Natural England Commissioned Report NECR183

River Eye SSSI: Strategic Restoration Plan

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NATURAL ENGLAND

Foreword

This report was commissioned by Natural England and overseen by a steering group convened by Natural England in partnership with the Environment Agency. The report was produced by Royal HaskoningDHV. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Background

The River Eye is a semi-natural lowland river which rises at Bescaby, approximately 10km north east of Melton Mowbray. It flows for approximately 21km, becoming the River Wreake as it flows through Melton Mowbray and around Sysonby Lodge. As a result of its characteristics as an exceptional example of a semi-natural lowland river, an area covering 13.65ha and a length of approximately 7.5km was designated a Site of Special Scientific Interest. This area, situated between Stapleford (National Grid Reference [NGR] SK 802186) and Melton Mowbray (NGR SK 764188) equates to approximately 40% of the total length of the River Eye.

A survey in 2010 showed that the ecological condition of the river not improved, and the principal reasons for this were water quality and siltation. The siltation problem is exacerbated by the lack of flow and structures, which impede the river's hydrological functioning.

The water quality is being addressed, but the physical character of the river channel also needs to be restored to secure good ecological and hydrological functioning.

In 2014, a geomorphological appraisal of the River Eye was carried out by Royal HaskoningDHV, the result of this appraisal enabled Royal HaskoningDHV to produce the River Eye SSSI technical report and restoration vision; combined make up the River Eye Restoration Strategy. This report identifies and prioritises physical restoration measures that will help to achieve favourable condition and water framework objectives.

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Further information
This report can be downloaded from the Natural England website: **www.gov.uk/government/organisations/natural-england**. For information on Natural England publications contact the Natural England Enquiry Service on 0845 600 3078 or e-mail **enquiries@naturalengland.org.uk**.

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CONTENTS

VISION FOR THE RIVER EYE SSSI

The River Eye between Stapleford and Melton Mowbray is designated as a Site of Special Scientific Interest (SSSI) because it is an exceptional example of a semi-natural lowland river, which is rare in the UK. The river supports a range of excellent habitats for plants, invertebrates, fish, birds and mammals. However, some of these habitats are not as good as they could be, as a result of siltation, changes to the river channel and the presence of structures such as weirs. Addressing these issues would allow the River Eye SSSI to support improved habitats whilst favourably adapting to climate change.

A vision has been developed for the future of the River Eye SSSI. The vision sets out what Natural England and the Environment Agency would like to achieve in the river in the future, and the actions that are needed to achieve the vision are presented in this strategic restoration plan. The agreement, help and support of landowners and managers is vital to achieving these goals. Landowners and managers and other interested parties were consulted during development of this plan. This final plan has been revised to take account of the comments received.

The character of the restored River Eye

The vision for the River Eye SSSI is to work towards a river system which has:

- **A wider riparian corridor.**
  The condition of the corridor of land next to the river channel is of vital importance in improving and maintaining the quality of habitats in the River Eye SSSI. A mosaic of different plant communities and plentiful input of leaf litter and woody material can create a range of different habitats in the river channel. The land next to the river could be managed differently to improve the range of habitats it supports, including valuable shelter for otters and birds, Woody material could be retained or installed in the channel to create more varied flows and provide habitats for fish and aquatic invertebrates.

Part of the River Eye in Management Unit 5, which supports a wider riparian corridor, with good marginal vegetation and habitat diversity.

- **A wider variety of bed sediments, flow types and depths.**
  For lowland clay-dominated rivers such as the River Eye SSSI, the bed sediments should comprise of silts and sands in sections characterised by slow flows, and coarse gravels in swifter flowing areas. The river channel is currently very uniform and has too little energy to keep coarse gravels free from silt, which means that there is very little variation in habitats. Restoration techniques such as channel narrowing and retention or installation of woody material will create swifter, more varied flows, reduce fine sedimentation in the river channel, and produce better quality habitats for aquatic plants and animals.

A good example of clean gravel substrate which supports aquatic vegetation communities in Management Unit 3 of the River Eye SSSI.

- **Increased connectivity between the river and riparian zone.**
  The shape of the river channel has changed over time as a result of increased land drainage and natural river erosion, resulting in banks becoming steeper with the transition between the bed and banks becoming very abrupt. This limits the presence of a transitional zone between aquatic and terrestrial habitats, and prevents the development of a varied mosaic of marginal plant communities. Changing the shape of the river banks so that they are shallower and have a more gentle transition into the river bed will allow more varied plant communities to develop and create a wider range of habitats for invertebrates, fish, mammals and birds.

A reach of the River Eye SSSI with good connectivity between the river channel and the riparian zone.

- **A reduction in the impacts of impoundments.**
  A number of large weirs and sluices have a major impact on the River Eye SSSI. They hold water levels artificially high, reduce the speed and energy of flows, encourage the river to deposit sediment on the bed, and increase the temperature of the water. They also limit the free movement of aquatic organisms upstream and downstream. This creates uniform habitats that are not able to support the diverse range of plants and animals that they should, and that do not cope well with extreme low and high flows and temperature. Removing these structures or changing the way in which they are operated can help to create more natural flow conditions and sediment movement and create better quality habitats for plants, insects, fish, and the mammals and birds that feed on them.

The effects of the impoundment in Management Unit 8 on the River Eye SSSI.

- **A reduction in the impacts of land management.**
  Because of the underlying geology and soils, sediment in the River Eye SSSI is naturally predominantly fine grained. However, land management activities such as artificial drainage, grazing and cultivation can increase the amount of sediment that enters the river, which reduces the quality of the habitats that can be supported. Grazing can also degrade the natural bank structure and damage marginal plant communities. Wider catchment activities under the Catchment Sensitive Farming and Environmental Stewardship initiatives are already reducing sediment supply and addressing the impacts of land management on the SSSI (e.g. by installing sediment traps and buffer strips along the edge of the channel). However, the river could be made even better if parts of the banks were managed differently to minimise the local impacts of land management activities on bank structure and marginal habitats.

Grazing of the channel banks has resulted in slumping in Management Unit 7. Temporary/rotational or reduced grazing pressure would allow vegetation to recover.

Illustrative visualisations of what the River Eye SSSI could look like once the restoration vision has been implemented are provided on the subsequent pages. The visualisations demonstrate how the channel can be reshaped so that it can adapt to extreme low and high flows with no subsequent overall change in channel capacity, particularly in high flows.

Photomontage of potential river restoration actions in Management Reach 4

Photomontage of potential river restoration actions in Management Reach 8

How can we deliver restoration?

In order to improve the River Eye SSSI and achieve the environmental goals outlined in this restoration plan, we will work with stakeholders to:

- Support and allow the river to recover where natural processes are already working well.
- Assist natural recovery by changing management or undertaking selective river restoration works.
- Remove manmade features where they damage the function and ecology of the river, whilst recognising the need to protect people and property from flooding, maintain regionally important water supplies and also the cultural, historic and landscape aspects.
- Actively restore the river channel where the characteristic features of the river can only be achieved by habitat re-creation.
- Ensure the river is adaptable into the future to new pressures such as climate change.

Keys to success

- Learn from earlier restoration actions already implemented on other rivers.
- Work together with landowners and land managers across the River Eye SSSI catchment.
- Accept that sustainable recovery will be over longer timescales and will depend on funding.
- Have a plan which is adaptable to new challenges and opportunities.
- Maintain the vision of restoring a site of national importance.
- Build solutions through consensus which can benefit people and wildlife.
- Contribution towards meeting the Government's target to restore 50% of SSSIs in England and Wales to favourable condition by 2020.
- Contribution towards meeting Good Ecological Status as part of the Water Framework Directive.

The future of the River Eye SSSI

Once the vision for the restoration of the River Eye SSSI has been implemented, the river will begin to change. The main results of this will be a smaller, more dynamic channel with greater sinuosity, large wood features, and geomorphological diversity. The river will then be able to support high quality lowland clay stream communities, including abundant fish populations, diverse invertebrate and plant communities, and a wide variety of bird and mammal species.

The channel will be more responsive to changes in flow and sediment supply, and will be more able to adapt to variations. The main variations associated with climatic change over the next 50 to 100 years are predicted to be an increase in flow volumes and frequency of extreme events, and a corresponding increase in sediment supply from surface runoff. If the river is not restored, the likely response to these changes will be a further increase in channel capacity and a corresponding increase in deposition of in-channel sediment. The result of this process will be a continuing trend towards uniform geomorphology, and a further decrease in the condition of the SSSI. The restoration options set out in this plan will ensure that the condition of the river improves, and does not deteriorate in response to climatic changes in the future. For example, by enhancing the connectivity between the river and the floodplain, high flows will not have such an erosive force and will reduce the risk of bank erosion. Due to climate change there may also be an increase in the frequency of extreme low flows during dry summer months. Changes to the river to reduce low flow capacity without changing the amount of water that can be held within the channel during higher flows will help prevent this becoming a problem.

1. INTRODUCTION TO THE RESTORATION PLAN

Restoration of the River Eye

The River Eye between Stapleford and Melton Mowbray is designated as a Site of Special Scientific Interest (SSSI) due to its characteristics as an exceptional example of a semi-natural lowland river. The site supports some areas of rich habitat types and a diverse range of aquatic plants, invertebrates, fish, birds and mammals. However, a 2010 assessment shows that the SSSI does not meet the required environmental standards due to a number of factors, including the inappropriate dredging, weirs, dams and other structures, siltation and water pollution issues. The River Eye SSSI is subsequently assessed as being in unfavourable no change condition.

The Environment Agency and Natural England are working together with their partners to restore the River Eye to Good Ecological Status and favourable condition. In order to produce a plan for the physical restoration of the River Eye SSSI, a catchment wide fluvial geomorphological study has been undertaken to assess the physical functioning of the river, and how it impacts on the river ecology. This study considers the processes of water and sediment movement in river catchments and channels and their floodplains, along with the forms produced by those processes. The findings from this study can be found in the Technical Report accompanying this River Restoration Plan (Royal HaskoningDHV, 2014).

Further Information Sources

Current Condition Assessment for the River Eye SSSI:
http://www.sssi.naturalengland.org.uk/Special/sssi/sssi_details.cfm?sssi_id=1001178

WFD Classification for the River Eye:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297490/gene0910bsqt-e-e.pdf

The Government's target for the condition of SSSIs

The condition of all SSSIs in England, including the River Eye, is assessed by Natural England against site-specific targets which are set out in a favourable condition table. A SSSI unit is assessed to be in "favourable condition" if the SSSI is being adequately conserved and is meeting its targets. The 2011 Government strategy 'Biodiversity 2020' outlined ambitious commitments to make 50% of the total area of SSSIs 'favourable condition' by 2020. A 2013 report by Natural England ('Spotlight on SSSIs') states that the total area of sites in favourable condition is 37.38%, highlighting that in total more than 130,000 hectares need to improve to favourable condition by 2020.

Favourable Condition

Natural England defines 'favourable condition' as SSSI land that is being adequately conserved and is meeting its favourable condition targets. Current government aims are to bring 50% of SSSI land up to favourable condition by 2020; in 2013 Natural England assessed the proportion of sites currently at favourable condition to be 37.38%.

The actions included in this plan will, in combination with other actions such as controlling invasive species, and reducing diffuse water pollution and abstraction, contribute to achieving the targets for favourable condition of the River Eye SSSI under the Biodiversity 2020 strategy.

European Directives

In December 2003, the Water Framework Directive (WFD) was transposed into national law by means of the Water Environment (WFD) (England and Wales) Regulations 2003. These Regulations provide for the implementation of the WFD through the designation of all surface waters (rivers, lakes, transitional (estuarine) and coastal waters) and groundwaters as water bodies and the aim to achieve Good Ecological Status in them by 2015.

The ecological status of a river is determined by the quality of the plant, invertebrate and fish communities it supports, the flow and physical habitat conditions, and the quality of chemical parameters such as pH, temperature and concentrations of various pollutants. These are assessed according to stringent standards. When a body of water does not reach these standards, the Environment Agency is the competent authority who works with the responsible parties, for example water companies, industry and landowners to improve its quality and aim to achieve compliance with the WFD in England.

The actions included in this plan will help the Environment Agency and Natural England identify pressures that affect the physical condition of the River Eye, and to develop solutions to address them. This restoration plan seeks to address the hydromorphological pressures on the river, other actions are required to address pressures such as water quality. It should be noted that the standards required to achieve favourable condition for SSSIs may be more stringent than those required to achieve Good Ecological Status and Good Chemical Status.

Good Ecological Status

The ecological status of a surface water body is assessed according to:

- The condition of biological elements, for example fish, benthic invertebrates and other aquatic flora;
- Concentrations of supporting physico-chemical elements, for example thermal conditions, salinity, and concentrations of oxygen, ammonia and nutrients;
- Concentrations of specific pollutants, for example copper and other priority substances; and
- The condition of the hydromorphological quality elements, including morphological condition, hydrological regime and tidal regime (coastal waters only).

Ecological status is recorded on the scale of high, good, moderate, poor or bad. 'High' denotes largely undisturbed conditions and the other classes represent increasing deviation from this natural condition, otherwise described as a 'reference condition'. The ecological status classification for the water body, and the confidence in this, is determined from the worst scoring quality element. This means that the condition of a single quality element can cause a water body to fail to reach its WFD classification objectives.

Good Chemical Status

Chemical status is assessed by compliance with environmental standards for chemicals that are listed in the EC Environmental Quality Standards Directive (2008/105/EC). These chemicals include priority substances, priority hazardous substances, and eight other pollutants carried over from the Dangerous Substance Daughter Directives. Chemical status is recorded as 'good' or 'fail'. The chemical status classification for the water body is determined by the worst scoring chemical.

Aims and objectives of the Restoration Plan

Potential actions to restore the physical structure of the river and improve conditions for ecology are set out in this plan. This plan aims to use the links between ecology and geomorphology identified in the accompanying Technical Report (Royal HaskoningDHV, 2013) to identify opportunities and constraints for managing, conserving and enhancing the river and help return the SSSI to favourable or unfavourable recovering condition. This plan suggests a range of catchment-scale and management reach-based solutions that will help to restore the river to favourable condition. It then identifies actions needed to deliver the solutions and prioritises which should be implemented over the short, medium and long term. The ultimate goal, where possible, is to move to a more naturally functioning and, where possible an un-constrained system that is able to adjust and respond to future changes.

This restoration plan aims to improve the overall ecological and geomorphological health of the river. It is a detailed study to confirm restoration and enhancement techniques that will, where possible, remove the constraints on the River Eye SSSI that are contributing to its existing unfavourable condition.

This will be achieved by adhering to the following specific objectives:

- Establish the key issues that currently affect the River Eye SSSI;
- Outline potential solutions for each management unit; and
- Provide an action plan identifying potential delivery mechanisms.

What will happen to the plan?

Potential restoration actions for the River Eye SSSI are identified at a high level in this plan. These actions have not been developed fully, and are intended to be used as a starting point for discussions with stakeholders in the river catchment. Natural England and the Environment Agency will work closely with landowners and other key stakeholders to identify potential constraints and develop long term, viable restoration actions which achieve a balance between environmental requirements and the needs of stakeholders. **Section 7** explains how landowners, land managers and other stakeholders have been involved in the development of the plan and the key issues that they have raised.

Structure of this plan

This plan is divided into six chapters as outlined in **Table 1.1.**

Table 1.1: Contents of the River Eye SSSI Restoration Plan

Chapter		Content
1	Introduction to the restoration plan	Explains the purpose of the plan
2	The River Eye SSSI	Outlines the key characteristics of the River Eye SSSI
3	Key issues	Outlines the key issues which affect the River Eye SSSI
4	Potential solutions	Outlines potential solutions for restoring the SSSI to favourable condition and achieving good ecological status
5	Reach-based restoration solutions	Outlines how and where the solutions could potentially be implemented
6	Action plan	Sets out the actions needed to deliver the solutions identified at the reach scale

2. THE RIVER EYE SSSI

The River Eye SSSI

The River Eye is a semi-natural lowland river which rises at Bescaby, approximately 10km north east of Melton Mowbray. It flows for approximately 21km, becoming the River Wreake as it flows through Melton Mowbray and around Sysonby Lodge.

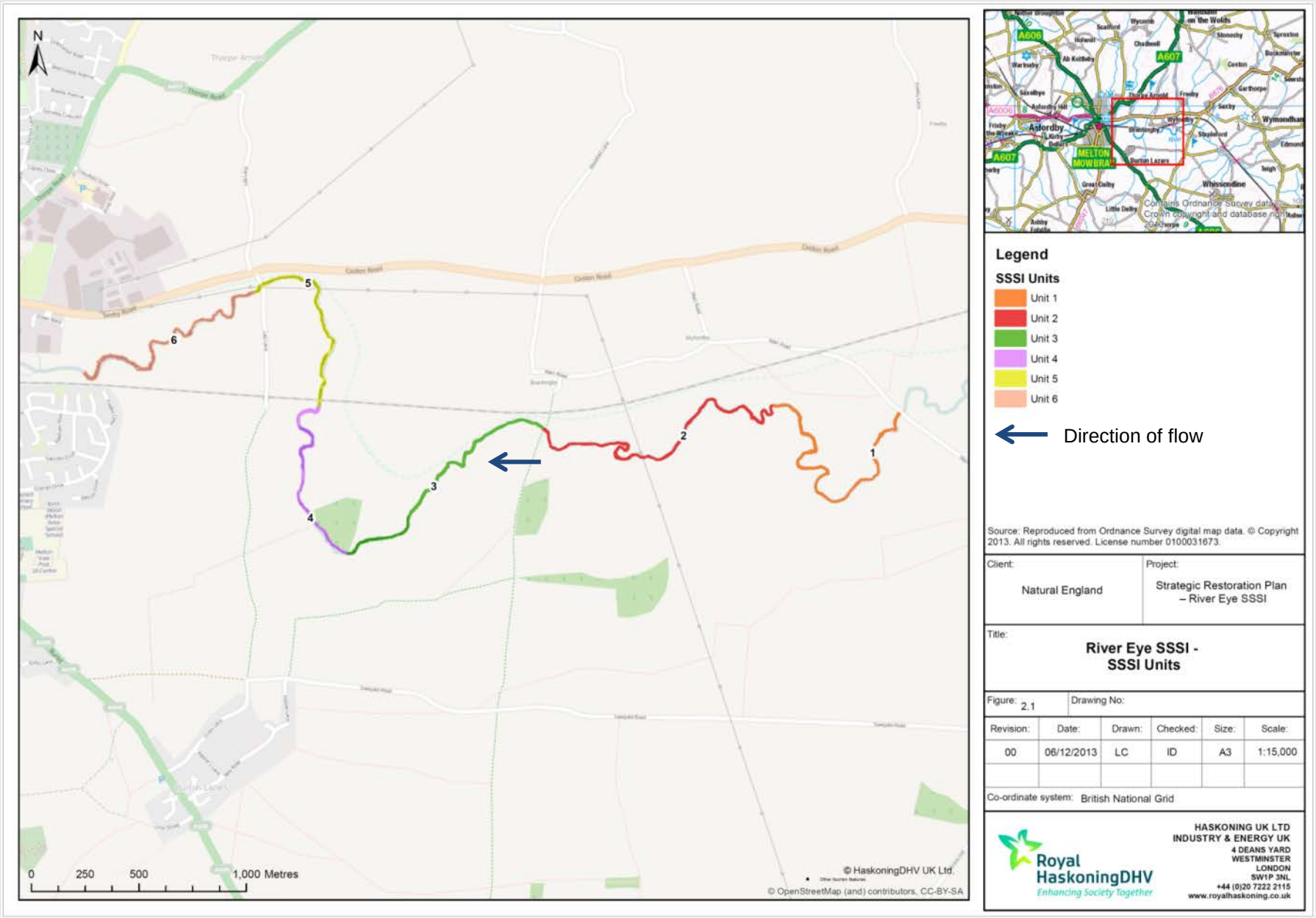
As a result of its characteristics as an exceptional example of a semi-natural lowland river, an area of 13.65ha between Stapleford (National Grid Reference [NGR] SK 802186) and Melton Mowbray (NGR SK 764188) was designated as a Site of Special Scientific Interest (SSSI) **(Figure 2.1).** The River Eye SSSI is divided into six units; Natural England is responsible for assessing their condition, and working with landowners to ensure appropriate management is in place.

The River Eye supports an abundant and exceptionally species rich aquatic flora. It has a primary SSSI notification for its river habitat; as a semi-natural lowland river type. This habitat notification comprises the river channel, its banks and parts of its riparian zone.

The site is additionally notified for a number of SSSI species, including plant and invertebrate assemblages, white legged damselfly (*Platycnemis pennipes*), white-clawed crayfish (*Austropotmobius pallipes*) and water boatman. The River Eye faces numerous pressures from water abstraction, discharges, agricultural runoff, historic channel modifications, and human impacts associated with the urbanisation.

For the purposes of this Restoration Plan, the River Eye has been divided into eight Management Reaches. These Management Reaches are shown in **Figure 5.1.** The SSSI unit locations are shown in **Figure 2.1.**

Figure 2.1: River Eye SSSI overview



Current condition of the River Eye SSSI

Although the River Eye has been recognised for its ecological value, it has been affected by a range of pressures resulting from natural conditions and past and present management of the river channel and surrounding catchment. The latest assessment, which was completed in 2010, identified that all units are in unfavourable condition. However, not all assessment criteria are in a failing condition, see **Table 2.1.**

Table 2.1: Condition of SSSI Units – 2010 Assessment

Unit Number	Assessment Description	Condition Assessment Comment
1	Unfavourable no change	Targets that have been achieved: • Biological GQA target met. • Chemical GQA target met. • Unionised ammonia target met. • Suspended solids target met. Targets that have not been achieved: • Phosphorus target (0.06 mg/L) has not been met but there has been a decrease in phosphorus since 1998. It is thought that the work being undertaken by Environmental Stewardship and CSF help to ensure the phosphorus target is met. Further work is required to mitigate against land drainage outfalls. • River profile target has not been met because of over-dredging and impoundment due to the weirs on the edge of Melton Mowbray. • Bankside vegetation target has also not been met and it should have a higher proportion of marginal water plant species. There should be areas of species rich marshy grassland, swamp vegetation and species rich neutral floodplain meadows. • Riparian zone target has not been met due to lack of semi-natural habitats. Species composition: two sites along the river were surveyed, one near Lags Lane and one near Ham Bridge. The site near Lags Lane passed this target and supports many characteristic water plant species but the Ham Bridge site failed due to the physical modifications. Also, many species recorded in 1979 are no longer present (Natural England, 2010 – Condition of SSSI Units). • River restoration is necessary to ensure the characteristic water plant species improve.
2	Unfavourable no change	
3	Unfavourable no change	
4	Unfavourable no change	
5	Unfavourable no change	
6	Unfavourable no change	

A variety of actions are in place or underway to address the unfavourable condition of the River Eye SSSI, such as the silt traps that have been installed under the Catchment Sensitive Farming initiative, and a reduction in phosphate contributions from Sewage Treatment Works (STW). Suspended solids data from the one available recording point in the SSSI indicates that the suspended solids targets are met. However, observations made during walk over surveys including those done to inform this report recorded widespread silt deposition. Sediment appears to be entering the water course in a number of places during high run off events and being deposited on the river bed. The one suspended solids gauging point does not reflect this, potentially due to the low spatial resolution of the monitoring, and peaks in levels being masked by averaging of data.

