lack of influence or adequate mechanisms to control nutrient inputs at a catchment level
- Uncertainties as to the importance of in-lake intervention in improving conditions.

The way forward

The theme plan proposes a strategic approach to improving lakes that comprises of five key elements involving a series of actions:

- **Development of a strategic partnership** – it is recommended that the current Lake Restoration Officer post, jointly supported by Natural England and the Environment Agency, is extended and the scope of the projects' work is widened from 'in-lake' work to include catchment management. Consideration should be given to the development of a more formal and targeted strategy to improve lakes, and opportunities to better link national and local partnerships should be explored.
- **Building the evidence base** – it is important that effective before and after monitoring of any restoration project is undertaken so that the scientific evidence base for lake restoration can be improved and

disseminated. Dissemination of the findings of a major review of past lakes related activity in the Broads should improve the understanding of the effectiveness of various lake restoration activities.

- **Better skills and knowledge** – identifying and developing capability and knowledge amongst key staff who are able to act as ‘lake champions’ is advocated. There is potential for a network to facilitate greater communication between restoration projects, and those producing guidance and evidence, as the River Restoration Centre does for river restoration projects.
- **Sustained and intensive activity to reduce diffuse and point source pollution at the catchment-scale** –there is a need to align and integrate Diffuse Water Pollution plans, and Lake Restoration plans and associated delivery activities.
- **Availability of funding** – it is proposed that a strategic programme of improvements to Natura 2000 lakes and their catchments is developed with partners including funding bodies such as the Heritage Lottery Fund and EU- LIFE. It is important that the new SSSI lakes restoration option under Countryside Stewardship is promoted and its roll-out supported.

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1. Introduction

Lakes are some of the most damaged habitats within the designated site series. A third (22) of Special Areas of Conservation (SAC) lakes are in an 'unfavourable no change' or 'declining' condition (see Figure 1), all but one due to eutrophication.

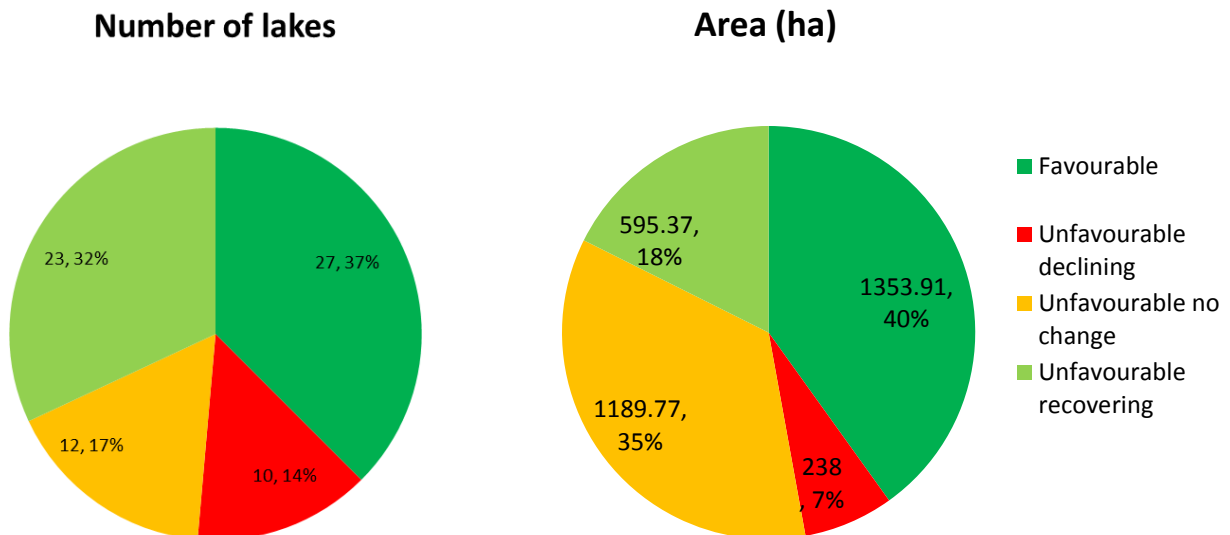


Figure 1 SAC lake habitat condition

The restoration of most lakes is strongly dependent on catchment based sources of nutrient enrichment being controlled effectively. However, reducing external nutrient sources alone may not be sufficient and in-lake measures may also be required to encourage and guide lake recovery. This is especially true in shallow lakes, where alternative (clear water 'favourable' and turbid water 'unfavourable') states are stable over a large nutrient range, so intervention is likely to be required to be able to shift states (Sheffer 1993 and others).

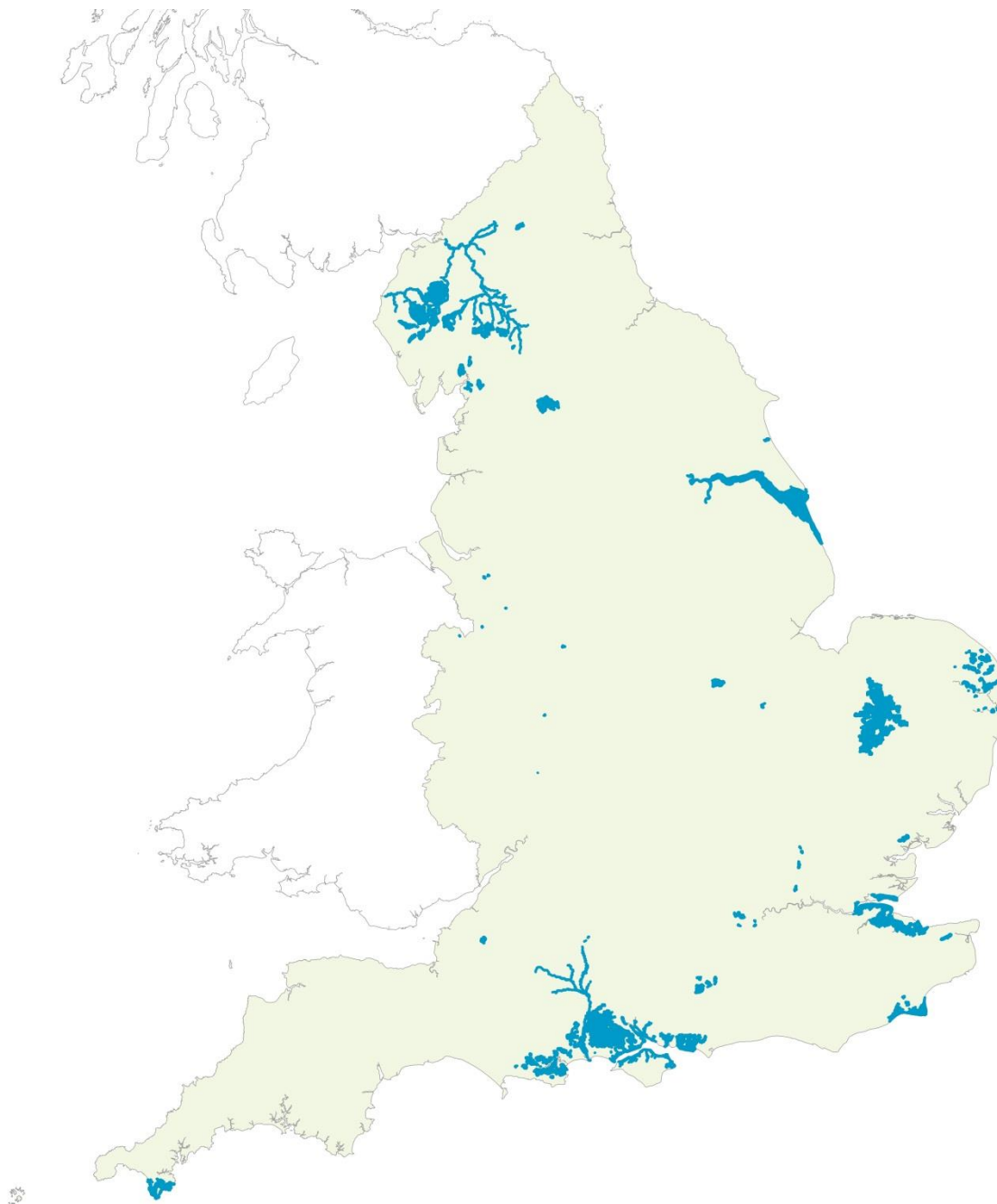
Although there has been significant progress in improving the quality of freshwaters over the last decade (Phillips, 2014), there are still a number of factors preventing the attainment of 'favourable' condition of SAC lakes, especially within the timeframes required by legislation. These include:

- Long timescales for recovery following intervention.
- Lack of mechanisms, finance and staff resource to influence catchment management on the scale and over the timescale required to secure recovery.
- The availability of sufficient and sustained funding for in-lake restoration (high cost per unit area compared with other habitats).
- Limited expert and specialist capacity at a local level to identify restoration required, and to drive improvement over the long-term.
- In some cases, a lack of confidence in the outcome of expensive restoration techniques.
- Ability to secure stakeholder agreement to prioritise and carry out restoration.

The Lakes Theme Plan aims to build on previous and current work by:

- Characterising the lakes within the Natura 2000 series.
- Describing the main policy drivers of Natura 2000 lake habitat improvement.
- Detailing the current condition of these lakes and the issues causing unfavourable condition.
- Reviewing current work aimed at addressing these issues.
- Compiling information on funding mechanisms and cost.
- Summarising issues and constraints on lake restoration.
- Suggesting potential options for addressing the issues.
- Providing an action table to initiate progress on management of Natura 2000 lakes.

Figure 2 Distribution of Natura 2000 sites with lakes (i.e. supports an Annex 1 lake habitat type and/or has a lake supporting an Annex 2 species or SPA feature(s))



2. Lakes in the Natura 2000 series

A diverse selection of lakes can be found within the Natura 2000 series. Some of these are notified as lake habitat of European importance, namely the SAC lake Annex I habitat types H3110; H3130; H3140; H3150; H3160 and H3170 (Table 1). This document focuses, primarily, on these sites. Some lakes within Natura 2000 sites may not contain SAC lake habitat but are still of importance to the conservation status of the Natura 2000 series, as they provide supporting habitat for Annex II species (e.g. Floating water-plantain, S1831, White-clawed crayfish, S1092, and Great crested newt, S1166), or birds under the Birds Directive. The distribution of these sites is shown in Figure 2 above and they are also listed in Table 2 (Annex 2).

