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# Glossary

<table>
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<th>Terms</th>
<th>Meaning/Definition</th>
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<tr>
<td><strong>Condition</strong></td>
<td>The condition of the SSSI land in England is assessed by Natural England, using categories agreed across England, Scotland, Wales, and Northern Ireland through the Joint Nature Conservation Committee. There are six reportable condition categories: favourable; unfavourable recovering; unfavourable no change; unfavourable declining; part destroyed and destroyed.*</td>
</tr>
<tr>
<td><strong>Favourable</strong></td>
<td>Favourable condition means that the SSSI land is being adequately conserved and is meeting its ‘conservation objectives’, however, there is scope for the enhancement of these sites.*</td>
</tr>
<tr>
<td><strong>GEP</strong></td>
<td>Good Ecological Potential. Those surface waters which are identified as Heavily Modified Water Bodies and Artificial Water Bodies must achieve ‘good ecological potential’ (good potential is a recognition that changes to morphology may make good ecological status very difficult to meet). In the first cycle of river basin planning good potential may be defined in relation to the mitigation measures required to achieve it.</td>
</tr>
<tr>
<td><strong>GES</strong></td>
<td>Good Ecological Status. The objective for a surface water body to have biological, structural and chemical characteristics similar to those expected under nearly undisturbed conditions.</td>
</tr>
<tr>
<td><strong>RBMP</strong></td>
<td>River Basin Management Plan. For each River Basin District, the Water Framework Directive requires a River Basin Management Plan to be published. These are plans that set out the environmental objectives for all the water bodies within the River Basin District and how they will be achieved. The plans will be based upon a detailed analysis of the pressures on the water bodies and an assessment of their impacts. The plans must be reviewed and updated every six years.</td>
</tr>
<tr>
<td><strong>SSSI</strong></td>
<td>Site of Special Scientific Interest. An area of land notified under the Wildlife and Countryside Act 1981 by the appropriate nature conservation body as being of special interest by virtue of its flora and fauna, geological or physio geographical features.</td>
</tr>
<tr>
<td><strong>SSSI unit</strong></td>
<td>SSSI units are divisions of SSSIs used to record management and condition details. Units are the smallest areas for which Natural England gives a condition assessment. The size of units varies greatly depending on the types of management and the conservation interest.*</td>
</tr>
<tr>
<td><strong>STW</strong></td>
<td>Sewage Treatment Works.</td>
</tr>
<tr>
<td><strong>Water Body</strong></td>
<td>Water body. A manageable unit of surface water, being the whole (or part) of a stream, river or canal, lake or reservoir, transitional water (estuary) or stretch of coastal water. A ‘body of groundwater’ is a distinct volume of groundwater within an aquifer or aquifers.</td>
</tr>
<tr>
<td><strong>Unfavourable declining</strong></td>
<td>This means that the special interest of the SSSI unit is not being conserved and will not reach favourable condition unless there are changes to site management or external pressures. The site condition is becoming progressively worse.*</td>
</tr>
<tr>
<td><strong>Unfavourable no change</strong></td>
<td>This means the special interest of the SSSI unit is not being conserved and will not reach favourable condition unless there are changes to the site management or external pressures. The longer the SSSI unit remains in this poor condition, the more difficult it will be, in general, to achieve recovery.*</td>
</tr>
<tr>
<td><strong>Unfavourable recovering</strong></td>
<td>Unfavourable recovering condition is often known simply as ‘recovering’. SSSI units are not yet fully conserved but all the necessary management measures are in place. Provided that the recovery work is sustained, the SSSI will reach favourable condition in time.*</td>
</tr>
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Executive summary

The River Test and Itchen, and many of their tributaries, are designated as Sites of Special Scientific Interest (SSSIs) under the Wildlife and Countryside Act, 1981. The River Itchen is also deemed to be internationally important for its wildlife and habitats and is designated as a Special Area of Conservation (SAC) under the European Commission (EC) Habitats Directive.

Recent condition assessments undertaken by Natural England showed that the riverine units within both the SSSIs are in unfavourable condition. The key reasons cited for the unfavourable condition include historical modifications to the physical structure of the channels, banks and riparian zone. Over the last decade, many projects have sought to address the various causes of unfavourable physical habitat condition with some notable success, such as The Itchen Navigation Heritage Trail Project.