What should the river be like?

The River Eye has been classified as a Joint Nature Conservation Committee (JNCC) River Community Type II lowland, clay-dominated river[1]. Based on the rationale for the physical restoration of the SSSI river series in England (Mainstone, 2007), the river would typically be expected to have bed materials dominated by silts and sands, with coarser gravels occurring in places and flows are sufficiently fast to prevent fine sediment accumulating on the river bed. Flow patterns are likely to be dominated by gentle gliding flows.

Natural England has defined favourable condition for designated features of interest of the River Eye. Standards for favourable condition are defined with particular reference to the specific designated features of the River Eye, based on a selected set of attributes for features which most economically define favourable condition. The site

[1] Holmes, NT, Boon, PJ and Rowell, TA (1999) Vegetation communities of British rivers - a revised classification. Joint Nature Conservation Committee, Peterborough.

specific targets cover all aspects of the river environment, including ecology, flow conditions, physical habitats and water quality. An overview of the site specific targets for favourable condition are summarised in **Table 2.2.**

Photographs of good quality habitats in the River Eye SSSI are shown in the **Restoration Vision** at the beginning of this plan. These demonstrate what the river should look like along its entire length if restored to a more natural state.

Table 2.2: Overview of generic attributes and site-specific targets (as defined with particular reference to the specific designated features of the River Eye SSSI) for SSSI favourable condition (Natural England, 2011)

Feature	Site-specific targets
Habitat functioning: water quality – suspended solids	The target for favourable SSSI condition is for no unnaturally high loads. The highest recommended value under the EC Freshwater Fish Directive is of an annual mean concentration of 25 mg l^{-1}. However, an analysis of prevailing conditions of most SSSI rivers indicates a precautionary target of 10 mg l^{-1}.
Habitat functioning: water flow	Flow regimes should include the maintenance of both flushing flows and seasonal base flows, including compliance with defined levels of abstraction and established ecological flow criteria. Maintenance of springs is also associated with achievement of favourable condition.
Plant community: species composition and abundance	In channel vegetation of SSSI rivers should be dominated by characteristic species. Species composition should comprise of at least 60% of species with abundance V or IV (e.g. creeping bentgrass *Agrostis stolonifera,* Common duckweed *Lemna minor,* and Water mint *Mentha aquatic)*, and at least 25% of species with abundance III (e.g. Fools watercress *Apium nodiflora,* Yellow water-lily *Nuphar lutea,* and Celery-leaved buttercup *Ranunculus sceleratus).*
Habitat structure: substrate	The substrate in lowland, clay-dominated Type II rivers should comprise of silts and sands in sections characterised by slow flows, and coarse gravels in swifter flowing riffles. The site-specific targets for the River Eye SSSI highlight the importance of most units displaying a variety of channel substrates. Widespread siltation on the channel bed has, therefore, been identified as a barrier to achieving favourable SSSI condition.
Habitat structure: channel and banks, and channel form	The River Eye SSSI should be characterised by sinuous meandering and a largely natural planform. Bank structure should be characterised by sequences of alternating steep and shallow bank profiles, potentially leading to vertical cliffs and point bars. Hard bank reinforcement and channel realignment should be restricted to no more than small areas of the channel. No substantial widening or deepening of the channel should be present under favourable conditions. Channel form should support a range of substrate types, variations in flow, channel width and depth, in-channel and side-channel features and both in-channel and bankside vegetation cover. The target score for favourable SSSI condition includes a planform score of at least 3 out of a possible 5. (>5-10% of Evaluated Corridor Section (ECS) river artificial, re-aligned, or constrained) (Note: higher scores reflect less anthropogenic modification).
Indicators of local distinctiveness	Maintain distinctive elements at current extent/levels and/or in current locations. Rare plant species include Shining pondweed *Potamogeton lucens* and Fan-leaver water-crowfoot *Ranunculus circinatus*.
Negative indicators: alien/introduced species	No impact on native biota from alien or introduced species.
Negative indicators: In-stream barriers	There should be no artificial barriers in place that significantly impair characteristic migratory species from essential life-cycle movements. These barriers also potentially impact flow and sediment dynamics, subsequently affecting the freshwater biotic communities.
Negative indicators: fish introductions	Fish introductions should not interfere with the ability of the river to support self-sustaining and healthy populations of characteristic species.
River and wetland invertebrate assemblages	Presence of a high quality suite of typical river and wetland associated invertebrates and no loss in species richness or diversity of rare species.

3. WHY IS THE RIVER EYE IN UNFAVOURABLE CONDITION?

Pressures on the River Eye SSSI

Several investigations into the geomorphological and ecological behaviour (the river form and habitat conditions) of the River Eye have been undertaken over the last few years, including reports by APEM (2010), Royal HaskoningDHV (2012) and JBA (2013). The results of these studies have been combined with a new detailed survey of the river form and habitat conditions (undertaken during summer 2013) as set out in the accompanying Technical Report (Royal HaskoningDHV, 2013). These investigations have identified that the physical habitat condition of the River Eye SSSI is affected by four main issues:

- Fine sediment deposition in the river channel.
- Channelisation and physical changes to the shape of the river channel and drainage network.
- The presence of manmade in-channel structures.
- A lack of suitable riparian and marginal habitats due to land management and changes to the river.

These issues are the result of the complex interaction of the physical and hydrological characteristics of the catchment (including rainfall, topography, and geology).and factors such as land use, land drainage and channel modifications that are influenced by man.

Table 3.1 provides a summary of each of these key physical issues and how they affect the SSSI. A summary of which parts of the SSSI are affected by these issues is provided in **Table 3.2.**

In considering pressures on the River Eye, there is a need to consider historic and current issues, but also to consider potential future changes, particularly those as a result of climate change.

Climate change implications for the River Eye

The latest climate projections from the UK Climate Projections 2009 (UKCP09 - http://ukclimateprojections.defra.gov.uk/), a climate analysis tool funded by Defra and produced by the UK Climate Impacts Programme (UKCIP), suggest that over the next 20-50 years, temperatures and precipitation levels in the River Eye catchment could be considerably different to current conditions. The main changes that are likely to occur are:

- Increased annual average daily temperatures: Temperatures are predicted to increase by up to 2°C by the 2020s, and 3°C by the 2050s.
- Decreased summer precipitation: Summer precipitation levels are predicted to decrease by up to 20% by the 2020s and up to 30% by the 2050s. This is likely to reduce river flows in the summer, and reduce the amount of water available to wetland habitats and grazing livestock.
- Increased winter precipitation: Winter precipitation levels are predicted to increase by up to 10% by the 2020s and up to 20% by the 2050s. This is likely to increase flows during the winter, leading to increased flood frequency and more sediment runoff.
- To summarise, over the next 50 years, summers are likely to become warmer and drier and winters are likely to become warmer and wetter.

There is therefore a need to consider climate change adaptation measures while working towards achieving favourable condition for the SSSI. This will ensure that the valuable habitats supported in the SSSI are able to adapt to a changing climate, and persist into the future.

Table 3.1: Pressures which affect the condition of the River Eye SSSI

What is the issue?	How does it affect the SSSI?	Where are the consequences?	What are the benefits of addressing this issue?	Example photograph
Fine sediment deposition in the river channel.	Fine sediment is supplied to the river as a result of natural in-wash from the wider catchment. The bedrock and many of the soils in the River Eye catchment are predominantly fine grained and easily erodible. Type II rivers are generally expected to have a high fine sediment yield, and have bed sediments that are largely dominated by fine sediments. However, it is clear that modifications to the river network and land management practices have encourage enhanced fine sediment deposition in much of the channel. Cultivation and grazing can increase soil erosion, ensuring that there is a plentiful supply of fine sediments into the river. This is exacerbated by the dense network of field drains that have been installed in the catchment. These drains increase the connection between the river and its floodplain, meaning that the river receives flows more quickly and there are clear pathways for moving eroded sediment into the river. The issues related to the plentiful supply of fine sediments are exacerbated by the changes to the river channel that have resulted in low energy flows (see **Channelisation**). This means that once it reaches the	Fine sedimentation affects the SSSI by: • Smothering the gravel in the river bed. This creates very uniform geomorphological conditions and reduces habitat diversity for plants, invertebrates and fish (including bullhead) which require coarser substrates.	The main benefits of addressing fine sedimentation issues include: • The creation of a more natural range of bed sediments, including areas of the coarse substrate that is required by some plants, invertebrates and fish species. • Improved conditions for the mammals and birds that prey on species reliant on coarse substrates. • The creation of more varied conditions for fish species and resulting improvements to recreational angling in the catchment.	 A uniform part of Management Reach 8 where slow flows have encouraged fine sedimentation on the river bed.

What is the issue?	How does it affect the SSSI?	Where are the consequences?	What are the benefits of addressing this issue?	Example photograph
	channel, there is not enough flow energy to move sediment a long distance downstream. It therefore accumulates on the river bed.			
Channelisation and physical changes to the shape of the river channel and drainage network.	A large proportion of the river channel has been enlarged, which results in steep banks, a very abrupt transition between the bed and banks, and an increased capacity. This results in an over-deep, over-wide channel with uniform banks, limited morphological diversity, low energy flows and a frequently abrupt transition between channel and bank habitats. The changes to the channel may be a result of historical dredging (potentially for land drainage purposes), natural down cutting in response to the installation of field drains and the resulting increase in response to rainfall, or a combination of the two.	Channel modifications affect the SSSI by: • Enhancing the deposition of fine sediment due to reduced flow energy. • Reducing flow variation due to channel bed and bank uniformity. • Reducing the diversity of bank, marginal and emergent habitats. • Reducing floodplain connectivity, potentially impacting on floodplain wetland habitats.	The main benefits of addressing issues related to channelisation include: • The creation of more natural, varied geomorphology, which is capable of supporting a wider range of habitats. • The encouragement of a more natural flooding regime, allowing marginal areas to become wetter and water levels to decrease slightly during floods. • An increase in flow energy and a corresponding decrease in fine sedimentation. • More resilient to a range of extreme flows under future climate change scenarios.	 An example of a steep sided bank in Management Reach 1 which has resulted in reduced floodplain connectivity and low energy flows.

What is the issue?	How does it affect the SSSI?	Where are the consequences?	What are the benefits of addressing this issue?	Example photograph
The presence of in-channel structures.	Structures such as weirs and sluices that are built across a river channel alter flow patterns and disrupt downstream transport of sediment. They increase water levels and reduce flow velocities, leading to the deposition of sediment upstream of the structure. Depending on the size of the in-channel structure, its influence can propagate for a considerable distance upstream and downstream. These effects can be detrimental to river habitats by encouraging sedimentation on the river bed and creating uniform flow conditions. Flow over the obstruction can also become very rapid leading to erosion of the bed and banks associated with the weir pool downstream. In addition, in-channel structures can act as a physical barrier to the free movement of aquatic species in the river channel if they are not able to swim past or jump over them. The River Eye SSSI is impacted upon by several in-channel structures: • The weir at Stapleford, which may limit the supply of coarse sediment to the SSSI downstream. • The flood control (Flood Alleviation Scheme) structures at Brentingby Junction, which change flows in the reach downstream.	In-channel structures affect the SSSI by: • Creating impounded conditions upstream, with increased water levels, reduced flow velocities, and increased fine sedimentation. • Creating uniform flow, geomorphological and habitat conditions upstream. • Presenting a barrier to the movement of coarse sediment, fish and other aquatic organisms. • Reducing erosive flows downstream of Flood Alleviation Scheme (FAS), which may limit the potential for flushing accumulated sediments from the channel.	The main benefits of addressing the impacts of in-channel structures include: • The creation of more natural flow regime, that is more varied and able to support a greater range of habitats. • An increase in flow energy and a corresponding decrease in fine sedimentation. • The provision of a long reach of channel that is free from barriers to the upstream and downstream movement of fish and other aquatic organisms. • The creation of more varied conditions for fish species and resulting improvements to recreational angling in the catchment.	 An example of a weir that forms part of the weir complex at the downstream extent of the River Eye SSSI.

What is the issue?	How does it affect the SSSI?	Where are the consequences?	What are the benefits of addressing this issue?	Example photograph
	• The complex of four large structures that are located on the river at the downstream limit of the SSSI. These reduce flow energy and create considerable upstream impoundment.			
A lack of suitable riparian and marginal habitats due to land management and changes to the river.	Riparian trees are an important part of the habitat of lowland clay rivers such as the Eye. They provide shading over parts of the channel, control temperature, their roots provide shelter for aquatic organisms, they help to stabilise river banks and reduce erosion, and they can also intercept sediment transported by surface runoff. In addition, they also provide a continued source of large woody material into the channel, which increases flow and geomorphological diversity and provides habitats for fish and invertebrates. Although tree cover along parts of the River Eye is good, there are some areas that lack any significant riparian trees. This is likely to limit the range of habitat niches that can develop in the river. Shallower sections at the edge of the river channel are an important part of the transitional zone between the river and its floodplain. These areas provide valuable habitats for a range of aquatic and emergent plants, invertebrates and some fish, and provide shelter for a range of species.	A lack of suitable riparian and marginal habitats affect the SSSI by: • Reducing the quality of in-channel habitats as a result of a lack of shelter and increased water temperatures. • Removing the physical habitat conditions that are able to support good quality marginal habitats. • Limiting the supply of large woody material, which provides shelter and habitat for a wide range of species • Lack of backwaters and associated floodplain habitats suitable as fish refuge areas in high flows	The main benefits of addressing the impacts of the lack of riparian and marginal habitats are: • Improved conditions for aquatic species and the mammals and birds that prey on them. • The creation of more varied conditions for fish species (including refuges in high flows) and resulting improvements to recreational angling in the catchment. • Promotion of bank stabilisation and a reduction in maintenance requirements.	 An example of a reach with a lack of suitable riparian and marginal habitats in Management Reach 8.

What is the issue?	How does it affect the SSSI?	Where are the consequences?	What are the benefits of addressing this issue?	Example photograph
	Channel resectioning along a significant proportion of the River Eye means that this transitional zone is frequently very abrupt, limiting the potential for the development of good quality marginal habitats.			

Table 3.2: Key issues identified within the River Eye SSSI (a tick indicates the issue affects the unit in question)

Key issue	Characteristic impacting on the ecology of the SSSI	*Corresponding SSSI Units*							
		1	*1-2*	*2-3*	*3-4*	*4*	*4*	*5*	*6*
		Management Reaches							
		1	2	3	4	5	6	7	8
Fine sediment deposition in the river channel.	• High turbidity in the water column limiting light penetration for water plants • Fine sedimentation on the channel bed limiting habitats for water plant communities, invertebrates and fish	✓	✓	-	✓	-	✓	✓	✓
Channelisation and physical changes to the shape of the river channel and drainage network.	• Floodplain disconnection, limiting the development of riparian and wetland habitats for bird populations • Exacerbation of fine sedimentation issues • Lack of marginal habitats for colonisation by aquatic vegetation • Lack of morphological and flow diversity, limiting the range of habitats for fish and invertebrate communities	✓	-	✓	✓	✓	✓	✓	✓
The presence of in-channel structures*.	• Creation of impounded conditions • Exacerbation of fine sedimentation issues • Potential disruption of coarse sediment transport • Physical barrier to free movement of fish and other aquatic organisms	-	-	-	-	-	✓	-	✓
A lack of suitable riparian and marginal habitats due to land management and changes to the river.	• Limited in-channel shelter for fish populations and invertebrates • Limited riparian shelter for bird communities and mammals	✓	✓	-	-	-	-	✓	✓

* Note that four large structures located on the river at the downstream limit of the SSSI influence unit 6.

4. POTENTIAL SOLUTIONS

Potential solutions to the key issues

The condition of the River Eye SSSI can be improved through a range of solutions. This chapter outlines these solutions, focussing on the aim of each, and how it could potentially be implemented. **Chapter 5** shows which solutions are proposed within each management reach of the River Eye.

The following potential solutions are appropriate to restore JNCC River Community Type II lowland, clay-dominated rivers such as the Eye to favourable condition (adapted from Mainstone, 2007). These have been grouped into the following broad categories:

Conserve and enhance
The lowest level of intervention, where areas of high quality habitat are protected and minor improvements are undertaken. Solutions under this category include:

- **Preserve and enhance** channel bank and floodplain wetland habitats through sensitive management and targeted habitat creation.

Rehabilitate
The next level of intervention, which is based on working with natural processes to encourage geomorphological and ecological development. Where natural recovery is already occurring, solutions should aim to encourage this process further. Where natural recovery is not occurring, solutions should aim to kick-start the process. Solutions under this category include:

- Reduced or modified **riparian zone management** operations, which promote natural recovery of river form and function. This can include modified livestock management and tree planting, the retention of large woody debris in the channel, and targeted maintenance of existing trees.
- **Introduce large woody debris** to increase flow and geomorphological diversity and provide shelter for aquatic organisms. This could be undertaken in conjunction with other enhancement works, such as bank reprofiling and reinstatement of coarse bed material.

Restore
The highest level of intervention, which involves more intensive intervention and creation of new habitats. Solutions under this category include:

- **Bank enhancements** to improve the transitional zone in the channel margins and promote the establishment of more diverse marginal vegetation communities.
- **Reinstate coarse bed material** to improve floodplain connectivity and create habitats for fish, invertebrates and plants that require coarse substrates.
- **Increase channel sinuosity** through remeandering or meander reconnection to restore habitat length, improve flow and substrate conditions, and produce better habitats.
- **Removal or modification of in-channel control structures** to restore natural river flows and sediment movement, promote the development of riffle habitats, and allow fish and other aquatic organisms to move freely.

Strategic review
Additional investigations to inform future management. Solutions under this category include:

- **Review operation of structures** to reduce the impact they have on SSSI habitats.

Conserve and enhance

Preserve and enhance habitats

Introduction
The aim of this solution is to ensure that the high-quality habitats that currently exist in parts of the river catchment are preserved and protected from degradation. This measure should be implemented at a catchment scale for maximum benefit, although there may be specific sites with habitat that it is particularly important to protect.

Application
Although the River Eye has been affected by human modifications and the SSSI is in unfavourable condition, it does still provide good quality habitats for a wide range of plants, invertebrates, fish, birds and mammals. These habitats are found throughout the river catchment and river corridor, and include a diverse range of features such as:

- Reaches with suitable gravel substrate for in-channel vegetation growth.
- Existing in-channel and marginal vegetation communities.
- Reaches with clean coarse substrate for fish spawning.
- Reaches with stable fine substrate for some plants, invertebrates and fish.
- Stretches of the channel with good flow and morphological diversity.
- Stretches of the channel with shelter for aquatic organisms but sufficient light for plants to thrive.
- River banks with a suitable profile to provide habitats for emergent and marginal vegetation.
- River banks with suitable vegetation cover for mammals and birds.
- Floodplain wetland habitats.

Existing examples of these habitats should be preserved in order to maintain the integrity of the river SSSI and prevent it from degrading further. Changes to current management practices or development that could potentially damage these habitats should be avoided where possible, and measures to minimise the potential impacts of any changes should be adopted on a site-specific basis. In some cases, it may be necessary to undertake more intensive habitat management work (including planting of suitable species) to improve the quality of existing wetland habitats.

Areas of high quality habitat to be preserved should be clearly flagged in Environment Agency and Natural England Geographic Information Systems (GIS) so that they can be fully taken into account in the consenting process.

Ecological benefits
Preserving and enhancing existing habitats will:

- Ensure that existing high-quality habitats are maintained.
- Provide a seed bank and source of local populations of plants and animals which can colonise newly restored reaches of the River Eye.

Rehabilitate

Riparian zone management

Introduction

Reduced or modified channel and riparian zone maintenance operations could be investigated to promote natural recovery of habitat function and structure, particularly in respect of the establishment of woody material in the channel and the development of marginal communities. Riparian trees are a vital part of more naturally functioning river systems, providing a variety of habitats, acting as a source of shelter and food for fish and invertebrates and helping to regulate water temperatures. Riparian trees provide a continuous supply of large woody material which has an important role in creating habitat variation in the channel. However there is a need to manage the riparian zone carefully to get the right balance between habitat restoration and management, adjacent land use and flood risk.

Application

Riparian tree planting

Tree planting should only take place in suitable areas, and consider existing features of riparian environment. Trees which require large amounts of water can dry out sensitive wetland areas, or shallow backwater habitats/margins. Trees should also not be planted in areas where they could contribute to flood risk. Large numbers of trees can reduce conveyance, reduce floodplain storage and cause blockages should branches/trunks fall into the watercourse. It is recommended that native species found in the locality should be used and any saplings planted should be of local provenance.

Rather than planting trees to provide thick cover along extended stretches of bank, planting should be targeted more carefully in order to create a more diverse mixture of light and shade in the river channel, particularly for spawning gravels and large pools, whilst still improving cover on the bank itself. Planting could therefore take the form of small clumps interspersed with more open areas of bank. For example, half to two thirds of the banks identified for planting could be left open to allow light to reach the banks and channel. Clump locations should be chosen to complement the natural features of the channel, such as on the inside of bends, adjacent to spawning gravels, or in locations that already have some vegetation present. Young trees with a maximum of 1 or 2 years growth should be planted where possible, as they generally have the highest survival and growth rates.

Management of selected riparian trees

Where individual trees provide too much shading and limit light penetration to the channel, or where they encourage erosion, impoundment or significant siltation, it may be possible to manage them differently to help improve in-channel habitats. This could include complete removal of some specimens (particularly willows), with this option new trees and woody material would have to be planted and installed as mitigation, or the removal of carefully selected limbs and over-hanging branches (e.g. through pollarding). The benefits of removal must be assessed carefully against the disadvantages of losing the trees, and further action should only be taken once specific agreement has been obtained from Natural England.

Retention of large woody material

Woody material is formed from trees and branches that fall into the river. Depending on the size of the material and the strength of flow in the river, this material can remain in situ or become transported further downstream. Woody material is therefore rarely static, and is often moved downstream during periods of high flow. Woody material is generally sourced from areas of banks with thick tree lining, but any bankside vegetation could potentially be a source of woody material. It is important to ensure that woody material in the river channel is preserved, so that it can provide valuable habitats for a range of aquatic life. The practise of routinely removing all woody material from the river channel should be discouraged where possible, in order to allow more natural levels of wood to remain in the channel. Unless woody material is blocking more than 10% of the cross-sectional area of a river it is unlikely to impact on water levels and therefore should not be removed. Without a strong case for removal, woody material should be left in the channel. This could be helped through the provision of information on the beneficial qualities of in-channel material to landowners and other parties who clear material from the river.