The management principles described in this paper may also be relevant to some of these sites, as the lake habitat must be managed so that the Natura 2000 features are maintained. In England all Natura 2000 sites are underpinned with Site of Special Scientific Interest (SSSI) status. Although not the focus of this review, the same principles also apply to lakes that are SSSIs but not SACs or Special Protection Areas (SPAs).

There are a total of 185 named lakes across 23 SACs and 24 SPAs (some overlap), totalling approximately 7475 ha. Eighteen SACs contain Annex I lake habitat and 65 named lakes within 16 SACs are notified for their SAC lake habitat. In addition, five SACs also contain SAC lake habitat found in a series of ponds and/or ditches (which are harder to quantify). A list of the SACs containing Annex I lake habitat is provided in Table 3 (Annex 3).

Table 1 SAC Annex I lake habitat types, details of which can be found on the Joint Nature Conservation Committee [website](#).

Annex I Habitat code	Habitat name
H3110	Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>)
H3130	Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or of the <i>Isoëto-Nanojuncetea</i>
H3140	Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.
H3150	Natural eutrophic lakes with <i>Magnopotamion</i> or <i>Hydrocharition</i> -type vegetation
H3160	Natural dystrophic lakes and ponds
H3170	Mediterranean temporary ponds

3. Key policy drivers

The key policy drivers for lake restoration are:

- **Habitats and Bird Directives** (EU Biodiversity 2020 Strategy) - the Habitats Directive contains a wide range of obligations designed to protect a range of habitats, including a number of our rarest lake types (listed in Table 1) and some wetland species. Similarly the Wild Birds Directive provides protection to all naturally occurring bird species, and singles out the rarest, and regularly occurring migratory species, for additional protection. They allow for the establishment and protection of Natura 2000 sites.
- **Biodiversity 2020** (targets for SSSI and priority habitat condition) - this is a national strategy for England's wildlife and ecosystem services. It sets out the Government's ambition to halt overall loss of England's biodiversity by 2020. Outcome 1A of the strategy states that, by 2020, better wildlife habitats will be established, with at least 50% of SSSIs in favourable condition, while maintaining at least 95% in favourable or recovering condition.
- **Water Framework Directive (WFD)** - water dependent Natura 2000 sites are classed as 'Protected Areas' under WFD. Lakes greater than 5 ha are also classed as WFD 'water bodies' so are integrated into the WFD monitoring and reporting of 'Ecological Status'. This includes SSSI lakes notified for their aquatic interest, as well as SAC lakes. Although there are deadlines within the Directive to achieve 'Good Ecological Status' there is a recognition that given the timescales involved in lake habitat recovery, many lakes will require extensions. Where targets for WFD status and SSSI/SAC condition differ, then the most stringent shall apply.

4. Analysis of condition and issues

A summary of the condition and issues on SAC lakes outlined in Table 3 (Annex 3) was collated in October 2014 from:

- information from the recently produced Site Improvement Plans (SIPs), produced for Natura 2000 sites as part of Improvement Programme for England's Natura 2000 Sites (IPENS); and
- information available through Natural England's SSSI reporting database.

Out of ~72 SAC lake habitat units, approximately a third (numerically) are in 'favourable' condition, a third in 'unfavourable recovering' condition and the remaining third are in 'unfavourable no change' or 'unfavourable declining' condition (see Figure 1). By area the proportion in 'unfavourable no change' or 'declining' condition is in fact higher at 42%.

The overwhelming reason for unfavourable condition is a deterioration of habitat linked to **eutrophication**. Thirty-three SAC lakes fail their condition assessment as a result of eutrophication, with a further four considered borderline or at risk of failing due to eutrophication impacts. This totals just over half (37; 51%) of all SAC lakes. Other issues identified as important are:

- invasive non-native species (7 sites; 10%);
- fish stocks (3 sites, 4%); and
- hydrological problems (6 lakes; 8%).

In addition there may be further issues which contribute to unfavourable condition of lake habitat which have been reported elsewhere, but have not been identified via SSSI condition reporting.

5. Issues & current management approaches

5.1 Eutrophication

Although the signs of eutrophication are relatively easy to identify (elevated nutrient levels, loss of submerged aquatic plant species, loss of more oligotrophic aquatic plant species, decrease in water clarity, increase in algal blooms, more de-oxygenation events, increase in siltation), the sources of nutrient enrichment can be harder to determine, and difficult to address. The introduction of the Water Framework Directive, and more comprehensive water quality monitoring of lakes, has greatly increased our understanding of the issues involved at individual sites (Phillips, 2014).

In many cases, the more obvious actions to reduce eutrophication, such as controlling large point sources from sewage treatment works and getting land immediately adjacent to lakes into agri-environment schemes, have already been progressed. Large discharge consents to Natura 2000 sites underwent a comprehensive review in 2000-2010 as part of the Environment Agency led 'Review of Consents' process. This was undertaken in consultation with Natural England to ensure that all existing permissions complied with the Habitats Directive. As a result, there are few large discharges that still contribute disproportionately to eutrophication on SACs. Despite this significant progress in reducing phosphorus inputs to freshwaters, there are still impacts to SACs from sewage. The combination of, for example, the remaining nutrient inputs from large sewage treatment works with less quantifiable and less well regulated smaller sources of sewage (e.g. small package plants, septic tanks and storm water overflows) may prove significant in some catchments. In many cases there is still work required to identify, quantify and find mechanisms to address these sources of nutrients.

Agricultural sources of nutrients inevitably affect all SAC lakes in England to some extent, as at least parts of most catchments are agricultural. Recent source apportionment modelling identified agriculture as the greatest contributor to the diffuse component of phosphorus and nitrogen affecting Natura 2000 catchments (UKWIR, 2014). The cumulative and catchment wide nature of agricultural diffuse pollution requires, understanding of pollution sources, engagement, and remedial measures over the same catchment scale.

Even where external sources of nutrients have been significantly reduced, it may not be sufficient to allow lake recovery. The legacy of historic phosphorus pollution often remains in the form of deteriorated habitat, lost habitat structure and function, and unstable, anoxic, nutrient-rich sediment that may continue to release phosphorus to the overlying water for decades. This is especially true of shallow lakes that have positive feedback mechanisms which stabilise the deteriorated (algal dominated, turbid) state (Scheffer 1993 and others). As both a clear water or turbid states can be stable over a large range of nutrients, there

is often a requirement to reduce nutrients to well below the level at which deterioration first occurred in order to achieve recovery, or to encourage recovery by intervening in other ways (such as through biomanipulation of fish communities, planting and sediment removal) (Moss 1996 and others). These consequences of historic pollution are difficult and expensive to rectify and the technical and financial implications are challenging for any one sector. It is also hard to determine whether over a sufficient timescale natural recovery will occur, or whether intervention is required, and if so, what.

The actions identified to address eutrophication issues in many SAC lakes have tended to involve further investigation of nutrient sources, development of nutrient budgets to quantify the various inputs to the lake, and the development of strategic plans to address them along with any further in-lake measures required to restore deteriorated lake habitat. In terms of SSSI management measures that underpin Natura 2000 sites, the remedies to address complex eutrophication issues in lakes include the 'Diffuse Water Pollution' (DWP) Plan remedy, and the 'Lake Restoration Plan' (LRP) remedy. The Diffuse Water Pollution Plan is a strategic document which identifies and co-ordinates catchment and partnership wide activity required to reduce pollution from agriculture for the benefit of the SSSI. Further information on DWP issues can be found in the IPENS [DWP theme plan](#).

The Lake Restoration Plan (LRP) 'remedy' is a mechanism by which Natural England staff can identify via the SSSI reporting database the need for funding and action to restore lake sites to achieving or favourable condition. The LRP acts as an umbrella 'remedy' that provides a framework for planning and overseeing all necessary remedies, as well as providing a home for direct in-lake management measures not picked up by other remedies, funding streams and/or programmes. In this way it ensures that action is undertaken on all the pressures impacting on habitat integrity and that they are sequenced in the right order (Madgwick, 2013).

Since 2011, Natural England and the Environment Agency have jointly funded a Lake Restoration Officer to gain a strategic overview of lake restoration being carried out and required across Natura 2000 sites/SSSIs in England and to assist in the development and delivery of this work. Work funded by Natural England's Water Framework Directive Grant in Aid budget has collected and reviewed information available for lakes with the LRP remedy, to help draw up and progress Lake Restoration Plans. Table 4 (Annex 4) provides an overview of the lake restoration work being carried out on both Natura 2000 and SSSI lakes in England and Figure 3 (Annex 5) provides a schematic of the lake restoration process.

5.2 Invasive non-native species (INNS)

The primary non-native invasive species recorded as a reason for unfavourable condition on SAC lakes is New Zealand Pygmy weed (*Crassula helmsii*). Initiatives exist and control attempts have been trialled, but the species is particularly difficult to eradicate. To date, control involves early detection and catchment wide eradication where possible, but ongoing management is all which can currently be achieved once populations are already established beyond removal.

There are other invasive species which are present and potentially impacting SAC lakes, but these are rarely reported. The most common examples include Canadian and Nuttall's pondweed (*Elodea canadensis* and *Nuttallii*), Zebra mussel (*Dreissena polymorpha*) and several species of invasive crustacean (e.g. Killer Shrimp & Signal Crayfish). Lack of reporting may be because they were not all explicitly mentioned as a reason for unfavourable condition in the previous condition assessment guidance. This should be addressed

through new condition assessment guidance published in 2015, which makes it clear that any non-native on the WFD high impact list is a cause for failure. Further strategic activity to address INNS issues will be covered by the IPENS [Invasive species theme plan](#).

5.3 Fish and angling

Fish community imbalances, fish stocking and fishery management practices are suspected of contributing to unfavourable condition in around 50 SSSI lakes, including 3 SAC lakes, but little systematic information on fish communities and their potential impact at these sites exists. In some situations, fishery management may be contributing to a eutrophication problem (e.g. by over-stocking, an unbalanced fish community or excessive use of ground bait). In others, recovery from eutrophication may be hindered by positive feedback mechanisms associated with the fish community (which may or may not be a fishery).