There are additional causes for the assessment of unfavourable condition on the Test and Itchen. Water quality on both the rivers has been affected by diffuse and point source pollution, including excess fine sediment and discharges from STWs and septic tanks. Invasive plants, invertebrates, and fish are also regarded as an issue in both catchments. The effects of climate change cause high water temperatures and extreme flows which are of increasing concern. These additional issues are being addressed by other initiatives.

The Wildlife and countryside Act 1981 (as amended by the CROW Act 2000) and the Water Framework Directive require that both the rivers are returned to favourable condition and good ecological status, respectively. For those rivers that have been identified as being in unfavourable condition Natural England has identified delivery partners (including the Environment Agency) to support in developing actions that could be undertaken to move the various SSSI units towards favourable condition.

The aim of this project is to appraise the geomorphological condition of the SSSI units within these rivers, identifying the condition of the rivers in relation to their 'natural' benchmark. From this, it was possible to identify the river restoration, rehabilitation and conservation/enhancement actions that could be put in place to restore the SSSI/SAC and bring the physical habitat into favourable condition. This includes the following specific objectives:

1. Determine the impacts of physical modifications on the geomorphology and ecology of the river
2. Provide an outline restoration plan for the river on a reach by reach basis
3. Identify potential delivery mechanisms to help achieve this

The focus of this restoration project is on ensuring the condition of habitats rather than the preservation of species directly. The principle being that, by restoring the habitats that are characteristic of a natural river of this type, the necessary characteristic flora and fauna will be able to re-establish.

The high level plan is intended to provide a framework for improvement of the physical form and ecological functioning of the SSSIs over the next 20–30 years. The actions identified herein on a reach by reach basis should be used as a guide for potential actions that can be adopted to improve the condition of the riverine SSSI. This does not necessarily involve actions that restore the channel back to its historic location on the floodplain. Each reach was considered on a case by case basis in the assessment. Other actions may also be also appropriate but the measures identified within this report are considered the primary actions necessary to improve the habitat.

This document is the technical report of the high level strategy, and underpins the accompanying management report.

An initial part of the development of the restoration plan was to review available information on both the SSSIs which included the basis of the designations, historical documents, plans as well as design and management reports. In addition, work already undertaken by Geodata (2010), which included fieldwork data and suggested management options, was reviewed and incorporated into the overall strategy.

Fieldwork undertaken as part of this project was conducted for the rest of the SSSIs where access could be granted. Overall the fieldwork included surveys of the main River Itchen, and various side channels, and the headwaters tributaries of the Arle and Candover Stream. For the Test the survey included the main River Test, and various side channels, as well as the River Dever and a small section of the River Anton.
Within the two river systems, a variety of different pressures were identified which affect the physical form and functioning of the channels and in turn the associated ecological functioning of these rivers. Principal pressures include:

**Riparian Zone**
- Modified by land use pressures leading to a reduction in tree cover in total, and a reduced area and width of riparian strip.
- Degradation of riparian buffer strip leading to a reduction in complexity of the riparian corridor.

**Banks**
- Uniform banks due to historic re-sectioning of the channel, leading to near vertical sides in places and an abrupt transition between marginal and bank side habitats. Limited complexity of marginal strip due to often intensive marginal vegetation management practices.
- Heavily poached banks in places leading to accelerated fine sediment input into the river. This is related to livestock pressure as well as humans, dog and swan access.

**Bed**
- Reduction in habitat diversity due to dredging, weed cutting practices and removal of coarse woody debris.
- Over-widening leading to significant lengths of channel which are prone to deposition.

**Planform**
- Channel straightening and re-sectioning has led to a reduction in longitudinal and lateral habitat complexity.
- Both rivers are perched in places with embankments on either side due to historical legacy of mills, water meadows, fish farms and watercress beds.

**Flow (types and velocity variability)**
- Both rivers are low energy systems but flow variability is reduced due to historic modifications affecting channel planform (straightening, widening and re-sectioning) and longitudinal connectivity (impoundments and deepening).
- The lack of coarse woody debris within the rivers reduces flow and velocity variability.

To address the various pressures identified on the two river systems a variety of actions have been identified that implemented in combination could support the SSSIs moving towards favourable condition. The primary actions identified for the majority of reaches were i) appropriate vegetation management of the riparian corridor and the marginal zone (along the bank edge); ii) riparian planting; iii) channel narrowing; iv) weir removal or partial removal/lowering; and v) actions that involve addressing poaching pressure. Intervention of these types would help support in the development of a narrower, free flowing channel that has good in-channel diversity, a mixture of light and shade, being more in keeping with what would be expected on natural Chalk systems of this type.