This approach does not intend that all removal of woody material in the catchment should cease. A large material accumulation could potentially cause structural damage or block flow through bridges, causing an increase in flood risk. In cases such as these where any potential benefits are outweighed by increased risk, it is recommended that sensitive management of woody material is undertaken. Natural England and the Environment Agency should give guidance to landowners on woody material in the River Eye SSSI and ensure that trees are only removed where appropriate, and not by default.

Riparian zone management

Establish riparian buffer strips

A buffer strip is an area of land adjacent to a watercourse that is left un-cropped in order to intercept surface drainage and to minimise soil erosion. Buffer strips can effectively reduce the amount of sediment and pollutants carried by runoff to tributaries, drainage networks and the main channel by slowing down overland surface flows and encouraging sediment to settle out.

Buffer strips are typically between 1 and 50m wide. They should be at least 5m wide to be effective, and their optimum width is approximately 20m. Wider strips with thicker vegetation are typically more effective at trapping sediment than narrower strips with less dense vegetation cover. In practice, the exact width of the features is largely dependent on the space available for their creation, the erodibility of the underlying soils and the nature of surrounding land use. Buffer strips are already widespread in parts of the SSSI. However, their use could potentially be extended to other parts of the SSSI to help limit the impacts of grazing livestock and encourage areas of the river banks and margins to stabilise and develop natural vegetation communities.

Grazing pressure management

Grazing livestock can cause alterations to the river bank profile as they seek drinking water from the river channel, or walk along the bank top. Trampling changes the bank structure by decreasing its steepness and creating a more gradual, often stepped, profile with little vegetation and exposed sediments. Where livestock trampling is excessive, large sections of bank can collapse and become devoid of vegetation cover, and as such become sources of sediment into the river channel. However, if vegetation on a previously trampled bank is allowed to re-establish, it can provide good quality habitats for marginal and bankside flora and fauna. Some of the best habitats for mammals, birds and submerged plants in the River Eye SSSI have developed on sections of the bank that have been altered by trampling and then allowed to revegetate.

There are two main techniques that could potentially be employed to restrict livestock access to banks:

- Rotational grazing: In a rotational grazing strategy, livestock are only allowed in the riparian zone for short periods of time to drink and graze (typically less than a week) and only when conditions are dry and bank erosion is minimised. Livestock can be restricted from having direct access to the stream (see above), and drinking points can be rotated throughout the year to allow adequate time for the river banks to recover before grazing is resumed.
- Fencing off trampled areas: An effective method to prevent trampling is to fence off grazed river banks to prevent access to badly affected areas so that they can revegetate. It will be important to allow some management of bank habitats to continue to ensure that the botanical interest of the river banks are maintained and that they continue to provide high quality habitats for invertebrates and other interest features. Allowing grazing to continue in a targeted and controlled manner, for example by periodically relocating fences once banks have recovered, is an effective way of achieving this aim. In fenced off areas, drinking water supply for livestock can be maintained through the provision of galvanised troughs, the installation of a piped water supply, or creating defined access points to the river. These access points can simply consist of areas of bank that are left unfenced for a period, which are later fenced off when trampling becomes heavy. The fence can then be reinstated and removed from another part of the bank to maintain access. Alternatively, fixed access points could be installed, although these ultimately offer less flexibility.

The River Eye has been a priority catchment for the Catchment Sensitive Farming programme for 5 years, and significant improvements in water quality have been noted during this period, The Eye is also a priority catchment for Higher level Stewardship Schemes- there is very little ploughing immediately adjacent to the river. The land management schemes in place adjacent to the river should result in improvements to the riparian zone over time.

Riparian zone management

Ecological benefits

The ecological benefits of improved riparian zone management practices include:

- Riparian tree planting offers several ecological benefits such as providing a valuable overwintering habitat for invertebrates and birds, providing an input of leaf litter to the channel and providing a habitat for terrestrial species.
- Large woody material provides an important refuge for fish, and can also provide a substrate for invertebrates and aquatic plants, which helps to increase the biodiversity of an otherwise uniform river channel.
- Targeted removal of bankside trees can, in some cases, help to improve in-channel habitats by reducing siltation and allowing more natural vegetation communities to develop.
- Buffer strips can be comprised of a mixture of natural plants, including grasses, shrubs and trees, and therefore can also provide valuable habitats for invertebrates, mammals and birds. They also help reduce the amount of fine sediment that reaches the river.
- Grazing pressure management will maintain stable bankside vegetation which provide valuable habitat for many species including mammals and birds. Bankside vegetation can also help to stabilise banks and protect them from excessive erosion.

Manage or introduce large woody material

Introduction

Flood risk management historically included complete removal of large wood from the channel to prevent the risk of blockage and to maintain conveyance. Increasingly however, working with natural processes where appropriate, is preferable, such as the use of in-channel wood to vary flow within the channel without impacting on flood risk. A management approach is needed that takes account of flood risk policies that set out where wood can be retained in the channel.

The introduction of large wood (known as Large Woody Material or LWD) should be applied as part of bank re-profiling/channel narrowing or as hydrologically permeable logjams, to restore diversity of substrate and water depth/velocity. Large wood refers to branches, trunks, root boles or entire trees that fall into the channel. Fallen trees and branches are a natural part of tree-lined river ecosystems and provide morphological diversity, localised flow diversity and areas of refuge within the channel. Wood accumulations affect the geomorphological processes of a river system which can impact sediment storage and flow routing, stream bed and bank structure, velocity distributions, and sinuosity of a stream. This solution may also include the preservation of woody material in the river channel, in order to provide cover for fish and aquatic invertebrates. This measure should be targeted on a catchment scale at appropriate locations for maximum benefit.

Application

It is important to consider the impact of woody material on local flood flows and possible flow diversions at the planning stage. An understanding of the geomorphology, hydrology and hydraulics of the site will help in this respect. It is recommended that where possible existing on-site woody material is used in any construction.

Where the need for the reintroduction of wood has been identified, careful consideration should be given to the size of the structure and the construction material. Complex placements that mimic natural conditions tend to be more stable because they have the greatest flexibility in adapting to changing channel and flow conditions. It is suggested that introduced material should form the key pieces of stable material accumulation, and the following points should be adhered to (Mott, 2006; Healthy Catchments Guidance, 2013; RRC Manual of Techniques, 2013):

- The length of reintroduced material should be at least as long as the channel width.
- The diameter should be at least 0.1m.
- If woody material is repositioned, it should be securely pegged into the bed or banks of the watercourse to prevent it becoming washed away during high flows.

- The angle at which the wood is secured is important for determining the impacts it will have. If the aim of woody material introduction is to stimulate natural erosional and depositional processes within a straightened channel, it should be secured at a wide angle from the bank. Conversely, if the aim of woody material introduction is to create localised flow diversity and provide in-channel habitats without significantly changing the geomorphology of the channel, it should be secured at a much shallower angle. Woody material can also be secured along banks to reduce localised bank erosion help them stabilise.

In terms of removal of woody material, this should only be considered when there is sufficient evidence that it is causing flood risk or causing excessive bank erosion. Unless woody material is blocking more than 10% of the cross-sectional area of a river it is unlikely to impact on water levels and therefore should not be removed. Without a strong case for removal, woody material should be left in the channel.

Ecological benefits

The ecological benefits of retaining or introducing woody material into the channel include:

- The provision of an important refuge for fish and invertebrates.
- The direct provision of a substrate for invertebrates and aquatic plants, which helps to scour spawning gravels where it is present and increase the biodiversity of an otherwise uniform river channel.
- Reducing the amount of sediment reaching the river, and the encouragement of local sedimentation, providing additional habitat niches in the river channel.

Restore

Bank enhancements

Introduction

River banks can be reprofiled to reduce their gradient and create shallow areas next to the channel edge. For example, a bank with a steep, uniform slope right down to the edge of the channel can be reprofiled to incorporate shallow ledges just under the water line, areas of vertical river cliff, and intermediate ledges that lead to a more stepped profile. Care should be taken to create a diversity of different bank conditions, and avoid creating or promoting uniform bank profiles. It should be noted that although the channel is re-shaped, the overall high flow capacity is retained.

Application

This process is generally undertaken using an excavator. If the bank material is particularly easy to erode, it may be necessary to stabilise the front edge of the bank using vegetation or geotextile matting. This can be pre-planted, and will allow natural vegetation to colonise. The gradient of the reprofiled bank should be approximately 35°, although this is dependent on the physical properties of the bank material. An angle of greater than 45° should be avoided. It may be necessary to undertake some reprofiling upstream and downstream of the target section of bank in order to create a smooth transition. However, this should be minimised to prevent damaging the existing banks and the habitats they support. Due to the potential for fine sediment sourcing whilst vegetation is re-establishing it is recommended that where possible, work is only undertaken on one bank at a time. Furthermore, it is recommended that an asymmetric profile which incorporates shallow shelves and low berms should be aimed for. Material excavated from the top of the bank can be replaced at the bank toe, which narrows the river channel and creates new areas of marginal and aquatic habitats, whilst maintaining overall channel capacity. It is important to preserve some areas of steep bank in areas where reprofiling is recommended to ensure that a suitable diversity of bank habitats is retained.

Ecological benefits

The ecological benefits of enhancing river banks include:

- The provision of more varied habitats for aquatic and emergent plants in the marginal and riparian zones, by creating a wider range of flow depths and different substrate types.
- The creation of niche habitats and shelter for a range of fish and invertebrate species at all stages of their life cycle.
- Improvements to food availability for fish, birds and mammals that prey on species that thrive in the new marginal habitats.

Reinstate coarse bed material

Introduction

Factors such as historical modification of the River Eye have resulted in an over-deep, over-wide channel that has an artificially large capacity. Although the River Eye has a substrate that is naturally dominated by fine sediments (sands, silts and clays), there are significant areas of coarse sediment (gravels, pebbles and cobbles) in parts of the SSSI. The reinstatement of these coarse bed sediments in areas where they are completely absent can help to create a more naturally functioning river system.

Where sediment has previously been removed from a river system, local reinstatement of in-channel sediment-related features only enhances localised habitat rather than restoring deficient natural processes associated with sediment supply.

Application

Gravel augmentation

Gravel augmentation (also known as gravel seeding, injection or replenishment) seeks to replenish a proportion of a regulated river's sediment budget deficit with imported sediment. This is typically achieved by introducing spawning gravels into the river at locations upstream of degraded spawning habitat reaches (e.g. just downstream of a weir or dam). It is assumed that augmented gravels will become suspended during high flows and transported downstream. Raised gravel areas are "drowned" out in high flows, so should not change extreme flood risk. Designs are rarely necessary for gravel augmentation, but a sediment budget and a monitoring program are useful tools to enable adaptive management.

Bed raising

In river channels that have been extensively dredged, resulting in over-deepening of the channel, it is possible to reinstate a proportion of the sediment that has been removed in order to raise the bed and reduce the size of the channel. This is likely to be the most applicable technique for application in the River Eye SSSI.

Sourcing of coarse sediments

Gravel material should be selected on the basis of its size and shape and should ideally be as similar to existing gravels within the river as possible. It may be possible to source gravels from dredged material where it has been deposited along the river bank or from areas where it accumulates naturally (e.g. upstream of control structures and bridges). Alternatively, there may be potential to source gravels from borrow pits in the floodplain, whereby coarse material from within the floodplain is excavated and introduced into the channel. The resulting pit can be infilled with finer material gained from additional river works (e.g. bank reprofiling), or used to develop floodplain wetland features.

Ecological benefits

The ecological benefits of reinstating coarse bed material include:

- The creation of a more diverse substrate within the channel
- The creation of a wider variety of habitat types for aquatic plants, invertebrates and some fish species; including spawning habitat for species such as bullhead, lamprey and trout.

Increase channel sinuosity

Introduction
Re-meandering or meander reconnection can be applied in certain locations to restore habitat length/area and improve flow, substrate and depth diversity, thereby providing improved habitat conditions to a wider range of flora and fauna.

Application
This solution is applicable to reaches that would naturally be expected to have a meandering planform but have been modified though straightening or resectioning. It is not appropriate to create meanders within reaches that would not naturally meander.

Creation of low flow berms
Bank material can be reprofiled to create low flow berms (or aquatic ledges) at the bank toe, effectively narrowing the channel as well as creating a more naturally varied bank profile which supports a range of marginal and bank habitats. This can be undertaken on alternate banks to increase sinuosity within a straightened river channel.

Low flow berms could also be created by building up the river bank from its base to the low water mark, using material from the bed (where possible). Alternatively, via a top down technique which involves reprofiling the banks and reshaping some of the material into a shallow ledge that gently dips in the channel. The berms can be protected with planted geotextile matting and/or aquatic vegetation to prevent it eroding.

Alternatively, in rivers with high sediment supply, berms could be constructed using hazel bundles (faggots) which are installed in the channel margins, away from the bank toe. The area behind the faggots is then allowed to infill naturally. This is often a sustainable and cost effective way of kick starting the river to naturally adjust to a more suitable form and function.

Installation of deflectors
As an alternative, it may be possible to introduce an element of sinuosity in a straightened river channel through the installation of structures to vary flow patterns. For example, large woody material or current deflectors and artificial shoals can be introduced on alternate banks to improve geomorphological diversity and introduce sinuosity. These structures ideally utilise soft engineering measures, and can be comprised of wooden posts and logs which are driven into the bed and backfilled with sediment.

In some locations, remeandering or meander reconnection may offer the opportunity to create new marginal wetlands and backwater habitats adjacent to the river channel.

Ecological benefits
The ecological benefits of increasing channel sinuosity include:

- The creation of niche habitats and shelter for a range of fish and invertebrate species at all stages of their life cycle.
- Varying the channel shape and creating a low flow will also help to focus flows and increase flow velocities. This will encourage the transport of fine sediment and help to maintain clean gravel substrates, whilst not reducing the channel capacity for flood flows.

Removal or modification of in-channel structures

Introduction

The aim of this solution is to remove in-channel structures where possible, in order to create more natural patterns of flow and sediment movement, and allow free passage of fish and other aquatic organisms along the river channel. This measure is specifically targeted in individual reaches, but is likely to help improve much larger reaches of the river.

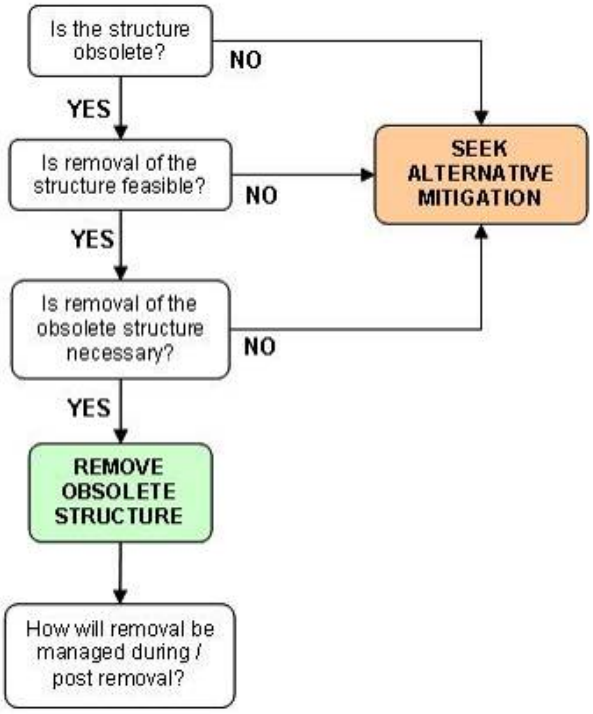
If a structure is no longer required for water level control or flood risk management, it could be possible to remove it. For example, structures originally built to raise water levels for milling may no longer be required if the mill no longer exists. The removal of a structure can provide significant benefits to the river channel by restoring characteristic water depths and flow velocities, reducing siltation of gravel substrates and allowing free movement of fauna.

Where it is not possible to remove a control structure, an alternative may be to lower it or alter it by creating a notch, so that the structure continues to increase water levels and/or maintain clean gravels for spawning habitats, whilst making them more easily passable to fish, water and sediment.

Application

When considering the removal of a structure it is important to assess the current function of the structure and the users that the structure is currently serving. In-channel structures also differ widely in size, situation and construction and the most appropriate approach to removal largely depends on the individual structure concerned. For many structures, especially small ones, removal is a relatively straightforward demolition project, although care must be taken to protect the surrounding structures and natural environments. However, the decision-making process as to whether dam or weir removal is the best option is often complex even for smaller structures.

The following steps can be applied to guide decision making when seeking to remove a structure:



The removal of a structure should be considered as the first option. This may be relatively straightforward for obsolete structures that no longer have a current function and do not have any historical interest, although technical considerations (e.g. impacts on existing valuable habitats, and technical practicalities of removal) may make removal unfeasible.

In some cases, the current function of a structure (e.g. flow gauging) may make it unfeasible to remove or change the way in which it is operated in the short term. However, it may be feasible to replace the structure with an alternative that has a lesser effect on the condition of the SSSI over longer timescales (specifically, once the structure has reached the end of its operational life and needs to be replaced). Where structures are listed, their

Removal or modification of in-channel structures

removal is unlikely to be feasible even over longer timescales. In this case, it may be possible to mitigate their effects on the condition of the SSSI, for example by constructing a new bypass channel.

Invasive works within the river channel are required in order to remove an in-channel structure. The nature of the works is dependent on the type of structure, but will typically involve breaking up the main elements above the river bed using heavy construction equipment. Removal of the foundations of the structure will require greater excavation. Construction of temporary dams in the river is likely to be required to create dry areas in which to work. Measures to prevent the escape of sediments and potential contaminants from construction equipment into the river would be required, and materials would need to be transported off site for disposal.

The physical alteration of a weir can be technically difficult, depending on the nature of the original structure. For example, it can be difficult and therefore time consuming and expensive to cut a channel in an existing reinforced structure. Older structures may not be stable enough to be modified easily. It can, therefore, be more cost effective to remove a structure and replace it with one of a more suitable design than to modify an existing and potentially unstable structure.

The geomorphology of the watercourse is a key aspect that requires careful consideration when altering or lowering structures. Many structures have been in place for hundreds of years and consequently, some rivers have become adapted to them. In these cases, removal of the structure many instigate significant instability for the system upstream and downstream if appropriate mitigation is not applied. Structures with a significant change in bed level represent a risk to system instability upon removal; this can be alleviated if the channel bed is regraded over an appropriate length. Regrading on a large scale can be expensive and result in significant disturbance to the in stream ecology and habitats. The benefits of removing a structure needs to be considered with the potential impacts and cost and sometimes alternative approaches that modify the structure can prove to be more appropriate.

It should be noted that changing the way in which a structure such as a sluice is operated can deliver a significant proportion of the benefits of complete removal without the expense and risks associated with the latter option. If removal is considered to be too expensive, risky or inappropriate due to the current function of a structure, changes to the way it is operated should be considered. This option is only applicable to sluices and other structures that can be operated, and does not apply to fixed weirs. See **Review operation of structures** for more information.

Ecological benefits

The ecological benefits of removing a structure or changing the way it is operated include:

- Creation of more natural patterns of flow and sediment movement, therefore creating habitat features more closely associated with the River Eye prior to anthropogenic change.
- Removing and modifying structures can also allow free passage of fish and other aquatic organisms along the river channel and maintain clean gravels for spawning habitats.
- Increased ability of river habitat and associated ecology to adapt to extreme low and high flows and temperature.

Strategic review

Review operation of structures

Introduction
The aim of this solution is to fully assess the operation of structures in order to ensure the protection of high-quality habitats in the River Eye SSSI.

Application
Existing structures must be reviewed in order to determine their impact upon flow conditions, sediment transport and ecological communities in the River Eye. In particular, the following structures should be reviewed:

- The online sediment traps at Ham Bridge on the River Eye and Sawgate Road on Burton Brook must be assessed to evaluate the effectiveness of the structure in trapping fine and coarse sediment. If it is found that the structures are a significant limiting factor on downstream coarse sediment supply, measures to improve conveyance of coarse sediment may be required.

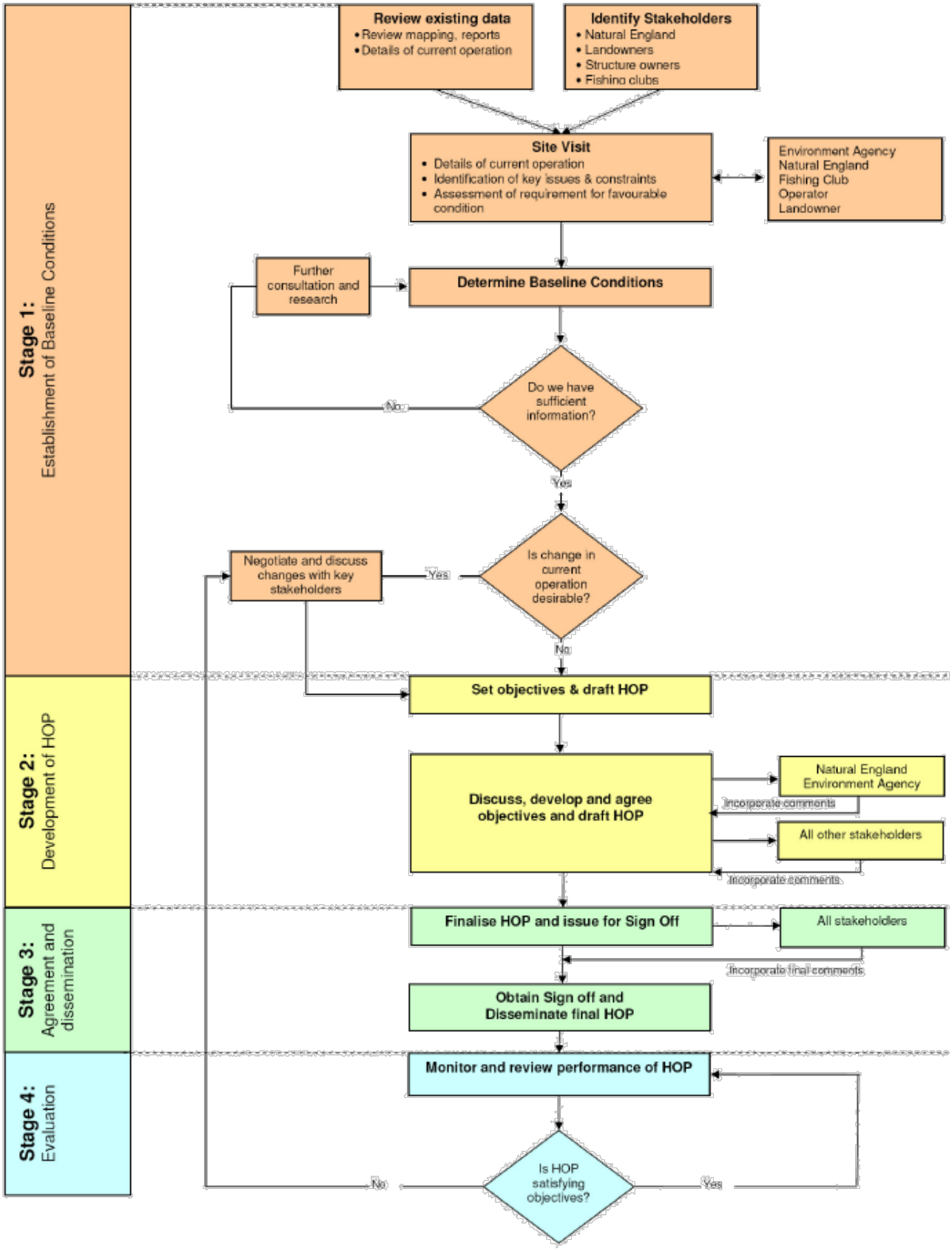
- The operation of the automatic flood gates that form part of the Melton Mowbray Flood Alleviation Scheme should also be reviewed to determine whether it will be possible to reduce the impact they have on the river channel. Specifically, the way in which the gates are opened to drain water levels following a period of flooding should be investigated to see if water can be drained more quickly and limited flushing flows reintroduced to move sediments in the river downstream without impacting upon flood risk.