Fish and feedback mechanisms:

In lakes impacted by eutrophication, fish can exacerbate or stabilise the symptoms of eutrophication through a combination of “top-down” and “bottom-up” processes. For example, large populations of small zooplanktivorous species, such as roach, may exert pressure on zooplankton populations, which in turn reduce the zooplankton grazing control on phytoplankton that is required to keep the water clear. Bottom feeders disturb sediment and uproot aquatic plants through their feeding habits, increasing turbidity and making nutrients more available to the water column, also favouring phytoplankton growth (Cowx 2012 and others; Moss 1996 and others;

In order to protect Natura 2000 sites/SSSIs from these potential impacts, generic stocking guidance exists which limits the stocking of fish to lakes to 200kg/ha biomass, with a presumption against bottom feeders such as common carp and common bream (Natural England, 2008). In practice this guidance does little to protect sites as it is hard to implement (with no data on existing stock) and many sites may no longer be actively stocked but still contain fish from historic stocking events, or have been illegally stocked. In some instances temporary or long-term fish community bio-manipulation is required to allow habitat to recover. Natural England is currently running an evidence project to collect fish community data across a range of Natura 2000 sites/SSSIs to understand better the actual impacts of fish and fishery management and inform future management advice in this area.

5.4 Hydrological issues

This covers a wide selection of issues, from over-drainage to impacts of abstraction. Where a drainage authority operates (e.g. a local council, Environment Agency or Internal Drainage Board), they have a responsibility to work with Natural England, landowners and other partners to agree and put in place a ‘Water Level Management Plan’ to ensure levels are appropriately managed to support the interest features of the SSSI/SAC. In other situations (e.g. where no drainage authority operates, or where work is small scale) a formal agreement may not be required and it may be sufficient to work with partners and landowners to block ditches to restore more natural water levels.

Where abstraction is suspected of impacting lake condition and function, investigations can be carried out and abstraction licences changed. This is through the National Environment Programme (NEP) for changes required to be made by water companies, or through the ‘Restoring Sustainable Abstraction’ programme

for other licences. Abstraction licences on Natura 2000 sites underwent a comprehensive review (2000-2010) as part of the Environment Agency led 'Review of Consents' process. This was undertaken in consultation with Natural England to ensure all existing permissions complied with the Habitats Directive. As a result there are few outstanding abstraction impacts that still require investigation and alteration.

Further detail on hydrological issues is covered by the IPENS [Hydrological function theme plan](#).

5.5 Other issues

There are a number of other issues not necessarily picked up through SSSI reporting but still considered to be potentially affecting Natura 2000 lakes. Eutrophication and grazing impacts from birds has been implicated in a number of sites (Moss 1978; Chaichana, Leah and Moss 2011). Although management has been carried out in some instances to protect areas from grazing or to cull or egg prick invasive bird species, such as Canada geese, some lakes (especially SPAs) may have bird species for which they are notified which are contributing to nutrients in the lake, leading to a conflict in conservation interests (Chaichana, Leah and Moss 2011). In reality the contribution of nutrients from birds (especially species for which SSSIs are notified) compared to other sources in all but the smallest sites is likely to be minimal. Generally bird impacts might be exacerbated if the habitat lacks resilience for other reasons, and/or if they are being encouraged by feeding.

Boat traffic has been raised as a potential issue exacerbating impacts of eutrophication and preventing recovery on some lakes. In the Natura 2000 series, this is largely confined to the Broads, where significant use for navigation (including motor boats) combines with the Broads having soft, easily disturbed sediments, and margins vulnerable to boat wash (George, 1994). The contribution of boat related impacts to SAC habitat condition is not known, nor is there currently any mechanism to address this.

Contamination of lake waters and sediments by toxic contaminants may also be impacting on lake ecology. In the Broads, concerns over the consequences of anti-foulant biocides have been raised in the past (Lambert 2006 and others; Sayer 2006 and others).

Many upland, low conductivity lakes have been impacted by acid deposition as a result of emissions of sulphur and nitrogen gases from power stations and other sources across the UK. Tighter emission controls since the 1980s have caused a significant reduction in acid deposition and a consequent improvement in water quality across acidified sites. However, despite some signs of ecological recovery, there is still a long way to go before the plant and animal communities in these systems will be restored to full health, and there is concern that other factors, such as climate change, might mask, slow down or even prevent a full recovery (Kernan 2010 and others).

Reducing the adverse effects of air pollution continues to be a major driver of air quality policy in the UK and internationally, and atmospheric nitrogen is also subject to its own IPENS [theme plan](#).

6. Funding mechanisms and cost of lake restoration

It is estimated that the potential cost of in-lake restoration in the period 2015-2021 on Natura 2000 sites

could be in the region of £6.7 million (Madgwick, 2014). However, there are significant caveats and constraints to being able to achieve favourable condition at these sites as discussed further in Section 7, not least because this does not include the cost of catchment measures required and only includes in-lake work which is worthwhile up to the end of the 2nd cycle of the River Basin Management Plans (RBMP) in 2021 (bearing in mind that some in-lake restoration will not be desirable until catchment sources of nutrients are further addressed). An exercise carried out in 2007 to quantify the total cost of bringing all lakes in the SSSI series into recovering condition (using all measures; catchment as well as in-lake management) estimated the total cost to all organisations as £1.1 billion, with £191 million of this potentially attributable to Natural England (Skeate and Perrow, 2007).

The development of lake restoration and diffuse water pollution plans and gathering of evidence to inform restoration planning is currently largely funded via Natural England's WFD Grant-in-Aid, which commenced in 2011. Some of this work has also been funded through the Conservation Enhancement Scheme (CES). The Environment Agency also carries out work in-house or funded through their Grant-in-Aid which supports lake restoration, principally their WFD monitoring and investigations work. It is possible to fund some aspects of lake restoration (e.g. marginal tree clearance) through agri-environment schemes but, in most cases, work in lakes is ineligible (as it is not agricultural land), so in these instances CES can be used instead. The resource available for CES in the future is uncertain. Under the Countryside Stewardship agri-environment programme, which is due to take effect from January 2016, a new option has been proposed that supports the restoration of large water bodies on SSSIs (including SPAs and SACs). If adopted, this may make sustained funding available where agreements can be negotiated.

There are a number of catchment level mechanisms for reducing nutrients to lakes that enable lake recovery. As previously mentioned, where lake restoration is required as a result of the current or past activity of a water company, then restoration planning and work can be programmed into the National Environment Programme to be funded via water company Asset Management Plans as discussed in Section 5.1. This covers any changes needed to existing discharge and abstraction licences and the infrastructure that supports them, but water company ownership of historic issues and in-lake measures may be more difficult to secure. The Diffuse Water Pollution theme plan goes into more detail into the mechanisms and funding available to incentivise farmers to reduce agricultural inputs to water. However, there is also recognition of the fact that existing planned measures and resources to tackle diffuse sources of nutrients will be insufficient to restore lakes (Anthony 2008 and others).

In addition to these regulatory funding sources, there are opportunities to seek funding from external sources such as EU funding designed to improve Natura 2000 sites (LIFE+), INTERREG, and the Heritage Lottery Fund (for larger projects) or smaller awards (e.g. Landfill Tax grants) for smaller projects. One disadvantage of these funding sources is that they are open to competition, and a significant amount of time needs to be invested in preparing an application without any guarantee that funding will be awarded. There is also, usually, a requirement for match-funding to be raised from other sources, and projects may be time-limited, reducing longer term planning and impact.

7. Issues and constraints

Lakes present significant restoration challenges due to the scale, cost and technical difficulty of restoration coupled with long timescales (often decades) for recovery and dependence on catchment-wide measures

being implemented.

The main challenges to successful lake restoration can be summarised as:

- The effects of climate change on the restoration baseline;
- a lack of progress in reducing catchment sources of nutrients;
- a lack of confidence in within-lake restoration methods;
- limited specialist staff resource at a local level;
- a lack of long term planning;
- the difficulty of public sector organisations making long term funding commitments; and
- the challenge lake restoration faces in being prioritised in current government targeting frameworks.

The longer term sustainability of trying to achieve current favourable conservation status targets in the context of climate change may be challenging. This means mitigating for climate change impacts, as well as the original eutrophication impact in any restoration planning, and being realistic about what the conservation objectives can be in the face of climate change. Recent EU funded research and dissemination work around climate change implications for freshwater management (through Euro-limpacs and REFRESH) can be used as a resource.

Currently the most significant, barrier to progressing in-lake restoration work across the Natura 2000 series is a lack of progress in reducing catchment sources of pollution. Although within-lake management may be required to restore lake habitat, long term benefits will only be secured if catchment sources of eutrophication are brought under control (Jeppesen 2012 and others). These constraints are discussed further in the DWP theme plan, but they relate to having sufficient local understanding of nutrient sources and having the resource and mechanisms to address these through incentives and advice to farmers. Although the development of Diffuse Water Pollution plans is aimed at overcoming the first constraint, there are limited and largely only voluntary measures currently employed to influence land management. There are also limited mechanisms for dealing with other small unregulated discharges, such as septic tanks. There is a need to identify Natura 2000 lakes where the use of available mechanisms is likely to fall short of addressing diffuse pollution adequately to achieve the water quality required for favourable condition.

Considerable within-lake restoration work has been carried out over the last 40 years in the Norfolk Broads. Much has been learnt about lake restoration through this work (Moss 1996 and others, Phillips 1999 and others) and through the current review of the effects of these lake restoration initiatives 30 years on (Phillips 2015 and others). Similar knowledge on shallow lake restoration is also available from projects in Europe (Gulati and van Donk 2002; Jeppesen, 2005; Søndergaard 2007 and others; Carvalho 2011 and others; and Jeppesen 2012 and others). Despite this wealth of experience and the extensive monitoring carried out over a long time period, there are still considerable uncertainties as to the importance of in-lake interventions in shallow lakes, especially over the longer term. Deeper lakes are more likely to respond positively to controls of nutrient inputs, but there are fewer examples of within-lake restoration measures which are likely to be effective. There is a common consensus that reducing external nutrient concentrations is the critical element to lake restoration and that within-lake restoration may be considered once external loading has been brought under control but where an ecological response is not being observed. Although action on within lake restoration can usually be implemented more immediately, the scientific certainty around the benefits of catchment nutrient source control versus within-lake

restoration will always favour the former.