Individual reaches have been defined as needing to be ‘restored’, ‘rehabilitated’ or ‘conserved and enhanced’ depending on the scale (for example an action could be applied at a whole reach level or at a part-reach level) and significance (for example does one action, such as weir removal, affect the whole reach?) and combination of actions required on a particular reach. Some reaches within the SSSI units have significantly more actions required than others, which is a result of historic legacies as well as current management practices. The understanding of the various pressures and actions required has helped develop restoration visions for each of the two catchments which outline how the rivers may look once the various actions have been undertaken.

To deliver the restoration strategy, Natural England and the Environment Agency will require the co-operation of landowners and river keepers. Consultation is being undertaken with these various groups as part of the development of this strategy but will also be particularly important in taking forward the individual projects. The restoration strategy will form the basis for supporting river management decisions in both catchments in the future.

Within the strategy a variety of constraints has been identified. These include abstractions and discharges; urban infrastructure; heritage; flood risk; and infrastructure associated with legacy issues such as mills. Where constraints have been identified, actions may be available that could address the particular issue, such as weir removal, but to go ahead there will need to be a willingness by all parties to move the project forward, and a technical assessment of the key benefits and associated risks in doing so.
A variety of drivers and funding sources exist to implement the plan and a full assessment of these opportunities will be developed in early 2013 and updated in this report.

Following publication of the draft reports and receipt of consultation feedback, the restoration plan has been finalised. Natural England and the Environment Agency will work with landowners, fishery managers and other interests to start implementing projects on the ground. It is recognised that some of the actions can be implemented easier and quicker (such as vegetation management) than others (such as weir removal of any major structures). Thus the opportunity to make significant improvements in the near future could be technically easy to achieve, but larger and/or more complicated issues may need to be progressed over longer timescales. The Environment Agency and Natural England will be looking into the prioritisation of sites from April 2013.
1. Introduction

1.1. Background to the SSSI

The Rivers Test and Itchen in Hampshire are two of the best examples of Chalk rivers in England, supporting diverse plant and wildlife species. As such both rivers, and many of their tributaries, are designated as Sites of Special Scientific Interest (SSSIs) under Section 28 of the Wildlife and Countryside Act, 1981 (as amended and inserted by section 75 and Schedule 9 of the Countryside and Rights of Way Act 2000), Section 17 of the Water Resources Act, 1991 and Section 4 of the Water Industry Act, 1991. In addition to this, the River Itchen is also deemed to be internationally important for its wildlife and habitat and is designated as a Special Area of Conservation (SAC) under the European Commission (EC) Habitats Directive.

These rivers are designated for both habitats and species, providing important examples of Chalk river and lowland, low gradient river habitats, with other notable features including fen meadow, flood pasture and swamp and fen habitats. Vegetation is also an important feature of the SSSIs with in-channel vegetation being dominated by Ranunculus spp, which provides a refuge for Brook Lamprey (Lampetra planeri) and Atlantic salmon (Salmo salar), also qualifying species for SAC designation.

Natural England undertook a condition assessment of the riverine SSSI units in March 2006 on the Test and March 2010 on the Itchen, the outcomes of which showed that both the SSSIs are in unfavourable condition. Over the last decade, many projects have sought to address the various causes of unfavourable condition within the sites and the focus of this particular project is on in-channel and riparian restoration, looking at the quality of habitat available and whether the river provides the appropriate natural and unconstrained physical conditions required to support the flora and fauna expected in a river of its type. The outcomes of this project will contribute to achieving favourable condition for the SSSIs under the Wildlife and Countryside Act and Good Ecological Status under the Water Framework Directive (WFD), another European Directive.

1.2. Rationale for restoration for the Test and Itchen SSSI

The riverine sections of the SSSIs are in unfavourable condition for a number of reasons, including historical modifications to the physical structure of the channels, banks and riparian zone and the progressive division of the main river channels into multiple channels. The results for current condition, based on the most recent Natural England assessment for both SSSIs are shown in Table 1.