In cases where the removal of a structure is not feasible, it may be possible to alter the way in which it is operated to reduce its impact on the SSSI. This can provide 90% of the benefit of removing a structure. Guidance for the formulation of structure operating protocols has been developed by Royal HaskoningDHV on behalf of the Environment Agency and Natural England (http://www.wise-rtd.info/sites/default/files/d-2012-01-26-Guidance_Hatch_Operating_Protocols.pdf) is summarised in the **flow chart overleaf.**

Ecological benefits
The ecological benefits of removing a structure or changing the way it is operated include:

- Creation of more natural patterns of flow and sediment movement, therefore creating habitat features more closely associated with the River Eye prior to anthropogenic change.
- Removing and modifying structures can also allow free passage of fish and other aquatic organisms along the river channel and maintain clean gravels for spawning habitats.

Guidance for the formulation of structure operating protocols

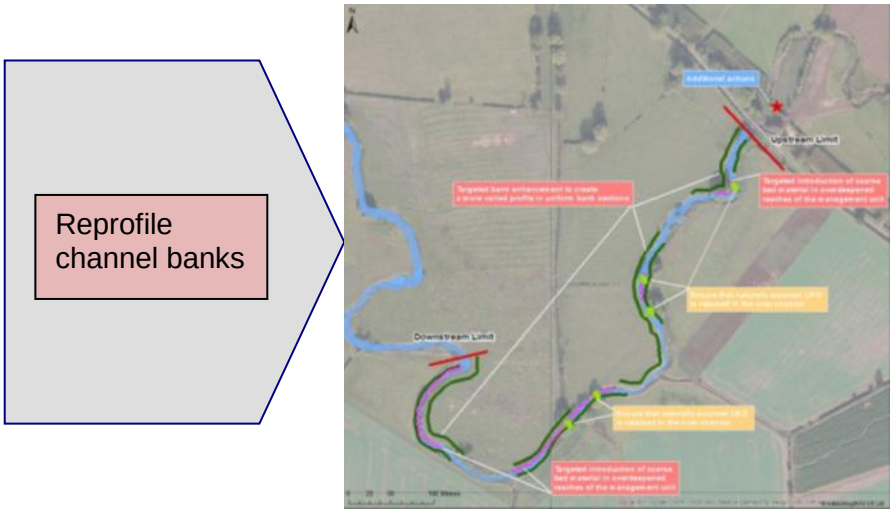


Finding out more about the solutions

Section 4 provides information on each category of solution, pointing to key guidance which can be referred to for more information. These categories are colour coded using the colours shown below:

Conserve and enhance
Rehabilitate
Restore
Strategic review

This colour coding is repeated in **Section 5** when labelling the solutions that apply in each reach of the River Eye, making it easy to cross-reference to the information contained **Section 4.** For example:



Implementing solutions on the ground

It is important to note that **Section 5** sets out high level potentially suitable options. The detail of any restoration projects will be developed in conjunction with landowners and other stakeholders, in order to identify constraints and design appropriate restoration options. Actions will only be taken forward once agreement has been gained from stakeholders, and will be carried out in close partnership to ensure effective delivery and viability of the solution.

To take forward the solutions in practice there are some important considerations that will need to be taken into account. **Section 6** shows an action plan which can be used to take forward the solutions for delivery on the ground over the short, medium and long term. In many cases the first action to be taken towards implementing the solution will be to investigate the feasibility of whether the solution is sustainable and takes into account the function of the river for both wildlife and those who use the river now and into the future. A key part of this must also be to take into account climate change, most importantly how adaptable the solutions are to climate change. Before any works are undertaken on the ground, it is important that ecologically valuable habitats (e.g. fish spawning grounds and water vole banks) are identified and measures are adopted to ensure that they will not be compromised by any proposed solutions. Access routes and site compounds, and arrangements for ground reinstatement must be agreed with landowners and managers in advance of works. All appropriate permissions must also be obtained, including flood defence consent, planning permission, waste licences etc as required.

5. RESTORATION SOLUTIONS

Summary of restoration solutions

The subsequent chapter provides details of how the specific solutions could be implemented on a reach-by-reach basis. An annotated aerial photograph is provided for each management reach, alongside details of the type of solution that could potentially be implemented. Many of these actions require further investigation before they can be implemented.

For the purposes of this Restoration Plan, the River Eye has been divided into eight Management Reaches. These Management Reaches are shown in **Figure 5.1.** The SSSI unit locations are shown in **Figure 2.1.**

The river channel has been sub-divided into these eight management reaches based on the prevailing geomorphological and ecological characteristics of each reach **(Figure 5.1).** A brief breakdown of the boundaries of each reach is provided in **Table 5.1.** Further information on how the river was subdivided, and on the geomorphological and ecological characteristics of each management reach, is provided in the accompanying River Eye SSSI Technical Report (Royal HaskoningDHV, 2013).

Management Reach summary sheets

The following pages contain summary sheets which identify the potential solutions recommended for each management reach. The solutions are colour coded according to the type of actions required, as explained in the previous section.

The solutions presented for each management unit represent recommendations for the types of actions that are required to improve the status of the River Eye SSSI. The solutions presented in this plan are **potential options**. Further consultation and development will be required before they can be implemented, where proposals are developed in close conjunction with landowners and other stakeholders over short, medium and long timescales.

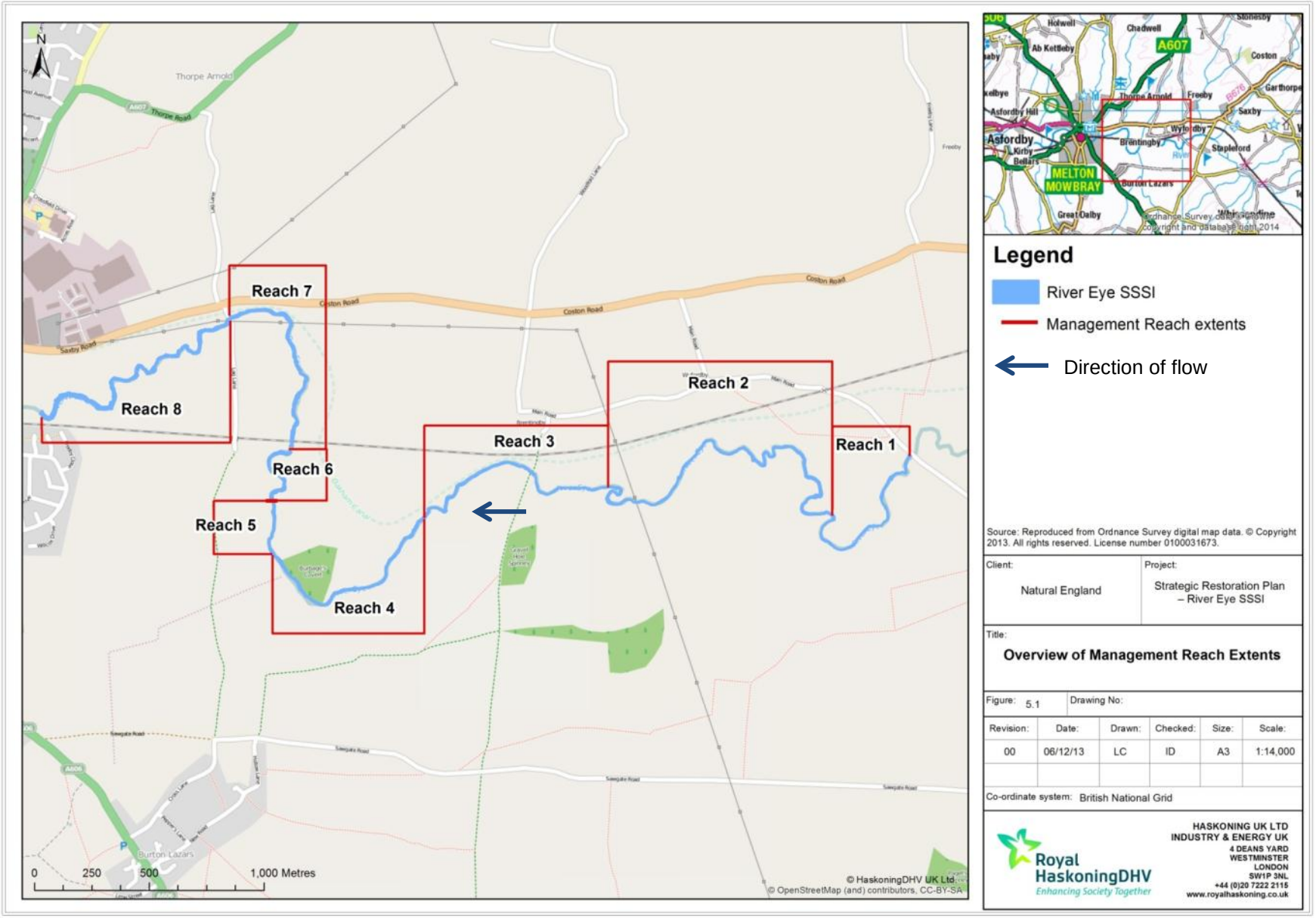
The solutions should be read in conjunction with **Section 4**, which provides further details of the type of actions that could be implemented on the ground.

Table 5.1: Summary of Management Reach characteristics

Management Reach	SSSI Unit	Upstream limit	Downstream limit	Example photograph	Key characteristics	Level of restoration required
1	1	SK 80131 18615	SK 79786 18361		Low energy glides characterise flow conditions in this reach. Deposition of fine sedimentation on the river bed is dominant. Channel geometry is uniform displaying a lack of in-channel morphological diversity and a disconnection to the floodplain.	**Restore**
2	1, 2	SK 79786 18361	SK 78762 18484		Uniform slow flowing conditions and extensive colonisation of the channel by macrophytes result in widespread siltation of the river bed through vegetational trapping. Channel-floodplain connectivity is disrupted by steep, uniform banks and an over-deepened channel.	**Restore**
3	2, 3	SK 78762 18484	SK 78032 18377		A varied range of in-channel habitat and flow conditions occur in this reach. Areas of clean gravel substrate are associated with an increase of in-channel morphological diversity. Floodplain connectivity is favoured by the presence of low, shallow banks.	**Conserve and enhance**
4	3, 4	SK 78032 18377	SK 77359 18193		Low energy glides and deposition of fine sediments on the river bed dominates this reach. Channel geometry is uniform displaying lack of in-channel morphological diversity.	**Restore**

Management Reach	SSSI Unit	Upstream limit	Downstream limit	Example photograph	Key characteristics	Level of restoration required
5	4	SK 77359 18193	SK 77357 18408		Riffle and run flows dominate this reach. Clean gravels and coarse sediment are present with sediment transport dominating the sediment regime throughout the reach. Channel-floodplain connectivity is disrupted by steep banks.	**Rehabilitate**
6	4	SK 77357 18408	SK 77435 18675		Glide and impoundment conditions dominate flows in this reach. Hard bank reinforcement associated with the Flood Alleviation Scheme (FAS) is present in the downstream sections of the reach. Channel-floodplain connectivity is generally limited by steep, uniform banks, hard bank reinforcement and over-deepening of the channel.	**Restore**
7	5	SK 77435 18675	SK 77169 19209		Uniform, slow flows dominate this reach with riffles present in isolated sections. Bank erosion contributes towards increased morphological diversity and the creation of vegetated berms throughout the reach.	**Rehabilitate**
8	6	SK 77169 19209	SK 76341 18814		Impoundment associated with in-channel structures downstream of the SSSI limits dominates this reach. Widespread deposition of fine sediments is associated with low flow velocities and extensive enlargement of the channel.	**Restore**

Figure 5.1: Location of the River Eye Restoration Plan Management Reaches



MANAGEMENT REACH 1
SSSI UNIT: 1

Required level of intervention | **Restore**

Key issues (see **Section 3** for unfavourable condition descriptions)

- Disconnection from floodplain
- Lack of morphological diversity
- Siltation

Management Reach overview

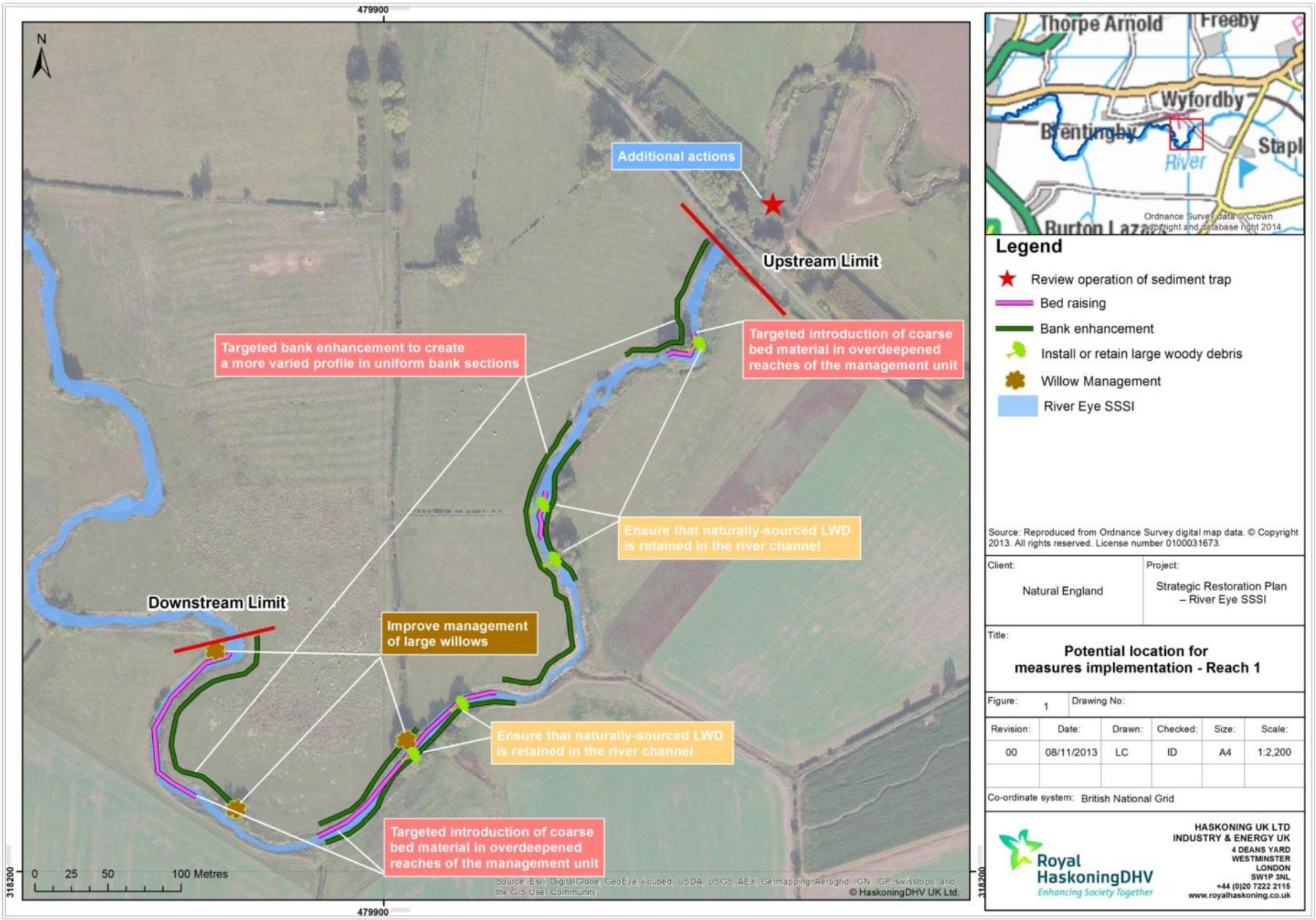
- Low energy glides characterise flow conditions in this reach.
- Deposition of fine sedimentation on the river bed is dominant.
- Channel geometry is uniform displaying lack of in-channel morphological diversity and disconnection to the floodplain.

Solutions (see **Section 4** for further details)

Restore	**Bank enhancements**	Targeted bank reprofiling to create a more varied profile in uniform bank sections, including the insertion of bank material into the river channel to reduce low flow capacity. This should not take place adjacent to the vegetated islands, and the small riffle at the downstream end of the Management Reach.	Increased morphological diversity, narrowing of river channel, greater range of marginal and in-channel habitat niches for macrophytes, fish and aquatic invertebrates.
	Gravel augmentation	Targeted introduction of coarse bed material in over-deepened reaches of the management reach. This should only be undertaken if lack of coarse sediment supply is identified as an issue following other channel enhancements and the strategic reviews of the weir and the sediment traps.	Increased morphological diversity, narrowing of river channel, greater range of marginal and in-channel habitat niches for macrophytes, fish and aquatic invertebrates.
Rehabilitate	**Retain large woody material**	Ensure that naturally-sourced woody material is retained in the river channel.	Increased flow and morphological diversity, creation of in-channel habitat niches for fish and aquatic invertebrates.
	Riparian zone management	Improve management of individual willow trees at the downstream end of the reach, through delimbing or complete removal.	Reduced siltation, localised reduction in bank erosion, increased range of riparian habitat niches for plants and invertebrates.
Strategic review	**Review operation of sediment trap**	Review operation of online sediment trap upstream of Ham Bridge to evaluate effectiveness in trapping coarse and fine sediment. It if is found to be a significant limiting factor on downstream sediment supply, measures to improve conveyance of coarse sediment may be required.	Potential increase in coarse sediment supply
	Review impact of Stapleford Weir	Review operation of online sediment trap upstream of Ham Bridge to evaluate effectiveness in trapping coarse and fine sediment. It if is found to be a significant limiting factor on downstream sediment supply, measures to improve conveyance of coarse sediment may be required.	Potential increase in coarse sediment supply.

Constraints

- Constraints related to current land use.
- Presence of dense buffer strips and riparian fencing in parts of the reach.
- It may not be possible to increase coarse sediment supply over the sediment trap if any modifications compromise its performance in reducing fine sediment loads downstream.


479900
N
Additional actions
Upstream Limit
Targeted introduction of coarse bed material in overdeepened reaches of the management unit
Targeted bank enhancement to create a more varied profile in uniform bank sections
Ensure that naturally-sourced LWD is retained in the river channel
Downstream Limit
Improve management of large willows
Ensure that naturally-sourced LWD is retained in the river channel
Targeted introduction of coarse bed material in overdeepened reaches of the management unit
0 25 50 100 Metres
318200
479900
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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Freeby
Wyfordby
Stapl
River
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Legend
Review operation of sediment trap
Bed raising
Bank enhancement
Install or retain large woody debris
Willow Management
River Eye SSSI
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Client: Natural England
Project: Strategic Restoration Plan – River Eye SSSI
Title: Potential location for measures implementation - Reach 1
Figure: 1
Drawing No:
Revision: 00
Date: 08/11/2013
Drawn: LC
Checked: ID
Size: A4
Scale: 1:2,200
Co-ordinate system: British National Grid
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MANAGEMENT REACH 2
SSSI UNIT: 1, 2

Required level of intervention	**Restore**

Key issues (see **Section 3** for unfavourable condition descriptions)

- Excessive growth of in-channel vegetation
- Disconnection from floodplain
- Lack of morphological diversity
- Siltation

Management Reach overview

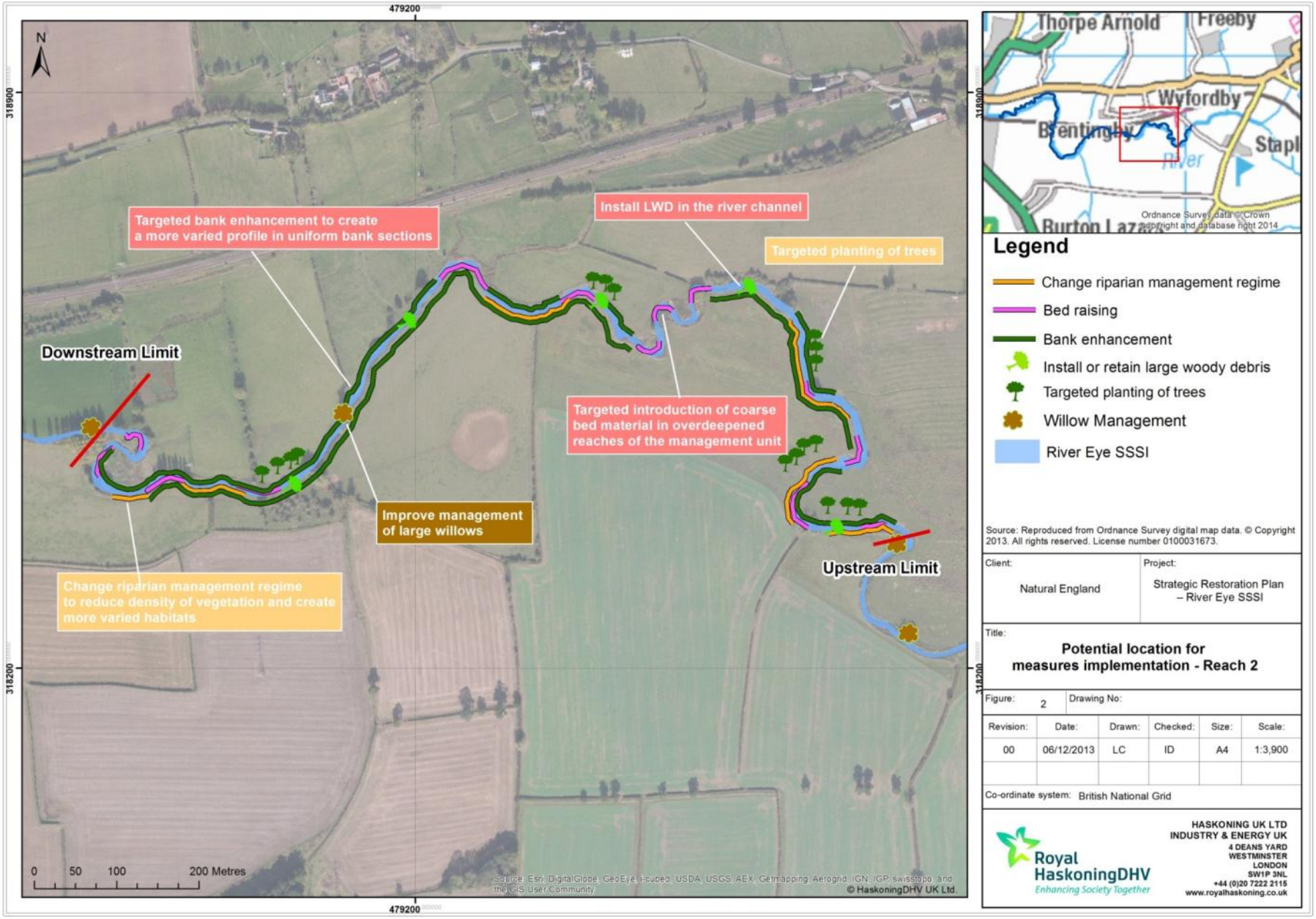
- Uniform slow flowing conditions and extensive colonisation of channel by macrophytes result in widespread siltation of the river bed through vegetational trapping.
- Channel-floodplain connectivity is disrupted by steep, uniform banks and an over-deepened channel.