Short-term drivers can lead to unrealistic expectations of, or at least demands for, visible signs of habitat recovery in the short term. Lake restoration measures tend to be complex, expensive and/or require long-term monitoring and management, requiring suitable staff resource and funding over a long time period. In the context of Natural England's Biodiversity 2020 delivery targets, lakes are rarely given precedence by Natural England local teams, because there is a temptation to prioritise priority is placed on habitats that cover a large area and which can be brought into 'favourable' or 'recovering' condition within a short timeframe. In the current biodiversity outcomes, emphasis is placed on getting 50% of SSSIs, by area, into favourable condition, giving priority to those sites that are most likely to come into condition in next five years.

8. Strategy to improve lakes

The theme plan proposes a strategic approach to improving lakes that comprises of five key elements involving a series of actions:

8.1 Strategic partnership

Natural England and the Environment Agency jointly fund a lake restoration project officer, whose work is overseen by a joint steering group. The post has the national oversight of the lake restoration projects being carried out within these organisations and provides support to projects that are delivered locally by area team staff and local partnerships. It is recommended that this continues, as a minimum, to maintain progress and monitoring of lake restoration activity. This work has to date primarily focused on within-lake restoration projects (Table 4, Annex 4), but given the constraints these face in achieving favourable conservation status, it is recommended that the scope is widened to include catchment management.

Although there is partnership working at a local level, there may be potential to integrate this better at a national level so that expertise can be shared and a consensus on direction agreed across potential delivery bodies.

A more formal and targeted strategy to improve lakes across the SSSI series, and especially on Natura 2000 sites, could be developed, building on previous extensive work in this area (e.g. through the lakes strategy (see Skeate & Perrow, 2007) and the [Lake Habitat Action Plans](#), UKBAP Tranches 1 and 2 (1995-1999)). However, it is recognised that delivery on this scale would take careful organisation and staff commitment from participating organisations to achieve success, and potentially a significant funding bid. It would also need to ensure the integration of catchment and with-in lake work.

8.2 Evidence

The Broads Authority, Natural England and partners, have commissioned a major review of ecological and chemical data, and past management activity in The Broads National Park. This review examines trends in relation to management activity and includes dossiers for each Broad with recommendations on management (Phillips 2015 and others). These dossiers provide the basis for deciding what work should be carried out over the next decade. The review also provides a greater understanding of the effectiveness of

various lake restoration activities, which will influence future activity carried out in the Broads National Park and across the SAC and SSSI series.

Effective before and after monitoring should be included as part of any restoration project so that the scientific evidence base for lake restoration can be improved and disseminated. This is an area which is often compromised due to budgetary constraints (especially beyond the life of a project) and the lack of experienced staff resource during the design of restoration projects. A potential way of overcoming these issues is to develop stronger links with academic institutions that have an interest in lake restoration. Researchers may be interested in helping develop the scientific foundation for projects and in studying the effects of management interventions.

As well as project monitoring, it is especially vital that long-term monitoring of lakes is maintained and protected. Without these datasets, it is not possible to diagnose issues, decide what management is required or monitor longer term recovery. The Environment Agency currently collects monthly water quality monitoring data on all SAC lakes greater than 5 ha in area as part of the WFD monitoring programme. In addition, there are long-term datasets collected by other institutions, such as the Defra UK Upland Water Monitoring Network (co-ordinated by University College London) and Lake District datasets held by Centre for Ecology and Hydrology (CEH). These include SAC lakes, but are also a valuable wider resource in understanding impacts and responses of lake systems to management.

There is the potential for a network to facilitate greater communication between restoration projects and with those producing guidance and evidence, just as the River Restoration Centre does successfully for river restoration projects. This resource would empower less experienced staff and organisations to carry out more evidence based lake restoration projects and provide opportunities for academic institutions to collect new data and strengthen our understanding of restoration science. Several organisations could, potentially, be part of a partnership including the Freshwater Biological Association (FBA) that helps facilitate the understanding of aquatic ecology; the UK and Ireland Lakes Network (www.ukandirelandlakes.org) which hosts an annual conference to bring together lake restoration and management expertise from across sectors and the Freshwater Habitats Trust with a focus on pond management (<http://www.freshwaterhabitats.org.uk/habitats/pond/pond-clinic/>).

At present, CEH hosts a lake restoration resource page that highlights their research in this area (www.ceh.ac.uk/sci_programmes/uk-lakes-restoration.html). UCL together, in collaboration with CEH and other research groups, are proposing an “Aquatic Restoration Partnership”, that draws together research findings from lake, pond, river, wetland and coastal restoration projects and makes them more readily available to the wider aquatic restoration community. Ideally, this initiative will develop some form of network that shares expertise, and builds consensus across multiple organisations. The network could help identify (and fill) gaps in our understanding about lake restoration processes. Funding for such a resource would be critical to its success.

8.3 Skills and knowledge

A strong partnership, and strong information sharing resources, would go some way towards addressing issues of limited expertise, as staff working in the area of lake restoration would be working within a common framework where they are supported and can seek advice. However, within individual organisations contributing to the partnership there would still need to be an acknowledgement and

commitment to set aside staff and budgetary resources over the longer term to carry out the lake restoration required. Identifying and securing the resource of key staff with lake interest/experience ('lake champions') could provide a more effective way of securing and developing the specialist skills required within organisations, but would require additional funding.

8.4 Catchment eutrophication

For further detail on the strategic approach to catchment management of pollution see the IPENS theme plan on [Diffuse Water Pollution](#). In the field of lake restoration it is, however, very important that any in-lake management work is undertaken with full acknowledgement of ongoing pollution sources, and that strategies to address these are at the forefront of any work so that in-lake work is sustainable. Where lake restoration projects are initiated, they need to focus on catchments as much as in-lake management, and the latter needs to be suitably sequenced to ensure sustainable results. It may be that lake restoration plans focus almost entirely on reducing external loads, at least in the first instance. To this end the lake restoration projects identified in table 4 need to be better integrated with the diffuse water pollution programme, so there is a combined vision for each lake which incorporates what is required both within lake, and across the catchment, and in what sequence. When it comes to delivery of lake restoration measures, there is a need to identify or establish effective catchment wide partnerships, which include the key stakeholders able to influence catchment management, but which also are sufficiently long term to be effective, and have clear objectives set around lake restoration informed by a good understanding of the restoration needs of the lake (e.g. Sayer 2014).

8.5 Funding

The existing funding sources are unlikely to increase, so a strategy to manage lakes needs to be developed within these broad funding constraints. For continued progress to be made on SAC lakes, some dedicated staff resource will be required, as a minimum, to ensure the lakes programme continues. Environment Agency monitoring on those lakes is also an essential element of better and more effective management, and this will require continued funding. Beyond that, the speed at which progress is made will rely on available funding and staff resource. This includes funding and staff resource allocated to DWP measures. At present lake restoration activity is not prioritised strategically, but rather by available local opportunities and resource. Additional funding could support a more strategic programme including information sharing facilities, additional monitoring and research around projects, more partnership engagement around an agreed set of target lakes as well as funding restoration work within those lakes and catchments.

9. Priority actions

The table below includes proposals for 12 high level priority actions and associated timescales for improving Natura 2000 lakes. The recommended actions and next steps identified are not definitive nor are they necessarily agreed commitments or resourced and further discussion is planned with potential partners to explore their potential roles and to identify others who may be able to contribute. Oversight of the Theme Plan actions will be coordinated through the IPENS After-LIFE steering group.

Action No.	Action description	Timescale	Who needs to be involved
1.	<p>Develop a prioritised programme approach for Natura 2000 and SSSI lakes involving a wider range of national partners to:</p> <ul style="list-style-type: none"> - Help agree priorities - Develop a programme of delivery - Foster information sharing and knowledge exchange - Develop funding opportunities 	2015-2020	Natural England, Environment Agency, Partners? (consult on who would be interested in this work – probably those involved with lake management such as major land owners, Broads Authority, Lake District National Park, National Trust, researchers, etc.)
2.	Develop a prioritised funding strategy for Natura 2000 lakes and engage with external funders such as EU Life and HLF to advocate funding for lakes	2015-2018	Natural England, Environment Agency, delivery partners
3.	Seek further funding to continue the joint Environment Agency/Natural England Lakes Restoration post for a further 3 years at least to coordinate lake restoration delivery work on Natura 2000 and SSSIs. Review thereafter.	2015-2018	Natural England, Environment Agency
4.	Seek further WFD funding to develop lake restoration plans, coordinate and deliver projects and lever in external funding.	2015-2018	Defra
5.	Align DWP Plans and lake restoration plans and their associated delivery activities.	2015-2020	Natural England, Environment Agency
6.	Identify where existing diffuse pollution reduction approaches are unlikely to allow for the favourable condition of lakes to be achieved and consider alternative approaches.	2015-2016	Natural England, Environment Agency

7.	Support the introduction of the proposed new Countryside Stewardship option that supports the restoration of large water bodies on designated sites and promote its uptake. Elsewhere secure future funding for lake restoration under Conservation Enhancement Scheme (CES) agreements.	2015-2017	Natural England, Defra
8.	Investigate, with partners, opportunities to develop an accessible internet portal site for lake and lakes restoration information.	2015-2018	Natural England, Environment Agency, University College London, Centre for Ecology and Hydrology, UK and Ireland Lakes Network
9.	Ensure that the Environment Agency water quality and ecological monitoring of Natura 2000 lakes continues and is allocated sufficient long-term staff resource and funding. Explore options for getting some data on smaller (less than 5 ha) SAC lakes.	2015-2020	Natural England, Environment Agency
10.	Seek to develop 'lake champions' within Natural England, Environment Agency regional/area teams and delivery partners to act as advocates, and sources of specialised knowledge.	2015-2020	Natural England, Environment Agency, delivery partners
11.	Ensure all restoration projects include effective before and after monitoring to improve the scientific evidence base for lake restoration.	2015-2020	Natural England, Environment Agency, delivery partners
12.	'Twin' lakes with similar restoration and recovery challenges to ensure efficient sharing of data, evidence and experience.	2015-2020	Natural England, Environment Agency, delivery partners