Solutions (see **Section 4** for further details)

Restore	**Bank enhancements**	Targeted bank reprofiling to create a more varied profile in uniform bank sections. This should include the insertion of bank material into the river channel to reduce low flow capacity.	Increased morphological diversity, narrowing of river channel, greater range of marginal and in-channel habitat niches for macrophytes, fish and aquatic invertebrates.
	Gravel augmentation	Targeted introduction of coarse bed material in over-deepened reaches of the management reach. This should only be undertaken if lack of coarse sediment supply is identified as an issue following other channel enhancements and the strategic reviews of the weir and the sediment traps.	Increased morphological diversity, narrowing of river channel, greater range of marginal and in-channel habitat niches for macrophytes, fish and aquatic invertebrates.
Rehabilitate	**Install large woody material**	Install woody material in the river channel in uniform reaches of the Management Reach.	Increased flow and morphological diversity, creation of in-channel habitat niches for fish and aquatic invertebrates.
	Riparian zone management	Change riparian management regime to reduce density of vegetation and create more varied habitats.	Creation of marginal habitat niches for macrophytes, invertebrates, mammals and birds.
	Riparian zone management	Targeted planting of trees to locally increase tree cover and provide a source of woody material.	Increased shelter and shading for fish, invertebrates, mammals and birds.
	Riparian zone management	Improve management of large willow tree on the north bank opposite Peg's Meadow, through delimbing or complete removal.	Reduced siltation, localised reduction in bank erosion, increased range of riparian habitat niches for plants and invertebrates.

Constraints

- Constraints related to current land use.
- Presence of dense buffer strips and riparian fencing in parts of the reach.


479200
318900
318200
N
Targeted bank enhancement to create a more varied profile in uniform bank sections
Install LWD in the river channel
Targeted planting of trees
Downstream Limit
Targeted introduction of coarse bed material in overdeepened reaches of the management unit
Improve management of large willows
Change riparian management regime to reduce density of vegetation and create more varied habitats
Upstream Limit
0 50 100 200 Metres
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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Thorpe Arnold
Freeby
Wyfordby
Stapl
River
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Legend
Change riparian management regime
Bed raising
Bank enhancement
Install or retain large woody debris
Targeted planting of trees
Willow Management
River Eye SSSI
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Client: Natural England
Project: Strategic Restoration Plan – River Eye SSSI
Title: Potential location for measures implementation - Reach 2
Figure: 2
Drawing No:
Revision: 00
Date: 06/12/2013
Drawn: LC
Checked: ID
Size: A4
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Co-ordinate system: British National Grid
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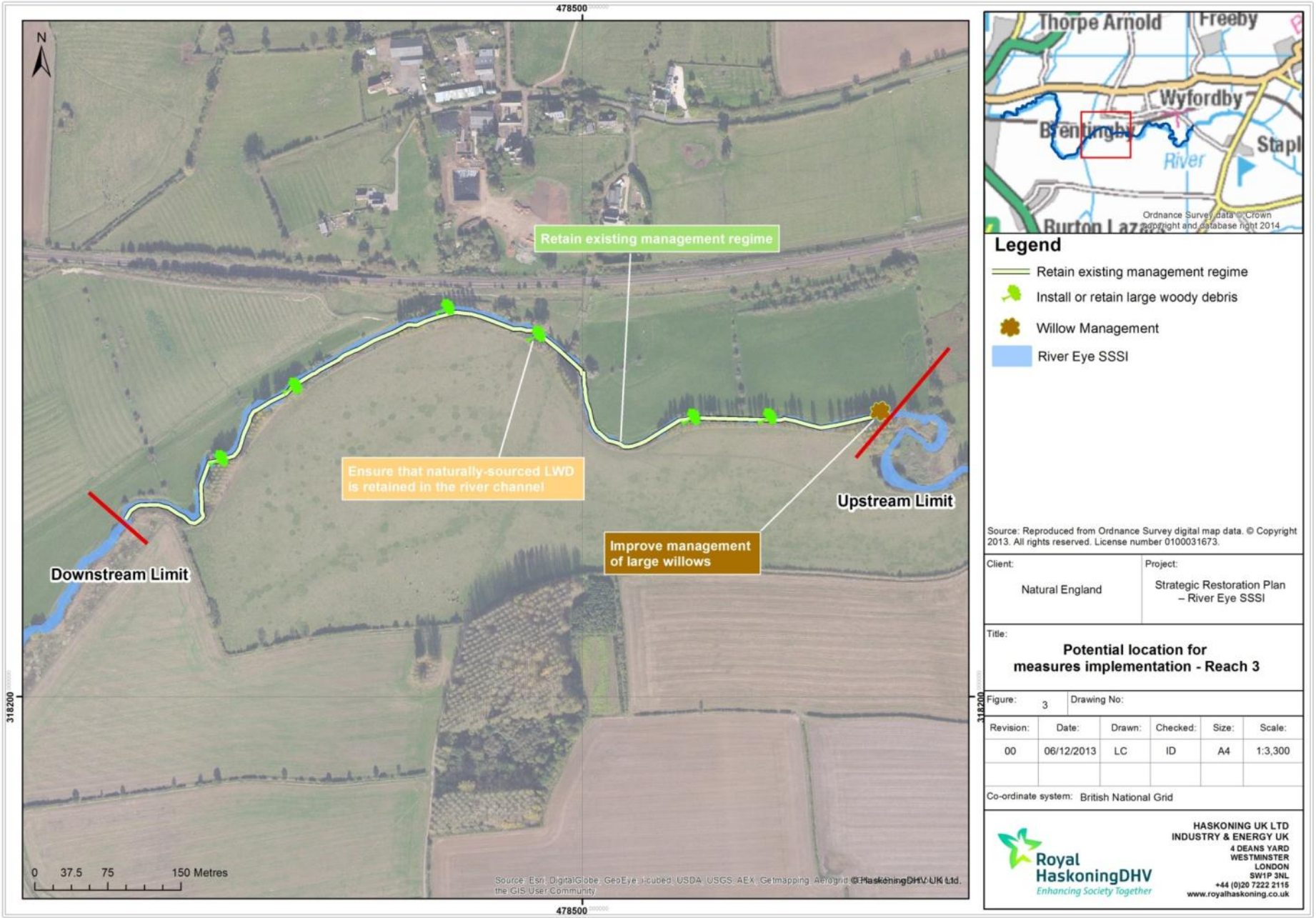
MANAGEMENT REACH 3 SSSI UNIT: 2, 3			
Required level of intervention	**Conserve and enhance**		
Key issues (see **Section 3** for unfavourable condition descriptions)			
• Lack of morphological diversity (isolated reach)			
Management Reach overview			
• A varied range of in-channel habitat and flow conditions occur in this reach. • Areas of clean gravel substrate are associated with an increase of in-channel morphological diversity. • Floodplain connectivity is favoured by presence of low, shallow banks.			
Solutions (see **Section 4** for further details)			
Rehabilitate	**Retain large woody material**	Ensure that naturally-sourced woody material is retained in the river channel to increase flow and morphological diversity. Existing trees could also be felled to provide a local source of material.	Increased flow and morphological diversity, creation of in-channel habitat niches for fish and aquatic invertebrates.
	Riparian zone management	Improve management of the large willow trees that are growing in the channel at the upstream end of the reach, through delimbing or complete removal.	Reduced siltation, localised reduction in bank erosion, increased range of riparian habitat niches for plants and invertebrates.
Conserve and enhance	**Continued management**	Retain existing management regime to ensure that excessive livestock trampling does not impact upon the existing morphology and habitats.	Retention of existing high quality habitat features.
Constraints			
• Constraints related to current land use. • Potential for woody material to block the access bridge (although this is limited due to the size of the bridge).			


478500
N
Retain existing management regime
Ensure that naturally-sourced LWD is retained in the river channel
Improve management of large willows
Upstream Limit
Downstream Limit
318200
0 37.5 75 150 Metres
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community
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Wyfordby
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River
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Legend
Retain existing management regime
Install or retain large woody debris
Willow Management
River Eye SSSI
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Client: Natural England
Project: Strategic Restoration Plan – River Eye SSSI
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Figure: 3
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Revision: 00
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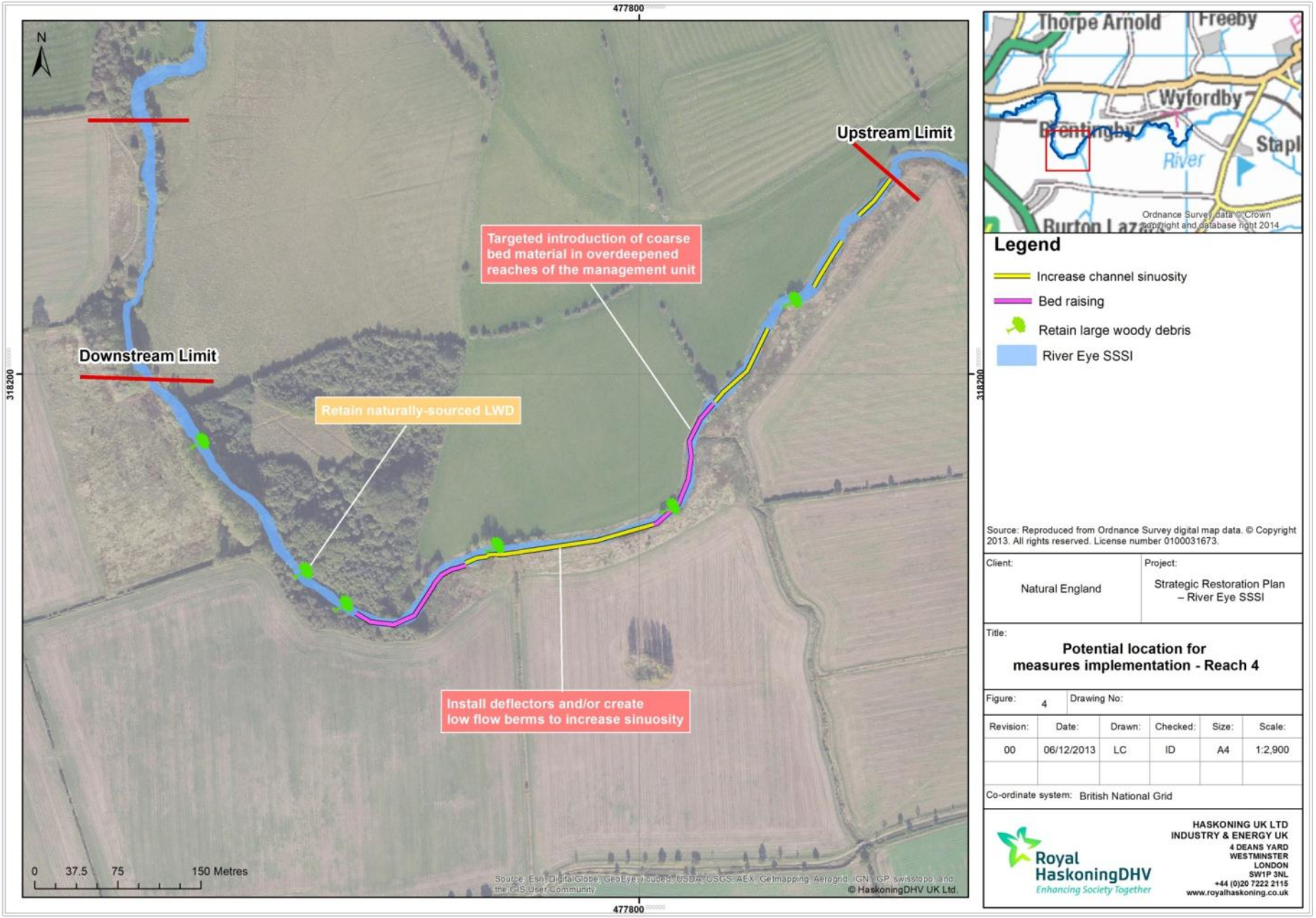
MANAGEMENT REACH 4 SSSI UNIT: 3, 4			
Required level of intervention	**Restore**		
Key issues (see **Section 3** for unfavourable condition descriptions)			
• Lack of morphological diversity • Siltation			
Management Reach overview			
• Low energy glides and deposition of fine sediments on the river bed dominates this reach. • Channel geometry is uniform displaying lack of in-channel morphological diversity.			
Solutions (see **Section 4** for further details)			
Restore	**Increase channel sinuosity**	Install deflectors and/or create low flow berms to increase sinuosity within the current bank line.	Increased morphological diversity, narrowing of river channel, greater range of marginal and in-channel habitat niches for macrophytes, fish and aquatic invertebrates.
	Gravel augmentation	Targeted introduction of coarse bed material in over-deepened reaches of the management reach. This should only be undertaken if lack of coarse sediment supply is identified as an issue following other channel enhancements and the strategic reviews of the weir and the sediment traps.	Increased morphological diversity, narrowing of river channel, greater range of marginal and in-channel habitat niches for macrophytes, fish and aquatic invertebrates.
Rehabilitate	**Retain large woody material**	Retain naturally-sourced woody material in the river channel to increase flow and morphological diversity in the downstream end of the Management Reach. Locally-sourced woody material could also be installed upstream.	Increased flow and morphological diversity, creation of in-channel habitat niches for fish and aquatic invertebrates.
Strategic review	**Review operation of sediment trap**	Review operation of sediment trap at Sawgate Road on Burton Brook to evaluate effectiveness in trapping coarse and fine sediment. It if is found to be a significant limiting factor on downstream sediment supply, measures to improve conveyance of coarse sediment may be required.	Potential increase in coarse sediment supply
Constraints			
• Constraints related to current land use. • It may not be possible to increase coarse sediment supply over the sediment trap if any modifications compromise its performance in reducing fine sediment loads downstream.			


477800
318200
N
Upstream Limit
Targeted introduction of coarse bed material in overdeepened reaches of the management unit
Downstream Limit
Retain naturally-sourced LWD
Install deflectors and/or create low flow berms to increase sinuosity
0 37.5 75 150 Metres
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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Legend
Increase channel sinuosity
Bed raising
Retain large woody debris
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Project: Strategic Restoration Plan – River Eye SSSI
Title: Potential location for measures implementation - Reach 4
Figure: 4
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Revision: 00
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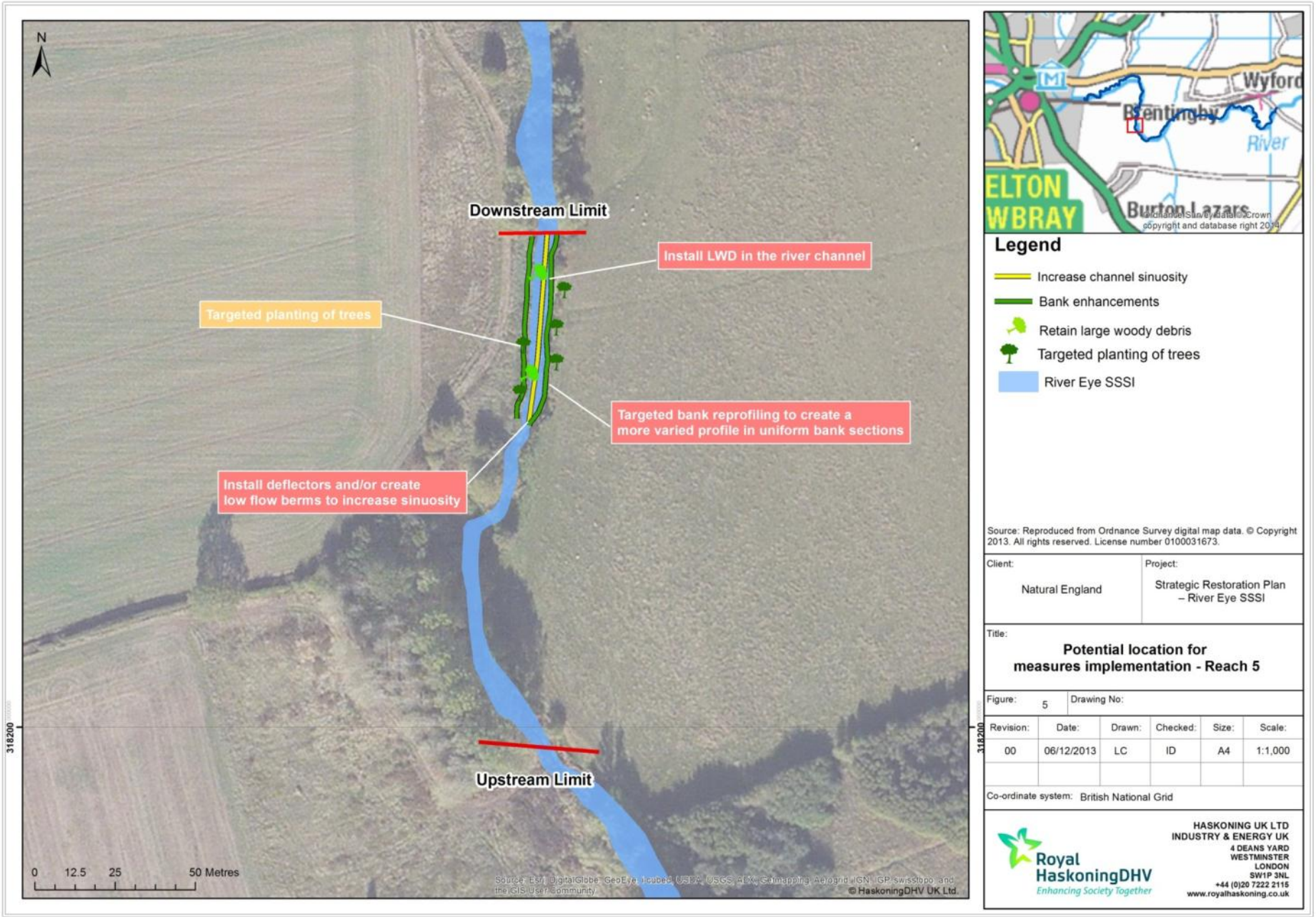
MANAGEMENT REACH 5 SSSI UNIT: 4			
Required level of intervention	**Rehabilitate**		
Key issues (see **Section 3** for unfavourable condition descriptions)			
• Disconnection from floodplain			
Management Reach overview			
• Riffle and run flows dominate this reach. • Clean gravels and coarse sediment are present with sediment transport dominating the sediment regime throughout the reach. • Channel-floodplain connectivity is disrupted by steep banks.			
Solutions (see **Section 4** for further details)			
Restore	**Bank enhancements**	Targeted bank reprofiling to create a more varied profile in uniform bank sections. This should include the insertion of bank material into the river channel to reduce low flow capacity.	Increased morphological diversity, narrowing of river channel, greater range of marginal and in-channel habitat niches for macrophytes, fish and aquatic invertebrates.
	Increase channel sinuosity	Install deflectors and/or create low flow berms to increase sinuosity within the current bank line in the downstream half of the Management Reach.	Increased morphological diversity, narrowing of river channel, greater range of marginal and in-channel habitat niches for macrophytes, fish and aquatic invertebrates.
Rehabilitate	**Install large woody material**	Install woody material in the river channel in the downstream half of the Management Reach.	Increased flow and morphological diversity, creation of in-channel habitat niches for fish and aquatic invertebrates.
	Riparian zone management	Targeted planting of trees to locally increase tree cover and provide a source of woody material.	Increased shelter and shading for fish, invertebrates, mammals and birds.
Constraints			
• Constraints related to current land use.			