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Annex 2. Sites where non-Annex 1 lakes provide supporting habitat for Natura 2000 features

Natura 2000 site name	Meeting Objectives?	Natura 2000 feature
Abberton Reservoir	Yes	Coot; Cormorant; Gadwall; Goldeneye; Great Crested Grebe; Mute Swan; Pochard; Shoveler; Teal; Tufted Duck; Waterfowl assemblage; Wigeon
Avon Valley	No	Bewicks Swan; Gadwall
Brown Moss	No	Floating water-plantain
Chew Valley Lake	Yes	Shoveler
Dungeness to Pett Level	No	Annual vegetation of drift lines; Coastal shingle vegetation outside the reach of waves; Great crested newt; Bewicks Swan; Common Tern; Little Tern; Mediterranean Gull; Shoveler
Fens Pools	Yes	Great crested newt
Hornsea Mere	No	Gadwall; Mute Swan
Humber Estuary	No	Great bittern; Common shelduck; Eurasian marsh harrier; Hen harrier; Pied avocet; European golden plover; Red knot; Dunlin; Ruff; Black-tailed godwit; Bar-tailed godwit ; Common redshank; Little tern; Waterbird assemblage
Lee Valley	Yes	Bittern; Gadwall; Shoveler
Lyppard Grange Ponds	Yes	Great crested newt
Rutland Water	Yes	Coot; Gadwall; Goldeneye; Goosander; Great Crested Grebe; Mute Swan; Shoveler; Teal; Tufted Duck; Waterfowl assemblage; Wigeon

Natura 2000 site name	Meeting Objectives?	Natura 2000 feature
Solent & Southampton Water	No	Black-tailed Godwit; Common Tern; Dark-bellied Brent Goose; Little Tern; Mediterranean Gull; Ringed Plover; Roseate Tern; Sandwich Tern; Teal; Waterfowl assemblage
South West London Waterbodies	No	Gadwall; Shoveler
Stodmarsh	Yes	Desmoulin's whorl snail; Bittern; Breeding bird assemblage; Gadwall; Grasshopper Warbler; Great Crested Grebe; Hen Harrier; Lapwing; Mallard; Pochard; Redshank; Reed Warbler; Savis Warbler; Sedge Warbler; Shoveler; Snipe; Tufted Duck; Water Rail; White-fronted Goose.; Wigeon
Thames Estuary & Marshes	No	Avocet; Black-tailed Godwit; Dunlin; Grey Plover; Hen Harrier; Knot; Redshank; Ringed Plover; Waterfowl assemblage

Annex 3. List of SAC Lakes, their condition and issues

SAC name	Lake name	Annex1 habitat	SSSI condition*	Size (ha)	Summary of issues	Action
Asby Complex	Sunbiggin Tarn	H3140: Hard oligo-mesotrophic waters with Chara	Unfav. Decl.	3.7	Nutrient enrichment. It is not fully understood if this is ongoing or historic, and how it should be managed.	Further investigation.
Breckland	Devil's Punchbowl	H3150: Natural eutrophic lakes	Fav.	0.5		
	Fowlmere	H3150: Natural eutrophic lakes	Fav.	8.6		
	Home Mere	H3150: Natural eutrophic lakes	Fav.	1.1		
	Langmere	H3150: Natural eutrophic lakes	Unfav. Decl.	4.6	Nutrient enrichment.	Review the findings from the investigation to ascertain whether a catchment scale approach is needed.
	Ringmere	H3150: Natural eutrophic lakes	Unfav. Decl.	2	Loss of aquatic plants and nutrient enrichment.	Review the findings from the investigation to ascertain whether a catchment scale approach is needed.
Craven Limestone Complex	Malham Tarn	H3140	Fav.	60	Peat cliff erosion and suspected increasing nutrients	Peat cliff stabilisation works. DWP including WQ monitoring.

SAC name	Lake name	Annex1 habitat	SSSI condition*	Size (ha)	Summary of issues	Action
Dorset Heaths (Purbeck & Wareham) & Studland Dunes	Little Sea	H3110: Oligotrophic waters of sandy plains	Unfav. Decl.	31.4	Increased phosphorus & turbidity. Illegally stocked carp. <i>Crassula</i> .	Carp removal and monitoring of inflow stream.
Lake District High Fells	Blea Tarn	H3130: Oligotrophic to mesotrophic waters	Fav.	7.4		
	Bowscale Tarn	H3130: Oligotrophic to mesotrophic waters	Fav.	2.2		
	Dock Tarn	H3130: Oligotrophic to mesotrophic waters	Fav.	2		
	Grisedale Tarn	H3130: Oligotrophic to mesotrophic waters	Fav.	11		
	Red Tarn, Helvellyn	H3130: Oligotrophic to mesotrophic waters	Fav.	7.8		
	Scales Tarn	H3130: Oligotrophic to mesotrophic waters	Unfav. Rec	1.2	Lake is favourable (within unfavourable terrestrial unit)	
	Styhead & Sprinkling Tarns	H3130: Oligotrophic to mesotrophic waters	Unfav. Rec	4.2	Lake is favourable (within unfavourable terrestrial unit)	
	Moor House - Upper Teesdale	Tarn Dub	H3140: Hard oligo-mesotrophic waters with	Unfav. Rec	0.3	Lake is favourable (within unfavourable terrestrial unit)
Morecambe Bay Pavements	Cunswick tarn	H3140: Hard oligo-mesotrophic waters with Chara	Unfav. Decl.	0.8	Eutrophication. Duck rearing likely to be contributing nutrients.	Change in duck management negotiated. Monitoring needs to be installed to judge whether this is sufficient.

SAC name	Lake name	Annex1 habitat	SSSI condition*	Size (ha)	Summary of issues	Action
	Hawes Water, Silverdale	H3140: Hard oligo-mesotrophic waters with Chara	Fav.	5.7	Favourable but at risk due to elevated nutrients	Diffuse water pollution plan
	Little Hawes Water	H3140: Hard oligo-mesotrophic waters with Chara	Fav.	0.2	Favourable but at risk due to elevated nutrients	Diffuse water pollution plan
Oak Mere	Oak Mere	H3110: Oligotrophic waters of sandy plains	Unfav. No change	18.4	Eutrophication from surrounding land use, possible hydrological change from nearby quarry abstraction and INNS (<i>Crassula</i>).	Diffuse water pollution plan, investigation into hydrology and INNS control plan.
Orton Pit	Orton pit ponds	H3140: Hard oligo-mesotrophic waters with Chara	Unfav. Rec	Ponds	Decrease in <i>Chara</i> due to succession. Succession also affecting terrestrial GCN habitat	Maintenance of early successional habitat through Conservation Enhancement Scheme
River Derwent and Bassenthwaite Lake	Bassenthwaite Lake	H3130: Oligotrophic to mesotrophic waters	Unfav. No change	523.9	Eutrophication resulting in failure of nutrient target & loss of aquatic plant species. Vendace population has declined to near extinction. INNS affecting habitat condition and Vendace (<i>Crassula helmsii</i> , Himalayan balsam & coarse fish including Ruffe).	Diffuse water pollution plan. 'Love your lakes' campaign. Implement Cumbria Freshwater Biosecurity Plan to control and eradicate invasive non-native species. R&D for control of Ruffe.
	Buttermere	H3130: Oligotrophic to mesotrophic waters	Fav.	90.90	Concern over status of Arctic Char	
	Crummock Water	H3130: Oligotrophic to mesotrophic waters	Fav.	249.70	Concern over potential impacts of abstraction	Keep under review

SAC name	Lake name	Annex1 habitat	SSSI condition*	Size (ha)	Summary of issues	Action
	Derwent Water	H3130: Oligotrophic to mesotrophic waters	Unfav. No change	528.7	Some loss of aquatic plant species (enrichment). INNS affecting habitat condition (<i>Crassula helmsii</i>)	No mechanism for eradicating <i>Crassula</i> identified.
River Eden	Ullswater	H3130: Oligotrophic to mesotrophic waters	Fav.	868.2	WQ targets close to failure	Diffuse water pollution plan.
Roman Wall Loughs	Broomlee Lough	H3150: Natural eutrophic lakes	Unfav. Rec	27.9	Nutrient levels are higher than expected but the exact cause is unknown	DWP activities and water quality monitoring.
	Crag Lough	H3150: Natural eutrophic lakes	Unfav. Rec	10.1	Nutrient levels are higher than expected but the exact cause is unknown	DWP activities and water quality monitoring.
	Greenlee Lough	H3150: Natural eutrophic lakes	Unfav. Rec	46.4	Nutrient levels are higher than expected but the exact cause is unknown	DWP activities and water quality monitoring.
The Broads	Bargate Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Unfav. Rec	4.4	Eutrophication but some recovery of species recently.	Monitor recovery.
	Barnby Broad	H3150: Natural eutrophic lakes	Unfav. Rec	2.3	Eutrophication: Feature failed on the diversity of characteristic species, the loss of one species since the last survey in 2009, and the level of filamentous algae.	Improved since mud-pumping in 2007. Monitor recovery. HLS to remove tree growth from hover.
	Barton Broad	H3150: Natural eutrophic lakes	Unfav. Rec	57.6	Eutrophication: not meeting plant or WQ targets	Diffuse water pollution plan. Maintenance of fish enclosures.