N
Downstream Limit
Install LWD in the river channel
Targeted planting of trees
Targeted bank reprofiling to create a more varied profile in uniform bank sections
Install deflectors and/or create low flow berms to increase sinuosity
Upstream Limit
0 12.5 25 50 Metres
318200
318200
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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Wyford
Bsentingby
River
ELTON
WBRAY
Burton Lazars
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Legend
Increase channel sinuosity
Bank enhancements
Retain large woody debris
Targeted planting of trees
River Eye SSSI
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Client: Natural England
Project: Strategic Restoration Plan – River Eye SSSI
Title: Potential location for measures implementation - Reach 5
Figure: 5
Drawing No:
Revision: 00
Date: 06/12/2013
Drawn: LC
Checked: ID
Size: A4
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MANAGEMENT REACH 6
SSSI UNIT: 4

Required level of intervention	**Restore**

Key issues (see **Section 3** for unfavourable condition descriptions)

- Impoundment
- Siltation
- Lack of morphological diversity
- Disconnection from floodplain

Management Reach overview

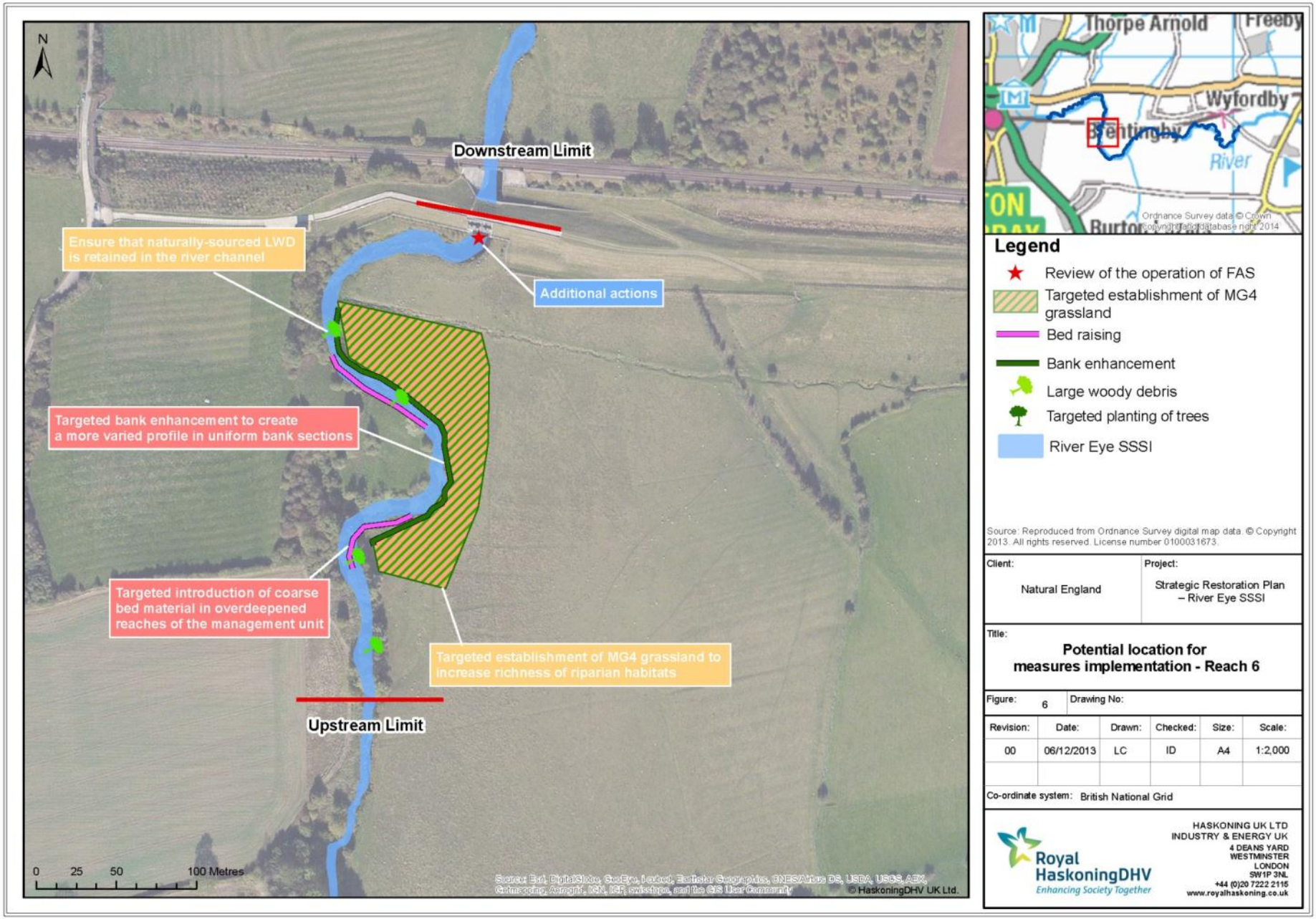
- Glide and impoundment conditions dominate flows in this reach.
- Hard bank reinforcement associated with the FAS is present in the downstream sections of the reach.
- Channel-floodplain connectivity is generally limited by steep, uniform banks, hard bank reinforcement and over-deepening of the channel.

Solutions (see **Section 4** for further details)

Restore	**Bank enhancements**	Targeted bank lowering to improve floodplain connectivity in the downstream reach of the Management Reach.	Increased morphological diversity, increased floodplain connectivity, increased opportunity for overbank sediment storage, greater range of habitats for wetland plants, invertebrates, mammals and birds.
	Gravel augmentation	Targeted introduction of coarse bed material in over-deepened reaches of the management reach. This should only be undertaken if lack of coarse sediment supply is identified as an issue following other channel enhancements and the strategic reviews of the weir and the sediment traps.	Increased morphological diversity, narrowing of river channel, greater range of marginal and in-channel habitat niches for macrophytes, fish and aquatic invertebrates.
Rehabilitate	**Riparian zone management**	Targeted establishment of MG4, species rich wet grassland to increase richness of riparian habitats and support favourable condition assessment for "Habitat structure".	Increased shelter and shading for fish, invertebrates, mammals and birds.
	Retain large woody material	Retain naturally-sourced LWD in the river channel to increase flow and morphological diversity in the upstream reach of the Management Reach. Existing trees close to the embankment could also be felled to provide an instant source of material.	Increased flow and morphological diversity, creation of in-channel habitat niches for fish and aquatic invertebrates.
Strategic review	**Review operation of Flood alleviation structures at Brentingby Junction**	Review of the operation of the under shot gates at the Brentingby junction and associated flood storage area. Operational regime may be adapted to promote the establishment of MG4 grassland upstream of the Flood Alleviation Scheme structures and embankment.	Potential increase in coarse sediment supply.

Constraints

- Constraints related to current land use.
- Operation of Flood Alleviation Scheme – flood risk cannot be increased.
- Potential for woody material to block the flood alleviation structures, requiring increased maintenance.
- Any modifications must avoid changes to the railway embankment.


N
Downstream Limit
Ensure that naturally-sourced LWD is retained in the river channel
Additional actions
Targeted bank enhancement to create a more varied profile in uniform bank sections
Targeted introduction of coarse bed material in overdeepened reaches of the management unit
Targeted establishment of MG4 grassland to increase richness of riparian habitats
Upstream Limit
0 25 50 100 Metres
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Thorpe Arnold
Wyfordby
River
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Legend
Review of the operation of FAS
Targeted establishment of MG4 grassland
Bed raising
Bank enhancement
Large woody debris
Targeted planting of trees
River Eye SSSI
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Project: Strategic Restoration Plan – River Eye SSSI
Title: Potential location for measures implementation - Reach 6
Figure: 6
Drawing No:
Revision: 00
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MANAGEMENT REACH 7
SSSI UNIT: 5

Required level of intervention	**Rehabilitate**

Key issues (see **Section 3** for unfavourable condition descriptions)

- Lack of morphological diversity
- Siltation
- Disconnection from floodplain
- Excessive growth of in-channel vegetation

Management Reach overview

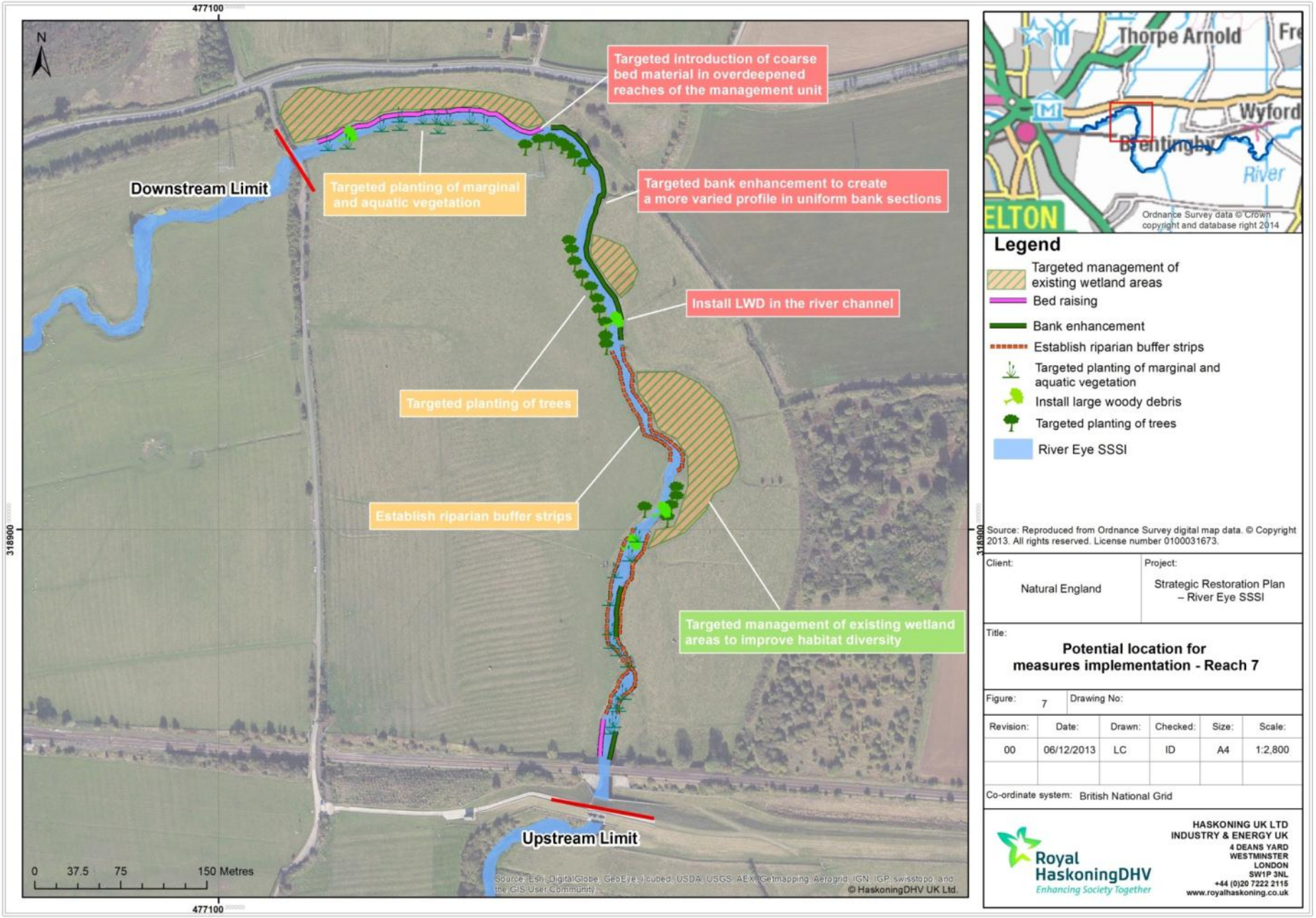
- Uniform, slow flows dominate this reach with riffles present in isolated sections.
- Bank erosion contributes towards increased morphological diversity and the creation of vegetated berms throughout the reach.

Solutions (see **Section 4** for further details)

Restore	**Bank enhancements**	Targeted bank lowering to improve floodplain connectivity throughout the Management Reach.	Increased morphological diversity, increased floodplain connectivity, increased opportunity for overbank sediment storage, greater range of habitats for wetland plants, invertebrates, mammals and birds.
	Gravel augmentation	Targeted introduction of coarse bed material in over-deepened reaches of the management reach. This should only be undertaken if lack of coarse sediment supply is identified as an issue following other channel enhancements and the strategic reviews of the weir and the sediment traps.	Increased morphological diversity, narrowing of river channel, greater range of marginal and in-channel habitat niches for macrophytes, fish and aquatic invertebrates.
Rehabilitate	**Install large woody material**	Install LWD in the river channel to increase flow and morphological diversity.	Increased flow and morphological diversity, creation of in-channel habitat niches for fish and aquatic invertebrates.
	Riparian zone management	Targeted planting of trees to locally increase tree cover and provide a source of LWD.	Increased shelter and shading for fish, invertebrates, mammals and birds.
	Riparian zone management	Targeted planting of marginal and aquatic vegetation to promote stabilisation of developing berms.	Increased morphological diversity, creation of in-channel habitat niches for fish and aquatic invertebrates.
	Riparian zone management	Establish riparian buffer strips in areas where the river is recovering to aid in channel stabilisation and the development of more diverse vegetation communities.	Increased morphological diversity (after recovery), increased shelter and shading for fish, invertebrates, mammals and birds.
Conserve and enhance	**Create floodplain wetlands**	Targeted management of existing wetland areas to improve habitat diversity. There may be potential to create new floodplain scrapes to help connect these areas with the river channel more effectively.	Improved habitat quality for wetland plants, invertebrates, mammals and birds.

Constraints

- Constraints related to current land use.
- Potential for woody material to block the bridge at Lag Lane (although this is limited due to the size of the bridge).


477100
N
Targeted introduction of coarse bed material in overdeepened reaches of the management unit
Downstream Limit
Targeted planting of marginal and aquatic vegetation
Targeted bank enhancement to create a more varied profile in uniform bank sections
Install LWD in the river channel
Targeted planting of trees
Establish riparian buffer strips
Targeted management of existing wetland areas to improve habitat diversity
Upstream Limit
316900
0 37.5 75 150 Metres
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Wyford
Brentingby
River
ELTON
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Legend
Targeted management of existing wetland areas
Bed raising
Bank enhancement
Establish riparian buffer strips
Targeted planting of marginal and aquatic vegetation
Install large woody debris
Targeted planting of trees
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Co-ordinate system: British National Grid
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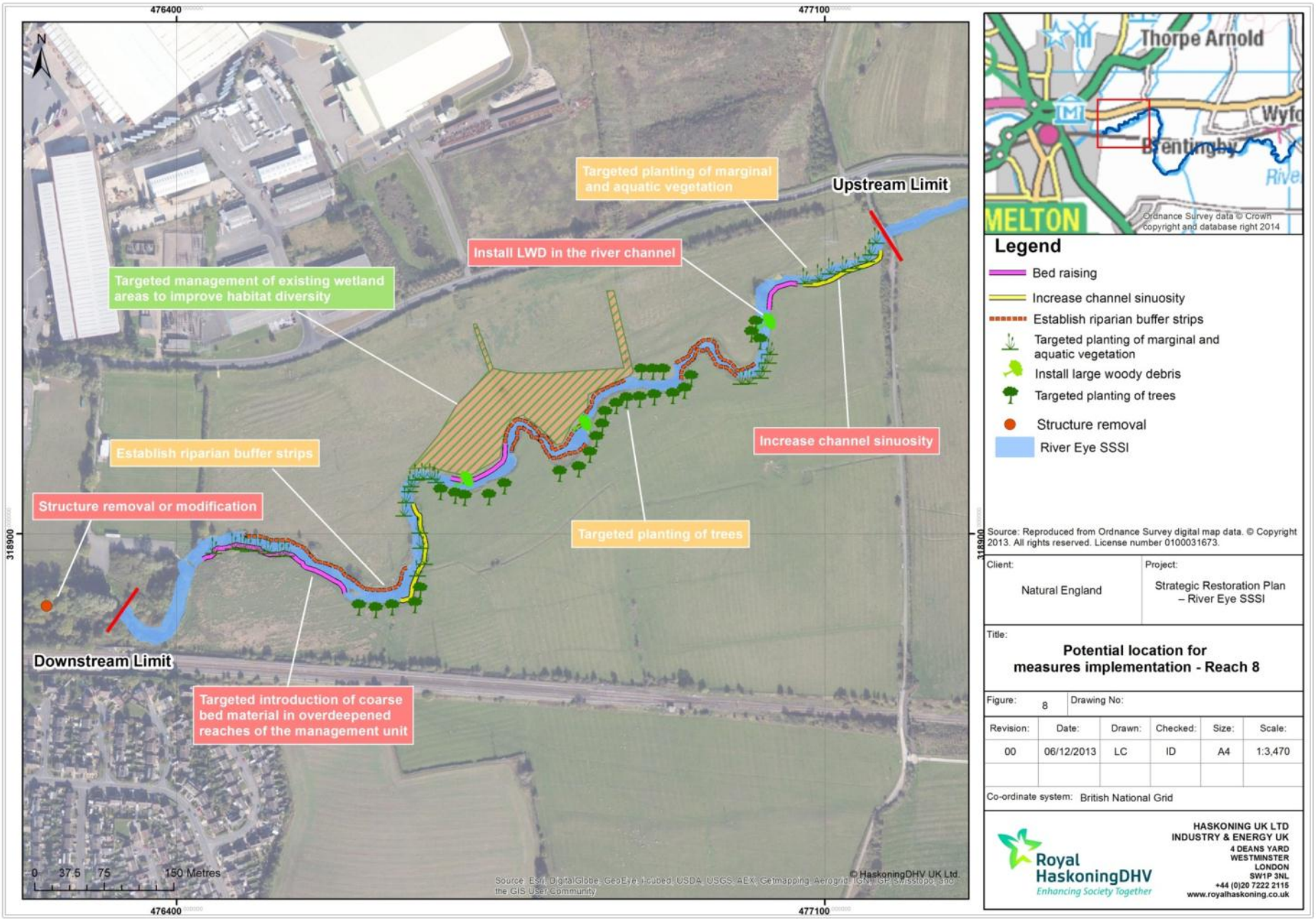
MANAGEMENT REACH 8 SSSI UNIT: 6			
Required level of intervention	**Restore**		
Key issues (see **Section 3** for unfavourable condition descriptions)			
• Impoundment • Siltation • Lack of morphological diversity			
Management Reach overview			
• Impoundment associated with in-channel structures downstream of the SSSI limits dominates this reach. • Widespread deposition of fine sediments is associated with low flow velocities and extensive enlargement of the channel.			
Solutions (see **Section 4** for further details)			
Restore	**Structure removal**	Removal or modification: Removal of Thorpe Weir and creation of new channel to link the River Eye with the River Wreake. Diversion of Thorpe Brook to provide water to the abstraction point. Install new weir and pumping station. Note that a solution has already been developed by JBA (2013). Modification of Thorpe Weir by lowering the crest height by 400mm. Note that a solution has already been developed by JBA (2013).	Naturalisation of flow and sediment regime, reduced siltation, increased flow energy, improved in-channel habitats for macrophytes, fish and invertebrates.
	Increase channel sinuosity	Create low level berms on the inside of meanders upstream of the weir. Note that a solution has already been developed by JBA (2013).	Increased morphological diversity, narrowing of river channel, greater range of marginal and in-channel habitat niches for macrophytes, fish and aquatic invertebrates.
	Gravel augmentation	Targeted introduction of coarse bed material in over-deepened reaches upstream of the weir complex. This should only be undertaken if lack of coarse sediment supply is identified as an issue following other channel enhancements and the strategic reviews of the weir and the sediment traps.	Increased morphological diversity, narrowing of river channel, greater range of marginal and in-channel habitat niches for macrophytes, fish and aquatic invertebrates.
Rehabilitate	**Install large woody material**	Install woody material in the river channel to increase flow and morphological diversity.	Increased flow and morphological diversity, creation of in-channel habitat niches for fish and aquatic invertebrates.
	Riparian zone management	Targeted planting of trees to locally increase tree cover and provide a source of material.	Increased shelter and shading for fish, invertebrates, mammals and birds.
	Riparian zone management	Targeted planting of marginal and aquatic vegetation to promote stabilisation of developing berms.	Increased morphological diversity, creation of in-channel habitat niches for fish and aquatic invertebrates.
	Riparian zone management	Establish riparian buffer strips in areas where the river is recovering to aid in channel stabilisation and the development of more diverse vegetation communities.	Increased morphological diversity (after recovery), increased shelter and shading for fish, invertebrates, mammals and birds.

Conserve and enhance	**Create floodplain wetlands**	Creation and enhancement of floodplain wetland habitats.	Improved habitat quality for wetland plants, invertebrates, mammals and birds.
Constraints			
• The in-channel structures just below the SSSI must be addressed first before any works are carried out within their zone of influence. See JBA 2013 for consideration of design options and preferred solution **(see Appendix A).** • Constraints related to current land use. • Flood risk cannot be increased as a result of channel modifications. • Water levels in Scalford Brook need to be retained to avoid compromising the water abstraction point.			


476400
477100
318900
N
Targeted planting of marginal and aquatic vegetation
Upstream Limit
Install LWD in the river channel
Targeted management of existing wetland areas to improve habitat diversity
Increase channel sinuosity
Establish riparian buffer strips
Structure removal or modification
Targeted planting of trees
Downstream Limit
Targeted introduction of coarse bed material in overdeepened reaches of the management unit
0 37.5 75 150 Metres
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Legend
Bed raising
Increase channel sinuosity
Establish riparian buffer strips
Targeted planting of marginal and aquatic vegetation
Install large woody debris
Targeted planting of trees
Structure removal
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Project: Strategic Restoration Plan – River Eye SSSI
Title: Potential location for measures implementation - Reach 8
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Co-ordinate system: British National Grid
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6. ACTION PLAN

Action planning

Further to identifying the reach-based solutions outlined in **Section 5** a plan for the implementation of the proposed solutions is needed. The following sections describe how the actions have been prioritised for delivery and explains what options are included within each reach action plan.

The solutions included in the action plan are those identified as being desirable to meet favourable condition for each reach. The solutions will need to be developed into the future through detailed consultation with key stakeholders (including landowners, land managers, riparian users, conservation bodies and recreational groups). As the River Eye SSSI restoration will be carried forward in partnerships over long time scales, the action plans will need to be updated and revised to take account of future consultation processes.

The implementation of actions described in this plan are dependent on funding and landowner agreement.

The purpose of the prioritisation process

The purpose of the prioritisation process was to identify actions that could be brought forward for delivery in the short or could be undertaken in the medium or long term. A cost banding (upper and lower cost estimate) is provided for each action to provide a cost range for delivering each plan. The timescales identified for the Phase 1, Phase 2 and Phase 3 actions have been set according to the requirements of the Water Framework Directive and the Biodiversity 2020 strategy, and are as follows:

Phase 1 actions: to be commenced by **2015.**
Phase 2 actions: to be delivered from **2015-2021.**
Phase 3 actions: to be delivered from **2021-2027.**

The Phase 1 actions have been sequenced to coincide with the next River Basin Management Planning cycles. Additional time has been provided for the completion of the Phase 2 and Phase 3 actions to allow for long term issues such as asset life to be considered.

Principles for prioritisation

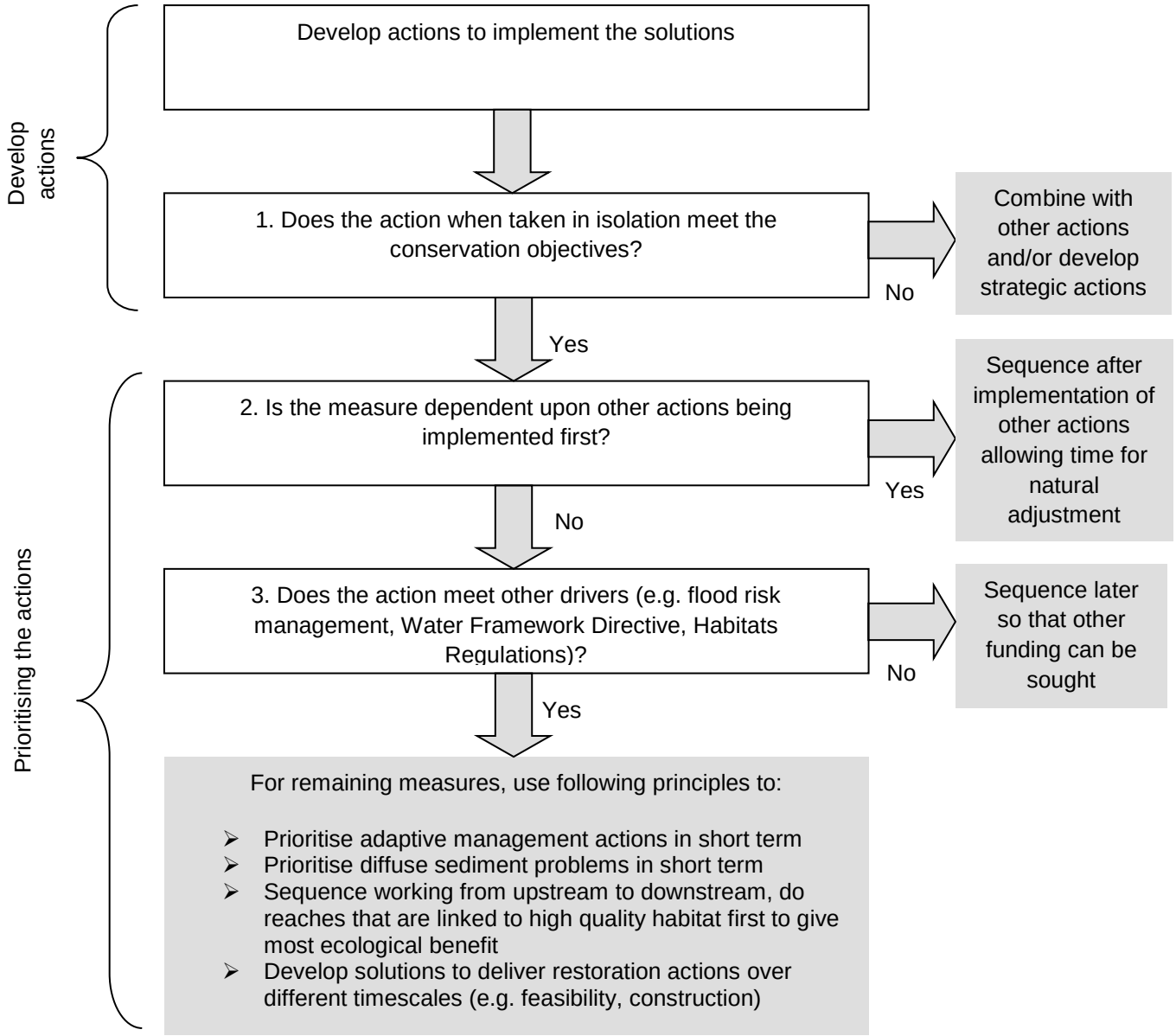
Natural England guidance suggests that the following principles should be used to help develop short, medium and long term plans:

>> Prioritise adaptive management actions in the short term.
>> Sequence working from upstream to downstream where possible.
>> Develop solutions to deliver restoration actions over different timescales (e.g. feasibililty, construction).

With reference to the last of these points, in some circumstances it will be important to investigate the feasibility of a solution prior to implementation and the first action will therefore be to undertake a feasibility study. Feasibility studies, could be potentially time consuming, and it is therefore important that they are undertaken in the short term to help identify later actions. Feasibility studies would normally address three key questions:

1. Will the solution successfully deliver the required objectives?
2. What are the potential constraints and benefits for factors such as biology, morphology, water quality, land use, flood risk, fisheries, recreation, and heritage?
3. Is the solution sustainable (this takes into account the function of the river for both wildlife and those who use the river now and into the future)?
4. Is there a funding mechanism available?

The overall approach is summarised in the flow chart overleaf.



Estimate costs to allow forward planning for funding

Table 6.1 outlines the breakdown of activities at each phase of the strategic restoration plan with respect to each management reach. More information is provided in the subsequent tables for short, medium and long term actions. Approximate cost estimates (including a lower and upper boundary) have been provided for each action. These costs are aggregated to provide total costs for each reach, and summed to provide an estimate of likely total expenditure over short, medium and long timescales.

In addition, an estimate of the potential proportion of funding which can be apportioned to different funding streams has also been made. These estimates are presented in **Table 6.2.** The works on the ground will be implemented in partnership between Natural England, the Environment Agency, the WFD Catchment Host (Trent Rivers Trust) and other local stakeholders. Suggestions for the most likely lead delivery partners are included in the tables.
More information is provided in **Section 7.**

All cost estimates are based on a reach costs database that was developed for the Environment Agency by Royal HaskoningDHV as part of their Long Term Investment Strategy Improvements Project. Note that the cost of any land loss land loss associated with chnannel change has not been included, however this is unlikely to be a major consideration on the River Eye.

Table 6.1: Breakdown of Phase activities

Phase	*Corresponding SSSI Units*							
	1	*1, 2*	*2, 3*	*3, 4*	*4*	*4*	*5*	*6*
	Management Reach							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 to be commenced by **2015**	Identify need for bank enhancements	Identify need for bank enhancements	Retain large woody material	Identify need to increase channel sinuosity	Identify need for bank enhancements	Identify need for bank enhancements	Identify need for bank enhancements	Agree preferred option for structure removal or modification
	identify need for gravel augmentation	identify need for gravel augmentation	Riparian zone management: willow trees	identify need for gravel augmentation	Identify need to increase channel sinuosity	identify need for gravel augmentation	identify need for gravel augmentation	Riparian zone management: planting of trees, marginal and aquatic vegetation, and establish buffer strips
	Retain large woody material	Riparian zone management: change management regime, tree planting and willow tree management	Continued management	Retain large woody material	Riparian zone management: tree planting	Riparian zone management: grassland planting	Riparian zone management: planting of trees, marginal and aquatic vegetation, and establish buffer strips	
	Riparian zone management: willow trees			Review operation of sediment trap		Retain large woody material	Investigate potential to create floodplain wetlands	
	Review operation of sediment trap					Review operation of flood alleviation structures at Brentingby Junction		
	Review impacts of Stapleford Weir							

Phase	*Corresponding SSSI Units*							
	1	*1, 2*	*2, 3*	*3, 4*	*4*	*4*	*5*	*6*
	Management Reach							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
2 to be delivered from **2015-2021**	Bank enhancements	Bank enhancements		Increase channel sinuosity	Bank enhancements	Bank enhancements	Bank enhancements	Structure removal or modification
	Gravel augmentation	Gravel augmentation		Gravel augmentation	Increase channel sinuosity	Gravel augmentation	Gravel augmentation	Identify need to increase channel sinuosity
	If necessary, alter operation of sediment trap	Install large woody material		If necessary, alter operation of sediment trap	Install large woody material	If necessary, alter operation of flood alleviation structures at Brentingby Junction	Install large woody material	Identify need for gravel augmentation
	If necessary, alter impacts of Stapleford Weir						Create floodplain wetlands	Identify need to install large woody material
								Identify potential to create floodplain wetlands
3 to be delivered from **2021-2027**								Increase channel sinuosity
								Gravel augmentation
								Install large woody material
								Create floodplain wetlands

Key	**Conserve and enhance**	**Rehabilitate**	**Restore**	**Strategic review**

Short Term Actions

Category	Action	Details	Potential Lead Delivery Partner	Cost	
				Minimum	Maximum
Management Reach 1					
Restore	Identify need for bank enhancements	Agree scope for bank re-profiling in this reach, produce detailed designs.	Catchment Hosts/EA	£5000	£10000
Restore	identify need for gravel augmentation	Agree scope for gravel augmentation and produce detailed designs of riffles, medial bars and lateral bars. This should be combined with designs for bank reprofiling.	Catchment Hosts/EA	£5000	£10000
Rehabilitate	Retain large woody material	Ensure that naturally-sourced LWD is retained in the river channel.	Catchment Hosts/EA	£613	£1225
Rehabilitate	Riparian zone management: willow trees	Improve management of individual willow trees at the downstream end of the reach, through delimbing or complete removal, complete removal must be off sent by introducing dead woody material and new bankside tree planting (where appropriate).	Catchment Hosts/EA	£500	£1000
Strategic review	Review operation of sediment trap	Review operation of online sediment trap upstream of Ham Bridge to evaluate effectiveness in trapping fine sediment. Depending upon outcomes of review, removal of some material may be required.	Environment Agency, in conjunction with Natural England	£5000	£15000
Strategic review	Review operation of sediment trap	Review operation of online sediment trap upstream of Ham Bridge to evaluate its effectiveness at trapping coarse sediment. It if is found to be a significant limiting factor on downstream sediment supply, measures to improve conveyance of coarse sediment may be required.	Environment Agency, in conjunction with Natural England	£0 – *reviewed alongside previous action*	£0 – *reviewed alongside previous action*
Strategic review	Review operation of Stapleford Weir	Review operation of Stapleford Weir to evaluate its effectiveness at trapping coarse sediment.	Environment Agency	£5000	£15000
			Subtotal	**£21,113**	**£52,225**
Management Reach 2					
Restore	Identify need for bank enhancements	Agree scope for bank reprofiling in this reach, produce detailed designs and complete bank enhancement works.	Catchment Hosts/EA	£5000	£10000
Restore	identify need for gravel augmentation	Agree scope for gravel augmentation, produce detailed designs of riffles, medial bars and lateral bars and complete gravel augmentation. This should be combined with designs for bank reprofiling.	Catchment Hosts/EA	£5000	£10000
Rehabilitate	Riparian zone management: change management regime	Change riparian management regime by allowing localised access of grazing livestock to channel margins (e.g. through targeted removal of fencing, followed by reinstatement and natural recovery).	Natural England	£5670	£11340
Rehabilitate	Riparian zone management: tree planting	Targeted planting of trees to locally increase tree cover and provide a source of LWD.	Natural England	£700	£1400

Category	Action	Details	Potential Lead Delivery Partner	Cost	
				Minimum	Maximum
Rehabilitate	Riparian zone management: willow tree	Improve management of large willow tree on the north bank opposite Peg's Meadow, through delimbing or complete removal. As mitigation against complete removal new dead woody material should be placed in the channel along with new riparian tree planting.	Catchment Hosts/EA	£500	£1000
			Subtotal	**£16,870**	**£33,740**
Management Reach 3					
Rehabilitate	Retain large woody material	Ensure that naturally-sourced LWD is retained in the river channel to increase flow and morphological diversity. Existing trees could also be felled to provide an instant source of material.	Catchment Hosts/EA	£858	£1715
Rehabilitate	Riparian zone management: willow trees	Improve management of the large willow trees that are growing in the channel at the upstream end of the reach, through delimbing or complete removal. As mitigation against complete removal new dead woody material should be placed in the channel along with new riparian tree planting.	Catchment Hosts/EA	£500	£1000
Conserve and enhance	Continued management	Retain existing management regime to ensure that excessive livestock trampling does not impact upon the existing morphology and habitats.	EA	£1000	£5000
			Subtotal	**£2,358**	**£7,715**
Management Reach 4					
Restore	Identify need to increase channel sinuosity	Determine dimensions and preferred construction technique for deflectors or berms, and produce detailed designs and complete works on the ground.	Catchment Hosts/EA	£5000	£10000
Restore	identify need for gravel augmentation	Agree scope for gravel augmentation and produce detailed designs of riffles, medial bars and lateral bars and complete gravel augmentation work. This should be combined with designs for increased sinuosity in the channel.	Catchment Hosts/EA	£5000	£10000
Rehabilitate	Retain large woody material	Retain naturally-sourced LWD in the river channel to increase flow and morphological diversity in the downstream end of the Management Reach. Locally-sourced LWD could also be installed upstream.	Catchment Hosts/EA	£735	£1470
Strategic review	Review operation of sediment trap	Review operation of online sediment trap upstream to evaluate effectiveness in trapping coarse sediment.	Natural England and EA	£5000	£15000
			Subtotal	**£15,735**	**£36,470**
Management Reach 5					
Restore	Identify need for bank enhancements	Agree scope for bank reprofiling in this reach, produce detailed designs and bank enhancement work.	Catchment Hosts/EA	£5000	£10000
Restore	Identify need to increase channel sinuosity	Determine dimensions and preferred construction technique for deflectors or berms, and produce detailed designs and complete works on the ground. These should be combined with designs for bank reprofiling.	Catchment Hosts/EA	£5000	£10000

Category	Action	Details	Potential Lead Delivery Partner	Cost	
				Minimum	Maximum
Rehabilitate	Riparian zone management: tree planting	Targeted planting of trees to locally increase tree cover and provide a source of LWD.	Natural England	£320	£640
			Subtotal	**£10,320**	**£20,640**
Management Reach 6					
Restore	Identify need for bank enhancements	Agree scope for bank lowering in this reach, produce detailed designs and bank enhancement works.	Catchment Hosts/EA	£5000	£10000
Restore	identify need for gravel augmentation	Agree scope for gravel augmentation and produce detailed designs of riffles, medial bars and lateral bars and complete gravel augmentation. This should be combined with designs for bank lowering.	Catchment Hosts/EA	£5000	£10000
Rehabilitate	Riparian zone management: grassland planting	Targeted planting of MG4 grassland species to increase richness of riparian habitats and support favourable condition assessment for "Habitat structure".	Natural England	£3000	£6000
Rehabilitate	Retain large woody material	Retain naturally-sourced LWD in the river channel to increase flow and morphological diversity in the upstream reach of the Management Reach. Existing trees could also be felled to provide an instant source of material.	Catchment Hosts/EA	£490	£980
Strategic review	Review operation of Flood alleviation structures at Brentingby Junction	Review of the operation of the under shot gates at the Brentingby junction and associated flood storage area. Operational regime may be adapted to promote the establishment of MG4 grassland upstream of the FAS structures and embankment.	Environment Agency to lead but in conjunction with Natural England	£5000	£10000
			Subtotal	**£18,490**	**£36,980**
Management Reach 7					
Restore	Identify need for bank enhancements	Agree scope for bank lowering in this reach, produce detailed designs and bank enhancement works.	Catchment Hosts/EA	£5000	£10000
Restore	identify need for gravel augmentation	Agree scope for gravel augmentation and produce detailed designs of riffles, medial bars and lateral bars and complete gravel augmentation. This should be combined with designs for bank lowering.	Catchment Hosts/EA	£5000	£10000
Rehabilitate	Install large woody material	Agree scope for installation of LWD, and produce detailed designs for placement. This should be combined with designs for bank lowering.	Catchment Hosts/EA	£1000	£2000
Rehabilitate	Riparian zone management: tree planting	Targeted planting of trees to locally increase tree cover and provide a source of LWD.	Natural England	£800	£1600
Rehabilitate	Riparian zone management: marginal and aquatic vegetation planting	Targeted planting of marginal and aquatic vegetation to promote stabilisation of developing berms.	Natural England	£1240	£2480
Rehabilitate	Riparian zone management: establish buffer strips	Establish riparian buffer strips in areas where the river is recovering to aid in channel stabilisation and the development of more diverse vegetation communities.	Natural England	£915	£1830

Category	Action	Details	Potential Lead Delivery Partner	Cost	
				Minimum	Maximum
Conserve and enhance	Investigate potential to create floodplain wetlands	Investigate the potential of targeted management of existing wetland areas to improve habitat diversity. There may be potential to create new floodplain scrapes to help connect these areas with the river channel more effectively.	Natural England	£1000	£5000
			Subtotal	**£14,955**	**£32,910**
Management Reach 8					
Restore	Agree preferred option for structure removal or modification	Finalise consultation on the preferred option to reduce impoundment. Produce detailed designs for the new channel or weir lowering and any associated infrastructure. These designs should incorporate measures to increase channel sinuosity, raise bed levels and install LWD.	EA	£30000	£50000
Rehabilitate	Riparian zone management: tree planting	Targeted planting of trees to locally increase tree cover and provide a source of LWD.	Natural England	£1760	£3520
Rehabilitate	Riparian zone management: marginal and aquatic vegetation planting	Targeted planting of marginal and aquatic vegetation to promote stabilisation of developing berms.	Natural England	£1100	£2200
Rehabilitate	Riparian zone management: establish buffer strips	Establish riparian buffer strips in areas where the river is recovering to aid in channel stabilisation and the development of more diverse vegetation communities.	Natural England	£1125	£2250
			Subtotal	**£33,985**	**£57,970**
			Grand total	**£133,826**	**£278,650**

Medium Term Actions

Category	Action	Details	Potential Lead Delivery Partner	Cost	
				Minimum	Maximum
Management Reach 1					
Restore	Bank enhancements	Targeted bank reprofiling to create a more varied profile in uniform bank sections, including the insertion of bank material into the river channel to reduce low flow capacity. This should not take place adjacent to the vegetated islands, and the small riffle at the downstream end of the Management Reach.	Catchment Hosts/EA	£26565	£53130
Restore	Gravel augmentation	Targeted introduction of coarse bed material in over deepened reaches of the management reach. Introduced material should take the form of lateral bars on the inside of meander bends, or riffles in straighter sections.	Catchment Hosts/EA	£68250	£136500
Strategic review	If necessary, alter operation of sediment trap	Following the results of the Phase 1 review, alterations to the sediment trap may be recommended.	Environment Agency, in conjunction with Natural England	*Costs of this action is dependent upon the results of the Phase 1 reviews*	
Strategic review	If necessary, alter impacts of Stapleford Weir	Following the results of the Phase 1 review, alterations to the Stapleford Weir may be recommended.	Environment Agency	*Costs of this action is dependent upon the results of the Phase 1 reviews*	
			Subtotal	**£94,815**	**£189,630**
Management Reach 2					
Restore	Bank enhancements	Targeted bank reprofiling to create a more varied profile in uniform bank sections. This should include the insertion of bank material into the river channel to reduce low flow capacity.	Catchment Hosts/EA	£67375	£134750
Restore	Gravel augmentation	Targeted introduction of coarse bed material in over deepened reaches of the management reach. Introduced material should take the form of lateral bars on the inside of meander bends, or riffles in straighter sections.	Catchment Hosts/EA	£106750	£213500
Rehabilitate	Install large woody material	Install LWD in the river channel in uniform reaches of the Management Reach.	Catchment Hosts/EA	£612.50	£1225
			Subtotal	**£174,738**	**£349,475**
Management Reach 4					
Restore	Increase channel sinuosity	Install deflectors and/or create low flow berms to increase sinuosity within the current bank line.	Catchment Hosts/EA	£52500	£105000

Category	Action	Details	Potential Lead Delivery Partner	Cost	
				Minimum	Maximum
Restore	Gravel augmentation	Targeted introduction of coarse bed material in over-deepened reaches of the management reach. Introduced material should take the form of lateral bars on the inside of meander bends, or riffles in straighter sections.	Catchment Hosts/EA	£6493	£12985
Strategic review	If necessary, alter operation of sediment trap	Following the results of the Phase 1 review, alterations to the sediment trap may be recommended.	Natural England and EA	*Costs of this action is dependent upon the results of the Phase 1 reviews*	
			Subtotal	**£58,993**	**£117,985**
Management Reach 5					
Restore	Bank enhancements	Targeted bank reprofiling to create a more varied profile in uniform bank sections. This should include the insertion of bank material into the river channel to reduce low flow capacity.	Catchment Hosts/EA	£2310	£4620
Restore	Increase channel sinuosity	Install deflectors and/or create low flow berms to increase sinuosity within the current bank line in the downstream half of the Management Reach.	Catchment Hosts/EA	£9000	£18000
Rehabilitate	Install large woody material	Install LWD in the river channel in the downstream half of the Management Reach.	Catchment Hosts/EA	£245	£490
			Subtotal	**£11,555**	**£23,110**
Management Reach 6					
Restore	Bank enhancements	Targeted bank lowering to improve floodplain connectivity in the downstream reach of the Management Reach.	Catchment Hosts/EA	£8085	£16170
Restore	Gravel augmentation	Targeted introduction of coarse bed material in over-deepened reaches of the management reach. Introduced material should take the form of lateral bars on the inside of meander bends, or riffles in straighter sections.	Catchment Hosts/EA	£4900	£9800
Strategic review	If necessary, alter operation of flood alleviation structures at Brentingby Junction	Following the results of the Phase 1 review, alterations to the flood alleviation structures at Brentingby Junction may be recommended.	Environment Agency to lead but in conjunction with Natural England	*Costs of this action is dependent upon the results of the Phase 1 reviews*	
			Subtotal	**£12,985**	**£25,970**
Management Reach 7					
Restore	Bank enhancements	Targeted bank lowering to improve floodplain connectivity throughout the Management Reach.	Catchment Hosts/EA	£11550	£23100

Category	Action	Details	Potential Lead Delivery Partner	Cost	
				Minimum	Maximum
Restore	Gravel augmentation	Targeted introduction of coarse bed material in over deepened reaches of the management reach. Introduced material should take the form of lateral bars on the inside of meander bends, or riffles in straighter sections.	Catchment Hosts/EA	£5800	£11760
Rehabilitate	Install large woody material	Install LWD in the river channel to increase flow and morphological diversity.	Catchment Hosts/EA	£490	£980
Conserve and enhance	Create floodplain wetlands	Targeted management of existing wetland areas to improve habitat diversity. There may be potential to create new floodplain scrapes to help connect these areas with the river channel more effectively.	Natural England	£1200	£2400
			Subtotal	**£19,040**	**£38,240**
Management Reach 8					
Restore	Structure removal or modification	Removal of Thorpe Weir and creation of new channel to link the River Eye with the River Wreake. Diversion of Thorpe Brook to provide water to MARS abstraction point. Install new weir (including fish pass) and pumping station so that water can be abstracted from Thorpe and Scalford Brooks. Or lowering of the Thorpe Weir.	Natural England and EA but dependent on decided option.	£773000	£1043000
Restore	Identify need to increase channel sinuosity	Once the control structure has been removed or modified, review the future need to increase channel sinuosity by creating berms on the inside of the existing meanders.	Catchment Hosts/EA	£2500	£5000
Restore	Identify need for gravel augmentation	Once the control structure has been removed or modified, review the future need to decrease channel depth through gravel installation.	Catchment Hosts/EA	£5000	£10000
Rehabilitate	Identify need to install large woody material	Once the control structure has been removed or modified, review the future need to increase flow and habitat diversity through the installation of LWD.	Catchment Hosts/EA	£1000	£5000
Conserve and enhance	Investigate potential to create floodplain wetlands	Once the control structure has been removed, investigate the potential to create new floodplain wetland habitats.	Natural England	£1000	£5000
			Subtotal	**£782,500**	**£1,068,000**
			Grand total	**£1,154,626**	**£1,812,410**

Long Term Actions

Category	Action	Details	Potential Lead Delivery Partner	Cost	
				Minimum	Maximum
Management Reach 8					
Restore	Increase channel sinuosity	Create low level berms on the inside of meanders upstream of the weir.	Catchment Hosts/EA	£30000	£60000
Restore	Gravel augmentation	Targeted introduction of coarse bed material in over-deepened reaches upstream of the weir complex. Introduced material should take the form of lateral bars on the inside of meander bends, or riffles in straighter sections.	Catchment Hosts/EA	£7473	£14945
Rehabilitate	Install large woody material	Install LWD in the river channel to increase flow and morphological diversity.	Catchment Hosts/EA	£367.50	£735
Conserve and enhance	Create floodplain wetlands	Creation and enhancement of floodplain wetland habitats.	Natural England	£1300	£2600
			Subtotal	**£39,141**	**£78,280**
			Grand Total	**£39,141**	**£78,280**

Table 6.2: Proportion of costs assigned to different delviery mechanisms (see Section 7 for additional information)

The actions and potential leads are largely assigned broadly by action based on the nature of the management. The table shows provisionally assigned costs. This does not mean that the funds are available or secured currently. The rate of delivery will largely depend on funding availability, landowner willingness and availability of staff and financial resources.