SAC name	Lake name	Annex1 habitat	SSSI condition*	Size (ha)	Summary of issues	Action
	Blackfleet Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural	Fav.	1	Shallow and requires monitoring over the long term	Brograve Project.
	Buckenham Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Fav.	2.23		
	Calthorpe Broad	H3150: Natural eutrophic lakes	Unfav. Rec	1.3	Improved water supply is continuing to improve the water quality of the Broad. Also was mud pumped in Feb 2009.	WLMP being implemented.
	Catfield Broad	H3150: Natural eutrophic lakes	Unfav. No change	0.9	Eutrophication. Ongoing recovery since mud pumping. Possible hydrological impacts from abstraction.	Monitor recovery post mud-pumping. Investigation into hydrology covers the lake too.
	Cockshoot Broad	H3150: Natural eutrophic lakes	Unfav. Rec	5.5	Eutrophication. Mud-pumping and biomanipulation as resulted in some recovery.	Monitor recovery and continue isolation from the River Bure.
	Decoy Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Unfav. No change	7.9	Eutrophication. Significant increase in macrophytes in 2013 may be first indication of natural recovery following improvements in river water quality over the last 20+ years.	Unsure what management recommended; waiting for Broads lake restoration review

SAC name	Lake name	Annex1 habitat	SSSI condition*	Size (ha)	Summary of issues	Action
	Filby Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Unfav. No change	40	Still high levels of phosphate in the Trinities, although site has recovered extremely well in recent years. There is still inherent instability in the system and a risk of deterioration.	Further sediment will be removed in AMP6 to maintain water depth (unlikely to reduce nutrients) and catchment wide measures continued to reduce further inputs.
	Hassingham Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Fav.	1.7		
	Heigham Sound	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Unfav. No change	33.18	Eutrophication & salinity issues, especially from the deep drainage of the Brograve catchment	Reedswamp erosion prevention and physical protection island building, DWP, Brograve Project.
	Hickling Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Unfav. Decl.	153.8	Eutrophication & salinity issues, especially from the deep drainage of the Brograve catchment	Reedswamp erosion prevention and physical protection island building, DWP, Brograve Project.
	Horsey Mere	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Unfav. Decl.	32.8	Eutrophication & salinity issues, especially from the deep drainage of the Brograve catchment	DWP, Brograve Project
	Hoveton Great Broad	H3150: Natural eutrophic lakes	Unfav. No change	32	Eutrophication, siltation & absence of aquatic plants	Lake restoration (desilting and biomanipulation) planned subject to securing external funding.
	Hudson's Bay	H3150: Natural eutrophic lakes	Unfav. No change	4.5	Eutrophication, siltation & absence of aquatic plants	Lake restoration (desilting and biomanipulation) planned subject to securing external funding.

SAC name	Lake name	Annex1 habitat	SSSI condition*	Size (ha)	Summary of issues	Action
	Irstead Holmes	H3150: Natural eutrophic lakes	Fav.	0.4		
	Lily Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Unfav. Rec	8.2	Eutrophication. Still high levels of phosphate in the Trinities, although site has recovered extremely well in recent years. There is still inherent instability in the system and a risk of deterioration.	Further sediment will be removed in AMP6 to maintain water depth (unlikely to reduce nutrients) and catchment wide measures continued to reduce further inputs.
	Little Broad	H3150: Natural eutrophic lakes	Fav.	1.3	Retain monitoring (some year not favourable).	
	Martham North Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Fav.	8.56		WLMP delivery
	Martham South Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Fav.	8.27		WLMP delivery
	Ormesby Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Unfav. Rec	52.25	Eutrophication. Still high levels of phosphate in the Trinities, although site has recovered extremely well in recent years. There is still inherent instability in the system and a risk of deterioration.	Further sediment will be removed in AMP6 to maintain water depth (unlikely to reduce nutrients) and catchment wide measures continued to reduce further inputs.

SAC name	Lake name	Annex1 habitat	SSSI condition*	Size (ha)	Summary of issues	Action
	Ormesby Little Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Unfav. Rec	37.9	Eutrophication. Still high levels of phosphate in the Trinities, although site has recovered extremely well in recent years. There is still inherent instability in the system and a risk of deterioration.	Further sediment will be removed in AMP6 to maintain water depth (unlikely to reduce nutrients) and catchment wide measures continued to reduce further inputs.
	Rockland Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Unfav. Rec	26	Eutrophication. Threats from salinity & INNS.	DWP, planting to protect islands from erosion & eradication of pennywort just outside the SSSI
	Rollesby Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Unfav. Rec	26.25	Eutrophication. Still high levels of phosphate in the Trinities, although site has recovered extremely well in recent years. There is still inherent instability in the system and a risk of deterioration.	Further sediment will be removed in AMP6 to maintain water depth (unlikely to reduce nutrients) and catchment wide measures continued to reduce further inputs.
	Round Water	H3150: Natural eutrophic lakes	Unfav. No change	0.09	Eutrophication, siltation	Mud-pumping not currently recommended. Options need to be reviewed.
	Sprat's Water	H3150: Natural eutrophic lakes	Fav.	0.24		
	Strumpshaw Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Unfav. Rec	2.2	Species abundance and diversity is variable.	DWP?

SAC name	Lake name	Annex1 habitat	SSSI condition*	Size (ha)	Summary of issues	Action
	Upton Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Fav.	6.6	Shallow areas require monitoring over the long term to assess sediment removal requirement	Sediment removal not currently recommended.
	Upton Little Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Unfav. Rec	1.17	Eutrophication & siltation	DWP. Mudpumping undertaken; waiting for recovery.
	Wheatfen Broad	H3140: Hard oligo-mesotrophic waters with Chara, H3150: Natural eutrophic lakes	Fav.	4.11		
	Woolner's Carr	H3150: Natural eutrophic lakes	Unfav. No change	0.1	Eutrophication, siltation	Restoration recommendations need to be reviewed. May need mud-pumping
The Lizard	Temporary ponds across the lizard	H3170: Mediterranean temporary ponds & H3140: Hard oligo-mesotrophic waters with Chara	Fav.	Ponds		Tyre tracks are scraped & scrub encroachment controlled to maintain areas of SAC temporary pond feature
The New Forest	Hatchet Pond	H3110: Oligotrophic waters of sandy plains	Unfav. Decl.	6.7	INNS and management as a carp fishery	<i>Crassula</i> being addressed through the New Forest Non-Native Plants project. The fishery use is being reviewed as part of a lake restoration plan.

SAC name	Lake name	Annex1 habitat	SSSI condition*	Size (ha)	Summary of issues	Action
	SAC pond	H3110: Oligotrophic waters of sandy plains. H3140: Hard oligo-mesotrophic waters with Chara	Unfav. Rec	1	INNS	<i>Crassula</i> being addressed through the New Forest Non-Native Plants project.
	Temporary SAC ponds across the New Forest	H3110: Oligotrophic waters of sandy plains	Mostly fav.	Ponds	INNS	<i>Crassula</i> being addressed through the New Forest Non-Native Plants project.
Wast Water	Wast Water	H3130: Oligotrophic to mesotrophic waters	Unfav. Rec	278	Eutrophication/siltation from some of the farm management practices in the catchment.	HLS/negotiation with land owners/occupiers
West Midlands Mosses	Abbots Moss dystrophic pools	H3160: Natural dystrophic ponds	Unfav. Decl.	Ponds	Eutrophication & increasing pH of dystrophic pools. Scrub encroachment	Investigation into pollution sources. Scrub clearance.
	Clarepool Moss dystrophic pools	H3160: Natural dystrophic ponds	Unfav. Rec	Ponds	Undergoing hydrological recovery	WLMP and tree clearance operations ongoing
	Chartley Moss dystrophic Pools	H3160: Natural dystrophic ponds	Unfav. Rec	Ponds	Undergoing hydrological recovery	Management in place for continued recovery of site (mainly felling conifers and maintaining high-water levels and low nutrient input).
	Wybunbury Moss pools	H3160: Natural dystrophic ponds	Unfav. No change	Ponds	Eutrophication	DWP plan.
Woolmer Forest	Cranmer Pond	H3160: Natural dystrophic ponds	Fav.	2.2		
	Woolmer Pond	H3160: Natural dystrophic ponds	Unfav. Decl.	2.1	INNS	Control of <i>Crassula</i>

***SSSI Condition:** Natural England assesses the condition of all SSSIs which underpin Natura 2000 sites every six years to assess the quality of their designated habitats and species. After the assessment each site/unit is placed into one of the following categories:

Favourable condition

This means that the special habitats and features are in a healthy state and are being conserved for the future by appropriate management.

Unfavourable – recovering condition

This means that all necessary management measures are in place to address the reasons for unfavourable condition – if these measures are sustained, the site will recover over time.

Unfavourable – no change or Unfavourable – declining condition

Used to describe sites where the Special Features of a site are not being adequately conserved, or are being lost. If appropriate management measures are not put in place, and damaging impacts are not addressed, these sites will never reach a favourable or recovering condition.

Annex 4. Natura 2000, Ramsar and SSSI lakes within the WFD with current lake restoration remedies or threat mechanisms

Key to Priority Score:

0. Notified feature under review (so LRP not a priority at this time).
1. Natura 2000 with lake restoration remedy in RBMP
 - a. SAC
 - b. SPA
2. Natura 2000 without lake restoration remedy identified in RBMP but with remedy now identified in ENSIS
 - a. SAC
 - b. SPA
3. Non Natura 2000 lake SSSIs with lake restoration remedy in ENSIS and in RBMPs
4. Non Natura 2000 lake SSSIs with lake restoration remedy in ENSIS but not in RBMP
5. Natura 2000 lake without LRP remedy
 - a. SAC lake
 - b. SPA or SAC for species (e.g. Great crested newt or *Luronium*) or another feature (not lake habitat)
6. Non Natura 2000 lake SSSIs without LRP remedy

Site name	Status	Lake	SSSI unit condition	WFD ID & status (2012)	Priority score	Lake restoration progress
Brown Moss	SAC	Pool	Unfavourable recovering	no WFD water bodies	2a	Lake restoration plan due 2015/16 but staffing still an issue. Pond is very nutrient rich so the possibility/logistics of desilting should be investigated.
Craven Limestone Complex	SAC	Malham Tarn	Favourable	GB30429844; Good	2a	Lake and moss restoration work in progress & due to complete 2014-15. This is to stabilise the moss edge and prevent erosion into the lake.