Management Reach	Potential Lead delivery partner	Short term		Medium term		Long term		Total (£)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
1	Environment Agency	£5,000	£15,000					5000	15000
	Environment Agency, in conjunction with Natural England	£5,000	£15,000					5000	15000
	EA / Catchment Hosts	£11,113	£22,225	£94,815	£189,630			105928	211855
2	Natural England	£6,370	£12,740					6370	12740
	EA / Catchment Hosts	£10,500	£21,000	£174,738	£349,475			185238	370475
3	Environment Agency	£1,000	£5,000					1000	5000
	EA / Catchment Hosts	£1,358	£2,715					1358	2715
4	Natural England	£2,500	£7,500					2500	7500
	Environment Agency	£2,500	£7,500					2500	7500
	EA / Catchment Hosts	£10,735	£21,470	£58,993	£117,985			69728	139455
5	Natural England	£320	£640					320	640
	EA / Catchment Hosts	£10,000	£20,000	£11,555	£23,110			21555	43110
6	Natural England	£3,000	£6,000					3000	6000
	EA / Catchment Hosts	£10,490	£20,980	£12,985	£25,970			23475	46950
	Environment Agency to lead but in conjunction with Natural England	£5,000	£10,000					5000	10000
7	Natural England	£3,955	£10,910	£1,200	£2,400			5155	13310
	EA / Catchment Hosts	£11,000	£22,000	£17,840	£35,840			28840	57840
8	Natural England	£3,985	£7,970	£1,000	£5,000	£1,300	£2,600	6285	15570
	Environment Agency	£30,000	£50,000					30000	50000
	EA / Catchment Hosts			£8,500	£20,000	£37,841	£75,680	46341	95680
	Natural England and EA but dependent on decided option			£773,000	£1,043,000			773000	1043000
Total		***£133,826***	***£278,650***	***£1,154,626***	***£1,812,410***	***£39,141***	***£78,280***	***£1,327,593***	***£2,169,340***

7. DELIVERING THE PLAN

Working with landowners and land managers

Approach to consultation

Natural England and the Environment Agency recognise that it is vitally important to work closely with landowners, land occupiers and other local stakeholders in order to achieve their restoration aims for the River Eye SSSI.

This Strategic Restoration Plan is intended as the first step towards engaging with landowners, land occupiers and other relevant stakeholders, by giving them an opportunity to comment on the outline restoration actions that have been proposed for each SSSI Management Unit. Their comments will be fully taken into consideration when restoration actions are developed further, ensuring that the needs of local stakeholders are balanced with requirements to achieve favourable condition for the River Eye SSSI and deliver the objectives of the WFD.

This Strategic Restoration Plan contains outline descriptions of the proposed restoration actions and an initial estimate of their likely implementation cost. This reflects the strategic nature of the report and the fact that the final details of each action will need to be developed in close consultation with the landowner and/or occupier. Further investigations will therefore be required to fully explore the feasibility of the proposed actions, develop designs that are supported by all stakeholders, and identify fully detailed implementation costs.

Comments from stakeholders

Draft copies of both the River Eye SSSI Technical Report and the River Eye SSSI Strategic Restoration Plan were issued to landowners/land managers in December 2013 to request feedback and comments on the proposals. Natural England held a series of face to face meetings with landowners and land managers on site in January and February 2014.

In addition to the landowners, copies of both draft reports were also issued for comment to other interested stakeholders including:

- National Farmers Union
- Countryside Landowners Association
- Ashfordby and Melton Society of Anglers
- River Eye Specialist Group (Angling Club)
- Leicestershire County Council
- Melton Borough Council
- Trent Rivers Trust (in their capacity as catchment partnership leads)
- Network Rail
- Severn Trent Water
- Private industry

Although stakeholders were supportive of the aims of the plan, a range of valid concerns were raised during the meetings. These are summarised below, alongside our response to these concerns.

Will channel narrowing result in increased flood frequency?
Natural England and the Environment Agency do not intend to increase flood risk along the River Eye. The channel bank reprofiling and cross section change options will be designed to reduce the low flow capacity of the channel, by focussing flows into a narrower, deeper channel. However, the overall capacity of the channel will remain unchanged, and it will still be able to convey the same high flows that it currently does. Where the aim of restoration is to improve the connection between the river and floodplain (with land manager agreement), agri-environment scheme options may be used to address potential land management changes that may result.

Will the reprofiled banks be susceptible to erosion, leading to loss of land?
The proposed restoration options are not intended to cause widespread channel adjustment and instability although newly reprofiled banks may initially need to be protected from river flows and rainfall to prevent excessive erosion. The level of bank protection required is dependent upon the properties of the existing bank material, and

the energy that the new banks will be exposed to. If excessive erosion of reprofiled banks is an issue at specific locations, the most appropriate bank protection measures may be considered on a site specific basis when new bank profiles are designed. However, these are likely to consist of “green engineering” techniques such as coir pallets or brushwood faggots to protect the bank toe from erosion, and planted geotextiles and reinforced turf to protect bare ground.

Will the installation of woody material Increase flood risk and promote bank erosion?
The impact of woody material on flow conveyance and bank erosion depends upon factors such as the size of the material, the proportion of the channel that is encroached upon, and the angle at which the wood is installed. In the River Eye, the woody material is intended to locally increase habitat diversity rather than promote widespread changes in geomorphology. Woody material installations will be carefully designed to ensure that they are well secured to the river bank and do not cause excessive channel instability.

Will it be possible to manage existing trees that currently grow over parts of the channel?
Natural England acknowledges that, in some cases, that unless large trees such as willows are correctly managed, they can cause impounded water levels and geomorphological instability. Management options for several large willow trees have therefore been included in the restoration plan. Agreement from Natural England is required before any additional tree management can take place and willow management would be undertaken in tandem with other restoration options. To mitigate against the removal of some in river willows large dead woody material would be installed.

The construction of the proposed river restoration options could make it very difficult to continue farming for the duration of the works. Will the landowner have the opportunity to input into planning construction works?
Natural England and the Environment Agency understand that the riparian zone and floodplain are used for agriculture. While some disruption while river and bank works are undertaken is inevitable, Natural England and the Environment Agency will work with landowners and land managers and experienced river restoration contractors to develop a phased plan for implementing the options that will minimise the disruption caused by the works. Key issues that will be resolved in consultation with landowners include access routes, the timing of the works in particular locations, measures to minimise the working area and reduce the potential for detrimental impacts on existing land uses.

Construction is likely to result in areas of bare ground, and may damage the existing surface of some parts of the floodplain. Will any damage be reinstated?
Any restoration works will be done by experienced river restoration contractors who have a strong track record of undertaking construction works in an environmentally sensitive way. Natural England and the Environment Agency recognises the importance of minimising damage to existing land and reinstating any unavoidable damage to the land surface. Landowners and land managers will be consulted when the reinstatement requirements that are specified in future contracts are developed.

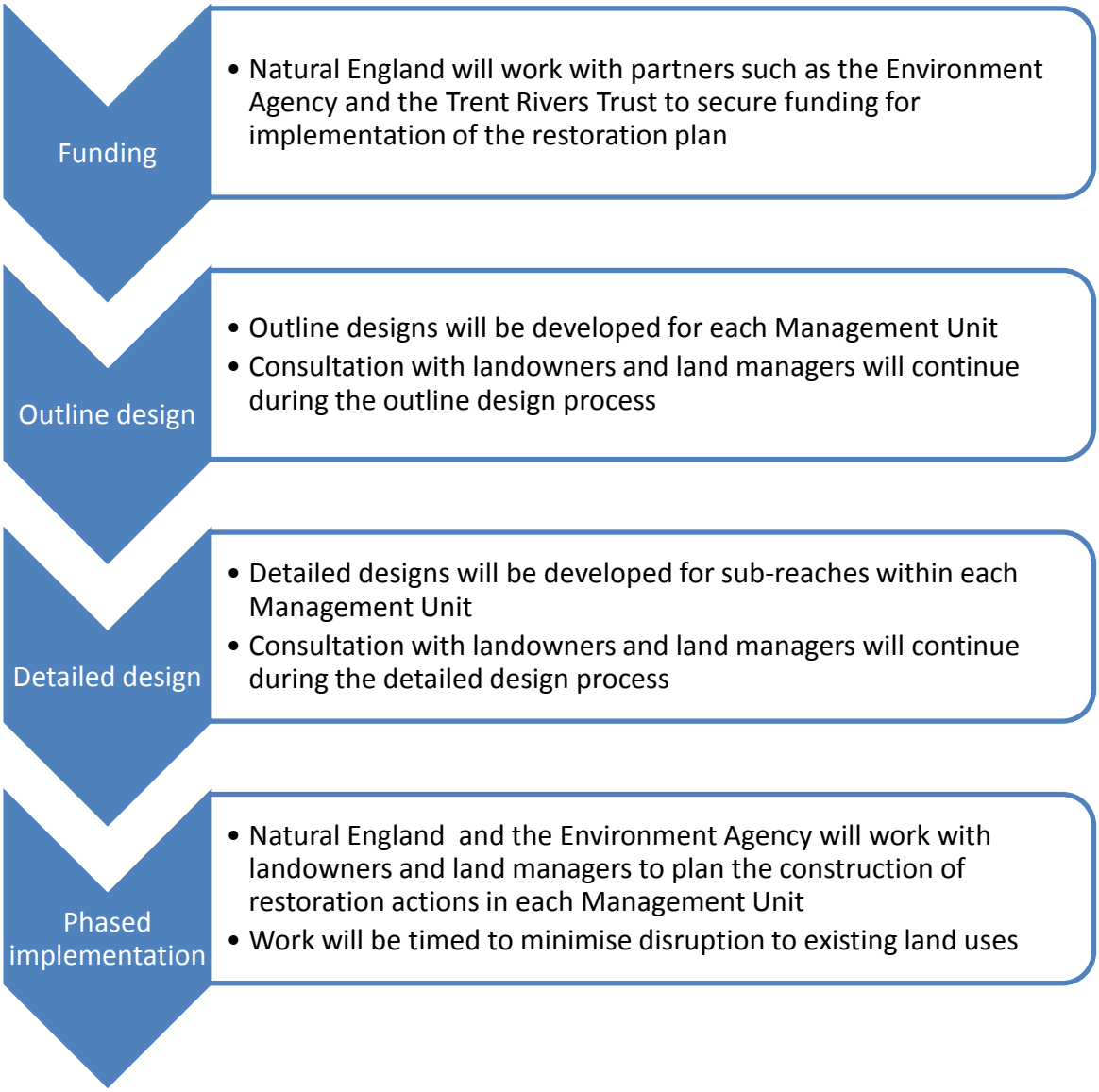
Some of the proposed actions are likely to require the use of reinforcing materials. Will the landowner have any input to this process?
Natural England and the Environment Agency will work closely with landowners and land managers to ensure that their views are considered during the design process. Every effort will be made to ensure that agreement can be reached on the materials used in the finished restoration actions.

Will restoration work take place in all the areas marked in the plan, or will the landowner have the opportunity to input into the final placing of restoration actions?
The restoration plan has identified the potential actions that are required to restore the River Eye SSSI, and the locations that the need to be implemented in. However, the plan has been produced at a high level and should not be interpreted as a design. Additional geomorphological and ecological surveys and consultation with landowners and land managers will be required to inform and refine site specific detailed designs that will be used to guide construction.

What are the next steps?

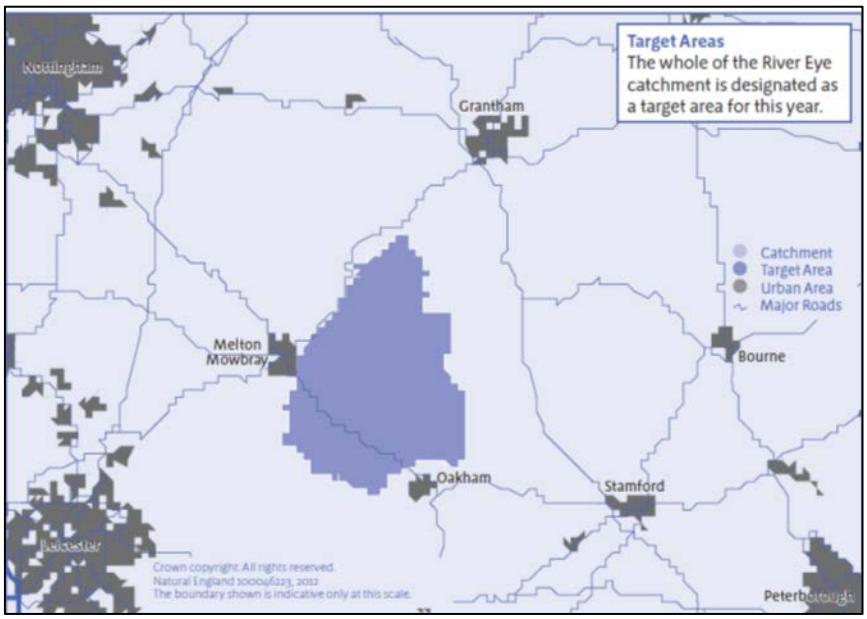
This restoration plan has identified at a high level the actions that are required to achieve the required standards for the SSSI, and has started the process of consulting with landowners, land managers and other key stakeholders. This is the very first stage in restoring the River Eye SSSI, and more work is required to secure funding and develop designs that can be implemented on the ground (**Figure 7.1**)**.** Natural England and the Environment Agency will work closely with stakeholders to ensure that their views are considered in each stage of the restoration process.

Figure 7.1: Conceptual diagram of the next steps in the restoraion of the River Eye SSSI



Potential funding sources and delivery mechanisms

Environmental Stewardship Schemes



Natural England currently works with landowners through Environmental Stewardship (ES), an agri-environmental scheme which aims, among other objectives, to help conserve wildlife. Environmental Stewardship has four elements:

- Entry Level Stewardship (ELS) provides a straightforward approach to supporting the good stewardship of the countryside through simple and effective land management that goes beyond the Single Payment Scheme requirement to maintain land in good agricultural and environmental condition. It is open to all farmers and landowners.
- Organic Entry Level Stewardship (OELS) is the organic strand of ELS. It is geared to organic and organic/conventional mixed farming systems and is open to all farmers not receiving Organic Farming Scheme aid.
- Upland Entry Level Stewardship (Uplands ELS) was launched in February 2010 to support hill farmers with payments for environmental management. It is open to all farmers with land in Severely Disadvantaged Areas, regardless of the size of the holding.
- Higher Level Stewardship (HLS) concentrates on the more complex types of management where land managers need advice and support and where agreements will be tailored to local circumstances. HLS applications will assessed against specific local targets and agreements will be offered where they meet these targets and represent good value for money.

The current Rural Development Programme for England (RDPE) 2007-2013 ended on 31 December 2013. Work is being carried out nationally on the design of the new RDPE. The current environmental stewardship schemes is due to finish at the end of this year. In 2014, about £26m will be available for HLS agreements for eligible expiring 'Classic' agreements, for SSSIs and other high priority cases, and to meet Water Framework Directive objectives.

New Common Agricultural Policy Schemes

Since 2011, the European Union has been negotiating a new Common Agricultural Policy (CAP), which will start in 2015. Although there'll be less money overall under the new CAP schemes, they will still benefit the rural economy in England by over £15 billion.

Most of this funding will be paid through the new Basic Payment Scheme (BPS) – including the greening payment and the young farmer payment – which will replace the Single Payment Scheme (SPS).

There will also be a new Rural Development Programme, which will invest at least £3.5 billion into environment and rural development schemes over the next 7 years. The Programme will support:

- the environment
- the farming and forestry sectors
- businesses and communities in rural areas

For the latest update on progress with the new RDPE see https://www.gov.uk/government/collections/common-agricultural-policy-reform#guidance-about-the-new-cap-schemes

Catchment Sensitive Farming (CSF)

CSF is land management that keeps diffuse emissions of pollutants to levels consistent with the ecological sensitivity and uses of rivers, groundwaters and other aquatic habitats, both in the immediate catchment and further downstream. It includes managing appropriately the use of fertilisers, manures and pesticides; promoting good soil structure and rain infiltration to avoid run-off and erosion; protecting watercourses from faecal contamination, sedimentation and pesticides; reducing stocking density; managing stock on farms to avoid compaction and poaching of land; and separating clean and dirty water on farms.

The CSF initiative for the River Eye SSSI aims to reduce nitrate, phosphorous and silt input into the river in order to improve water quality and reduce the risk of flooding. This is sought to be achieved by changing agricultural practices and using silt traps in the river. Natural England and the Environment Agency have worked alongside Lancaster University to design and trial a total of five silt traps in Leicestershire, with scope to incorporate this project into other environmental stewardship schemes if successful. The benefits achieved from this scheme will include:

- Improved environmental outcomes; such as reduced silt reaching the River Eye SSSI which will in turn reduce phosphate input into the river and help the river meet Water Framework Directive water quality targets;
- Improved efficiency; for example managing the silt input will help address diffuse pollution issues in future Catchment Management Plans; and
- Strengthening relationships; for example between Natural England, Environment Agency and local farmers.

Catchment Sensitive Farming will also be affected by the changes to the Common Agricultural Policy and new Rural Development Programme.

WFD implementation funding

In 2011, the Department for Food, Environment and Rural Affairs (Defra) launched a £110 million fund to help fund the implementation of the WFD. £92 million will be allocated between 2011 and 2014 to enhance water habitats, remove structures, improve fish passage, address geomorphological pressures and reduce the impacts of pollution on the water environment. The remaining £18 million was allocated to provide help to landowners to implement measures to address agricultural diffuse pollution under the CSF programme. Part of this funding was used by Defra to establish the Catchment Restoration Fund. This fund is administered by the Environment Agency, and is available for charitable organisations to apply for funding to improve the river environment and deliver WFD aims. However, this fund is now closed to new bids and has not yet been formally replaced.

Alternatively, it may be possible to fund the scheme-level implementation of the restoration plan through the Environment Agency's and Natural England's WFD Grant in Aid funding from the Treasury, although this funding currently is due to end in March 2015.

Environment Agency Flood Risk Management biodiversity outcome measures

The Environment Agency budgets are set annually for flood risk management capital expenditure and maintenance budgets. There is the potential to fund some restoration activities through these budgets where the objectives are in line with the Flood Risk Management strategy. Actions here could include altering or removing major impounding structures and unblocking blocked channels and removing obstructions to flow.

Natural England Conservation and Enhancement Scheme

Natural England's Conservation and Enhancement Scheme (CES) may be available to deliver improvement work for SSSIs in cases where other grant schemes are not available. The CES has an annual budget of up to £500,000, and can provide funds on five year agreements. Depending upon the degree of benefit a scheme will have on a SSSI, the CES can provide between 50% and 100% of required funding. 50% match funding is required for public bodies, and other Government grants are excluded from this total. Additional information can be found on the Natural England website
http://webarchive.nationalarchives.gov.uk/20140605090108/http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/funding/conservationandenhancementscheme.aspx

Trent Rivers Trust

The River Eye is located in the River Trent catchment. The Trent Rivers Trust is an environmental charity which aims to protect and improve the River Trent and all its tributaries, create diverse wetland habitats in the catchment, encourage the uptake of sustainable management and development practices, and engage the local population with the river and its ecosystems (http://www.trentriverstrust.org/site/pages/vision-and-aims). The Trent Rivers Trusts and its volunteers and associates are currently undertaking sediment management work in parts of the River Soar catchment (into which the River Eye eventually drains). With the likely provision of funding for WFD implementation to catchment bodies through the Environment Agency's Catchment Based Approach, it may be possible to engage the Trust more fully with the issues that affect the River Eye.

Further information sources

SSSIs and their management

Introduction to Sites of Special Scientific Interest
http://www.naturalengland.org.uk/ourwork/conservation/designatedareas/sssi/default.aspx

Biodiversity 2020
https://www.gov.uk/government/publications/biodiversity-2020-a-strategy-for-england-s-wildlife-and-ecosystem-services

River restoration and WFD implementation

EU RESTORE Healthy Catchments guidance
http://www.restorerivers.eu/RiverRestoration/Floodriskmanagement/HealthyCatchmentsmanagingforfloodriskWFD/tabid/3098/Default.aspx

River Restoration Centre Manual River Restoration of Techniques
http://www.therrc.co.uk/rrc_manual.php

Catchment Based Approach to WFD implementation
http://www.environment-agency.gov.uk/research/planning/131506.aspx

Humber River Basin Management Plan
http://www.environment-agency.gov.uk/research/planning/124803.aspx

Changing agricultural and land drainage management practices

Defra (2005) Controlling soil erosion: A manual for the assessment and management of agricultural land at risk of water erosion in lowland England
http://www.defra.gov.uk/erdp/pdfs/es/guidance/soilerosion-lowlandmanual.pdf

Association of Drainage Authorities and Natural England (2008) The Drainage Channel Biodiversity Manual: Integrating Wildlife and Flood Risk Management
http://naturalengland.etraderstores.com/NaturalEnglandShop/product.aspx?ProductID=e2dae3b7-f789-40e8-b0f6-8cf8a1637032

Other

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Natural England. 2011. Conservation objectives and definitions of favourable condition for designated features of interest – River Eye.

Mott, N. 2006. ‘Managing Woody Material in Rivers, Streams & Floodplains’. Staffordshire Wildlife Trust, UK, Printed by George Street Press, Stafford – Wildlife Trust Corporate Members.