Site name	Status	Lake	SSSI unit condition	WFD ID & status (2012)	Priority score	Lake restoration progress
Dorset Heaths (Purbeck & Wareham) & Studland Dunes	SAC	Little Sea	Unfavourable declining	GB30846102; Good	2a	Outline lake management plan produced 2012-13. Environment Agency now monitoring inflow. Carp traps were installed October 2013. Traps not that successful, so now gill nets have been employed and on 1 st July 2014 caught 11, 8lb carp. In October 2014 a further 30 large carp removed after one days netting. A finer net is also being used to see if they could catch small carp to confirm (or otherwise) whether the carp are breeding in large numbers. They found no evidence of breeding this year and whilst they did only check in a couple of places it could mean that the numbers are reducing overall.
Morecambe Bay Pavements	SAC	Cunswick tarn	Unfavourable declining	no WFD water bodies	2a	Palaeo work done as part of PhD 2009-13. Duck rearing is an impact which still needs addressing. No plan here (and none currently planned) as negotiation is happening with the landowner. However would benefit from monitoring to judge impact of management changes (reduction in duck stocking agreed).
Roman Wall Loughs	SAC	Crag Lough	Unfavourable recovering	GB30328220; Moderate	2a	Environment Agency, Tyne Rivers Trust, and National Park to do various works focusing on Greenlee Lough through various funding streams. These mainly focussing on catchment management & lake monitoring.
The Broads	SAC SPA	Broomlee Lough	Unfavourable recovering	GB30328172; Good	2a	

Site name	Status	Lake	SSSI unit condition	WFD ID & status (2012)	Priority score	Lake restoration progress
		Greenlee Lough	Unfavourable recovering	GB30328165; Moderate	2a	
		Ant Broads and Marshes Barton Broad	Unfavourable recovering	GB30535655; Moderate	2a	Broads Lake Restoration Strategy 2009 and more recently Broads Biodiversity and Water Strategy 2013 summarise the prioritisation of lake restoration in the Broads. Lake restoration evidence gathering and implementation actions being progressed by Natural England, Broads Authority, Environment Agency and partners. Broads review (2013-15) to produce dossiers on individual broads to recommend management. Final report due in March 2015.
		Bure Broads and Marshes SSSI: Decoy Broad	Unfavourable no change	GB30535959; Poor	1a	Decoy: Waiting for dossier, but lake restoration may to be required - significant increase in macrophytes in 2013 may be first indication of natural recovery following improvements in river water quality over the last 20+ years.
		Hoveton Great Broad Hudsons Bay	Unfavourable no change Unfavourable no change	GB30535977; Poor	1a 1a	Hoveton Great Broad: Desilting plan drawn up 2012/13 and being refined and funding sought 2014/15 through HLF & LIFE. Outcome of funding bids July 2015. Hudson's Bay: As with Hoveton Great Broad.

Site name	Status	Lake	SSSI unit condition	WFD ID & status (2012)	Priority score	Lake restoration progress
		Ranworth Broad	Unfavourable no change	GB30536050; Poor	1b	Ranworth: Restoration awaiting outcome of broads review work. Biomanipulation has been successful and could be carried out in a larger area.
		Sprat's Water And Marshes Round Water	Unfavourable no change	no WFD water bodies	2a	Sprat's Water and Marshes: LRP recommended no action, but this to be reviewed. DWP plan being drawn up. Round water and Woolner's Carr may need mud-pumping.
		Spat's Water	Favourable		1a	
		Woolner's Carr	Unfavourable no change		2a	
		Upper Thurne Broads and Marshes SSSI: Hickling Broad	Unfavourable declining	GB30535640; Poor	1a	Hickling: Pymnesium project 2011-14, Goose monitoring and goose guard installation 2012-14. Restoration feasibility study being drawn up 2013/14. Physical protection and littoral margin thought to be important and likely to recommend further catchment management actions as essential. Largely reliant on extension to Brograve Project.

Site name	Status	Lake	SSSI unit condition	WFD ID & status (2012)	Priority score	Lake restoration progress
		Horsey Mere	Unfavourable declining	GB30535645; Moderate	1a	Similar issues to Hickling.
		Trinity Broads SSSI: Ormesby Little Broad	Unfavourable recovering	No status (?) GB30547011	2a	Ormesby Little Broad; Rollesby Broad; Lily Broad; Ormesby Broad: Lake restoration being implemented. Biomanipulation carried out but system still unstable. Continued monitoring required to see whether other lake restoration actions are required. Some desilting to be carried out through water industry Asset Management Plan (AMP) 6 to maintain water depth.
		Rollesby Broad	Unfavourable recovering	GB30547010	2a	
		Lily Broad	Unfavourable recovering	no WFD waterbody ID	2a	

Site name	Status	Lake	SSSI unit condition	WFD ID & status (2012)	Priority score	Lake restoration progress
		Ormesby Broad	Unfavourable recovering	GB30547009	2a	
Wast Water	SAC	Wast Water	Unfavourable recovering	GB31229183; Good	2a	LRP remedy added 2013/14. Negotiation required with adjacent landowners to reduce diffuse pollution from fields.
Alresford Pond	SSSI	Alresford Pond	Unfavourable declining	GB30744431; Good	0	Lake restoration plan produced in 2013/14. Natural England's Detailed Notification Review will probably conclude that this not standing water habitat, but restoration plan still required in relation to SAC river restoration, reedbed and bird interest. Being managed by Hampshire & Isle of Wight Wildlife Trust.
Aqualate Mere	Ramsar/SSSI	Aqualate Mere	Unfavourable no change	GB30935724; Poor	3	Lake restoration planning mainly done but large amounts of funding (3 million) required to carry out desilting. Work in 2011-14 on preparation for restoration and review of funding sources. Discussions ongoing now between Natural England and Environment Agency external funding teams (Nov 2013). Heritage Lottery Fund submission September 2014, was not approved in January 2015 but re-submission later in the year was encouraged following revision of the proposals.

Site name	Status	Lake	SSSI unit condition	WFD ID & status (2012)	Priority score	Lake restoration progress
Berrington Pool	Ramsar/SSSI	Berrington Pool	Unfavourable recovering	GB30936634; Good	4	LRP remedy added January 2014. Carp fishery a concern. No plan yet.
Betley Mere	Ramsar/SSSI	Betley Mere	Unfavourable no change	GB31234330; Poor	3	Lake restoration plan produced 2013/14. An experimental approach including water level management, biomanipulation and constructed reedbeds is recommended. Staff resource an issue.
Bomere Shomere and Betton Pools	Ramsar/SSSI	Bomere pool, Shomere pool, Betton pool	Unfavourable recovering	GB30936544; Poor	3	Lake restoration targeting marginal tree encroachment in 2012/13. DWP covers water quality issues. Carp fishery a concern.
Bradgate Park and Cropston Reservoir	SSSI	Cropston Reservoir	Unfavourable no change	GB30436331; Poor	4	Nutrient budget being led by EA working with Severn Trent & funded by AMP 5. Desk study complete. Field work to commence 2013/14. Need to follow up on results. Impact assessment of public water supply abstractions being led by Severn Trent Water Limited in conjunction with the Environment Agency and funded by AMP 5. All work completed in December 2013. Need an update on how the report conclusions are going to be implemented and how this will address outstanding SSSI remedies.

Site name	Status	Lake	SSSI unit condition	WFD ID & status (2012)	Priority score	Lake restoration progress
Clumber Park	SSSI	Clumber Park	Unfavourable recovering	GB30433056; Moderate	4	Nutrient issues being investigated by Environment Agency. Environment Agency to carry out fish survey in 2013/14. Need to follow up on results.
Cole mere	Ramsar/SSSI	Cole mere	Unfavourable recovering	GB30935079; Poor	4	Work on hydrology monitoring to inform restoration (2013-14).
Elterwater	SSSI	Elterwater	Unfavourable no change	GB31229222; Moderate	3	Lake investigation done under the water industry regulator's 2009 Price Review (PR09) process to conclude in September 2013 with preferred lake restoration option. Funding for implementation through PR14. Steering group being set up 2013-14 to review options, develop a detailed lake restoration plan and implement. Likely to start with river channel realignment to increase flushing.
Fenemere	Ramsar/SSSI	Fenemere	Unfavourable no change	GB30935620; Poor	3	Has a fishery management plan. Biomanipulation to be agreed between Natural England and Environment Agency 2013/14. Staffing an issue.
Fleet Pond	SSSI	Fleet Pond	Unfavourable recovering	GB30643315; Poor	4	Lake restoration plan in place and being implemented 2013/14-14/15.

Site name	Status	Lake	SSSI unit condition	WFD ID & status (2012)	Priority score	Lake restoration progress
Hatch Mere	Ramsar/SSSI	Hatch Mere	Unfavourable no change	GB31233210; Moderate	4	Environment Agency lead lake restoration trial (Phoslock). Preliminary monitoring complete 2012/13 with treatment in February 2013. Monitoring in 2013/14. Final report due summer 2015.
Heath Lake	SSSI	Heath Lake	Unfavourable no change	GB30642945; Moderate	4	Lake restoration plan being developed 2013-14. A feasibility and design study for Heath Lake restoration is in AMP6 (for delivery 2015-2020). This is still subject to Ofwat approval in the 2014 Price Review (PR14). We hope that the actual restoration works will then go into AMP7 (for delivery 2020-2025).
Holme Pit	SSSI	Holme Pit	Unfavourable recovering	GB30435028; Moderate	4	Lake restoration plan produced 2012-13. Water quality monitoring required 2014-15, but resource (finance and staff) an issue.
Marton Pool, Chirbury	Ramsar/SSSI	Marton Pool	Unfavourable recovering	GB30936881; Moderate	3	Hydrological scoping 2012/13, sluice repair 2013/14. Sluice repair delayed to 2014/15. This may fall under the Water Level Management Plan WLMP remedy and & funding mechanism.
Mickletown Ings	SSSI	Mickletown Ings	Unfavourable declining	GB30430809; Moderate	4	Investigations into water pollution issues needed. This project now focussing on INNS in 2014/15. DNR likely to conclude that standing water is not the notified feature, so LRP may not be required.

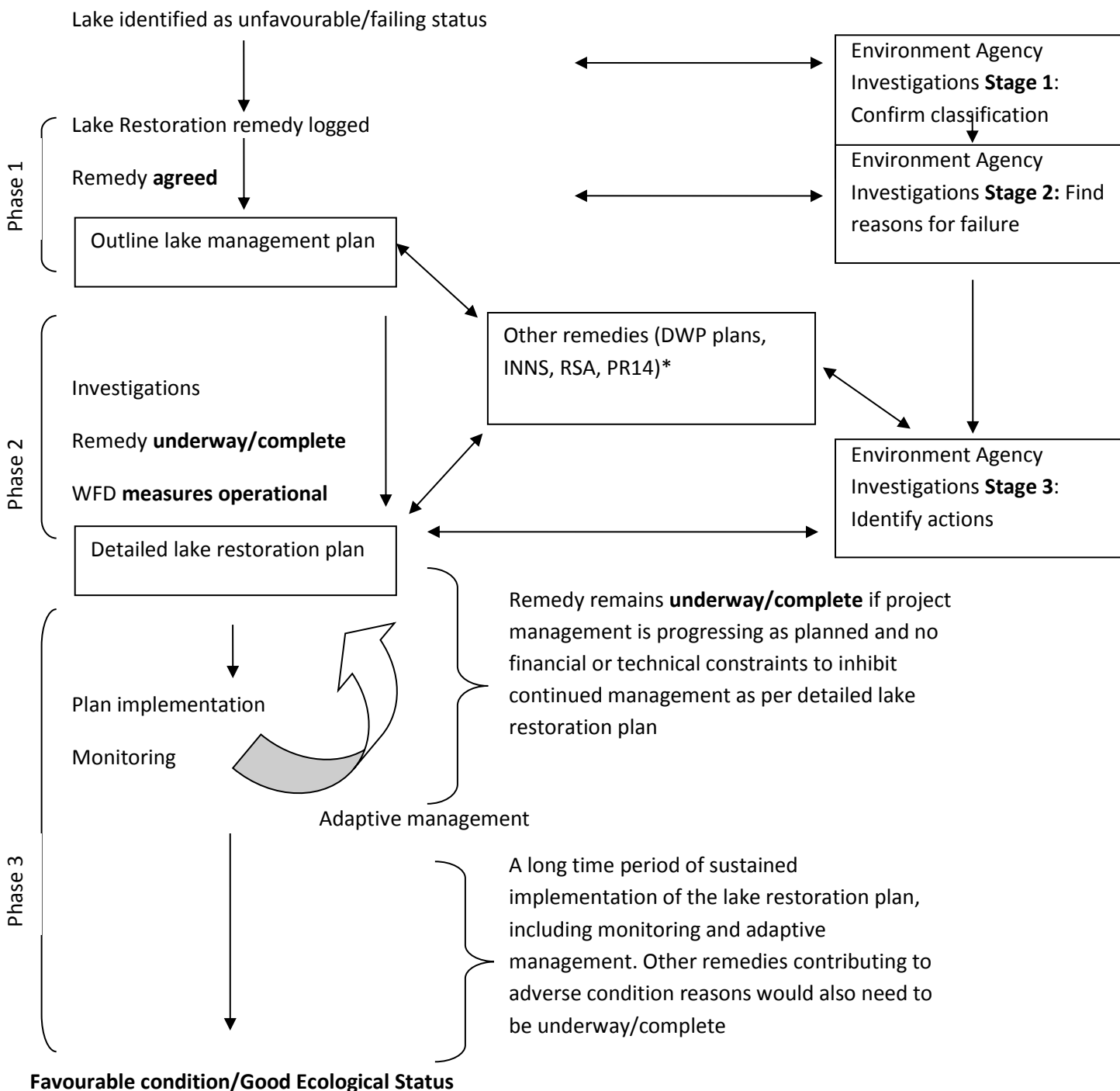
Site name	Status	Lake	SSSI unit condition	WFD ID & status (2012)	Priority score	Lake restoration progress
Ockham and Wisley Commons	SSSI	Boldermere	Unfavourable recovering	GB30643218; Moderate	3	Lake restoration (biomanipulation) carried out 2011/12. Natural England's Site information database needs to be updated to reflect that lake restoration work complete. <i>Crassula</i> now being controlled. No further lake restoration work currently required.
Oss Mere	Ramsar/SSSI	Oss Mere	Unfavourable declining	GB31234545; Poor	3	Lake restoration management works around hydrological restoration, tree clearance etc (2013/14). No further lake restoration work required for now. Hydrological restoration still needs to be done. Repair and make safe sluice on outfall to sustain water levels in the mere. Fish stocking investigation.
Quoisley Meres	Ramsar/SSSI	Quoisley Big Mere	Unfavourable recovering	GB31234438 & GB31234441; Moderate	4	Study in 2012/13 to evaluate options and design of scheme for improving hydrology of outflow of Quoisley Big Mere. Scheme implemented 2013/14. Now complete.
Skelsmergh Tarn	SSSI	Skelsmergh Tarn	Favourable	GB31229353; Moderate	4	LRP remedy added Jan 2014. Fishery a concern
Stover Park	SSSI	Stover Park	Unfavourable no change	GB30846229; Moderate	3	Outline lake management plan written. Some active desilting 2013/14 and larger desilting feasibility study being done 2013/14.

Site name	Status	Lake	SSSI unit condition	WFD ID & status (2012)	Priority score	Lake restoration progress
Swanholme Lakes	SSSI	Swanholme Lakes	Unfavourable no change	GB30533426; Good	0	Lake restoration may be needed; site to undergo detailed notification review first. Will not be progressed until at least 2015/16; staffing issues.
Sweat Mere and Crose Mere	Ramsar/SSSI	Sweat mere and Crose Mere	Unfavourable no change	GB30935212; Poor	3	Restoration planning in 2012/13. Re-naturalisation of hydrology to be started 2013/14. May be delayed until 2014/15.
Tattershall Old Gravel Pits	SSSI	Tattershall Old Gravel Pits	Unfavourable declining	GB30533852; Good	4	Lake restoration plan in completed 2013/14. No conclusive recommendations.
Tatton Meres	Ramsar/SSSI	Tatton Meres	Unfavourable no change	GB31232804; Poor	3	Outline lake management plan produced 2013/14. Further actions fall to DWP. LRP can be removed.
Thompson Water, Carr and Common	SSSI	Thompson Water	Favourable	GB30537306; Moderate	4	Outline lake management plan produced 2013/14. Largely DWP required.

Site name	Status	Lake	SSSI unit condition	WFD ID & status (2012)	Priority score	Lake restoration progress
The Mere, Mere	Ramsar/SSSI	Mere mere	Unfavourable no change	GB31232744; Moderate	4	Environment Agency lead lake restoration trial (Phoslock). Preliminary monitoring complete 2012/13 with treatment in February 2013. Monitoring in 2013/14. Further catchment investigations likely.
Thurstonfield Lough	SSSI	Thurstonfield Lough	Unfavourable no change	GB30228429; Moderate	6	Long term lake restoration plan agreed (2011/12) with owner, including Elodea, Typha and silt removal as well as increased filtering of incoming waters.
Westwick Lakes	SSSI	Westwick lakes	Unfavourable declining	GB30535397; Good	4	Investigations into nutrients carried out 2011-13. Lake restoration produced 2013/14. Actions to be started 2014/15 with further catchment monitoring and negotiation with owner over reduction in duck rearing and associated monitoring.
White Mere	Ramsar/SSSI	White Mere	Unfavourable recovering	GB30935091; Bad	3	Lake hydrological restoration scoping work and implementation in 2012/13. Implementation due 2014/15.

Site name	Status	Lake	SSSI unit condition	WFD ID & status (2012)	Priority score	Lake restoration progress
Whitmoor Common	SSSI	Brittens Pond	Unfavourable no change	GB30643359; Moderate	0	Low priority under WFD funding as pond is not a notified feature (under review). Wildlife Trust are looking to fund restoration through SITA. Remedy owned by Natural England has been changed to complete, not SSSI feature. The Environment Agency has been involved in fish removal and advised on reed planting and this remedy is also underway/complete. Surrey Wildlife Trust is project managing the removal of silt and have funding from SITA. They are currently obtaining permissions, etc.

Annex 5. Schematic of the lakes restoration process



*(DWP plans – Diffuse Water Pollution plans, INNS- Invasive Non-native Species, RSA - Restoring Sustainable Abstractions programme, PR14 - Water industry regulator's 2014 Price Review)

Annex 6. List of IPENS Theme Plans

The table below provides hyperlinks to the suite of IPENS theme plans, which are available on the Natural England publication catalogue.

Theme plan	Hyperlink
Atmospheric nitrogen deposition	http://publications.naturalengland.org.uk/publication/6140185886588928?category=5605910663659520
Climate change	http://publications.naturalengland.org.uk/publication/4954594591375360?category=5605910663659520
Diffuse water pollution	http://publications.naturalengland.org.uk/publication/5848526737113088?category=5605910663659520
Grazing	http://publications.naturalengland.org.uk/publication/4839898496368640?category=5605910663659520
Habitat Fragmentation	http://publications.naturalengland.org.uk/publication/5004101806981120?category=5605910663659520
Hydrological functioning	http://publications.naturalengland.org.uk/publication/6400975361277952?category=5605910663659520
Inappropriate coastal management	http://publications.naturalengland.org.uk/publication/6371629661683712?category=5605910663659520
Invasive species	http://publications.naturalengland.org.uk/publication/6130001713823744?category=5605910663659520
Lake restoration	http://publications.naturalengland.org.uk/publication/5583022327857152?category=5605910663659520
Public access and disturbance	http://publications.naturalengland.org.uk/publication/6621454219083776?category=5605910663659520
River Restoration	http://publications.naturalengland.org.uk/publication/5478339747774464?category=5605910663659520

Annex 7. Stakeholders contacted during the development of the Lakes Theme Plan

Organisation Name	
RSPB	Forestry Commission
National Trust	Mineral Products Association
Centre for Ecology and Hydrology	Landscapes for Life
Environment Agency	National Farmers Union
Broads Authority	National Parks England
Natural Resources Wales	Wildlife Trusts
Liverpool John Moores University	Water UK
University College London - Environmental Change Research Centre	Yorkshire Water
Stirling University	UK and Ireland Lakes network
Freshwater Biological Association	Crown Estate
Somerset Drainage Board Consortium	Defence Infrastructure Organisation
Defra	

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