Table 1: Condition assessment for the riverine SSSI units on the Rivers Test and Itchen

<table>
<thead>
<tr>
<th>%Area</th>
<th>River Itchen</th>
<th>River Test</th>
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<tbody>
<tr>
<td>% Area Favourable Condition</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>% Area Unfavourable Recovering</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>% Area Unfavourable No Change</td>
<td>100%</td>
<td>25.1%</td>
</tr>
<tr>
<td>% Area Unfavourable Declining</td>
<td>0%</td>
<td>74.9%</td>
</tr>
<tr>
<td>% Area Destroyed/Part Destroyed</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Many of the causes behind these changes lie in the historical and commercial use of the rivers, which in various cases are outdated and no longer used in modern times. The evidence of these historic practices remains, leaving a legacy of inappropriate river and land management, relative to the condition of the river. There are a range of reasons for the SSSI units not achieving either ‘favourable’ or ‘unfavourable recovering’ condition for a range of reasons including physical habitat modifications. As a result, Natural England and the Environment Agency must identify measures to improve the physical condition of the river. An agreed river restoration strategy must be prepared and implementation progressed on the ground. Additional actions are underway or will be required to address other issues such as pollution and invasive species which affect the Rivers Test and Itchen.

Failure to achieve favourable condition is at least in part reflected in the WFD classification for the rivers. The WFD status of the River Test and River Itchen ranges from Good to Poor Ecological Status (see Table ).
There are a variety of reasons for failure to achieve good status for the designated water bodies on the Test and Itchen. These include fish, phytobenthos, invertebrates, macrophytes, quantity and dynamics of flow, ammonia (phys chem. and Annex 8). Four water bodies on the River Itchen and only one on the River Test is designated as heavily modified. In comparison the SSSI unit assessment lists structures and inappropriate water levels as a key reason for failure to meet favourable condition.

### Table 2: WFD status of the Test and Itchen water bodies

<table>
<thead>
<tr>
<th>Water body name</th>
<th>Water body ID</th>
<th>Overall ecological status/potential</th>
<th>Reason for failure to achieve good status</th>
<th>Hydromorphological status</th>
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<tbody>
<tr>
<td>River Itchen</td>
<td>GB107042022580</td>
<td>Poor</td>
<td>Phytobenthos and Fish</td>
<td>A/HMWB</td>
</tr>
<tr>
<td>River Alre</td>
<td>GB107042022590</td>
<td>Good</td>
<td></td>
<td>A/HMWB</td>
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<tr>
<td>River Alre</td>
<td>GB107042016330</td>
<td>Moderate</td>
<td>Several measures are not in place</td>
<td>A/HMWB</td>
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<tr>
<td>River Itchen</td>
<td>GB107042016300</td>
<td>Good</td>
<td>Not Designated</td>
<td>A/HMWB</td>
</tr>
<tr>
<td>Candover Brook</td>
<td>GB107042022620</td>
<td>Good</td>
<td>Not Designated</td>
<td>A/HMWB</td>
</tr>
<tr>
<td>Bow Lake</td>
<td>GB107042016630</td>
<td>Poor</td>
<td>Invertebrates, Macrophytes, Phytobenthos, Ammonia (Phys Chem) and Ammonia (Annex 8) Several measures are not in place</td>
<td>A/HMWB</td>
</tr>
<tr>
<td>River Itchen (Cheriton Stream)</td>
<td>GB107042016670</td>
<td>Good</td>
<td>Not Designated</td>
<td>A/HMWB</td>
</tr>
<tr>
<td>Arle – Upstream of Drove Lane</td>
<td>GB107042016680</td>
<td>Moderate (uncertain)</td>
<td>Not Designated</td>
<td>A/HMWB</td>
</tr>
<tr>
<td>River Test</td>
<td>GB107042016460</td>
<td>Moderate</td>
<td>Fish (Poor)</td>
<td>A/HMWB</td>
</tr>
<tr>
<td>Test (Upper)</td>
<td>GB107042022660</td>
<td>Good</td>
<td>Not Designated</td>
<td>A/HMWB</td>
</tr>
<tr>
<td>River Dever</td>
<td>GB107042022680</td>
<td>Good</td>
<td>Not Designated</td>
<td>A/HMWB</td>
</tr>
<tr>
<td>River Dever</td>
<td>GB107042022690</td>
<td>Good</td>
<td>Not Designated</td>
<td>A/HMWB</td>
</tr>
<tr>
<td>River Test</td>
<td>GB107042022750</td>
<td>Good</td>
<td>NA</td>
<td>Not Designated</td>
</tr>
<tr>
<td>River Dever</td>
<td>GB107042022770</td>
<td>Moderate</td>
<td>Fish, Invertebrates and DO</td>
<td>Not Designated</td>
</tr>
<tr>
<td>River Test (Lower)</td>
<td>GB107042016840</td>
<td>Poor</td>
<td>Macrophytes, Phytobenthos, Quantity and dynamic of flow</td>
<td>Not Designated</td>
</tr>
<tr>
<td>River Test (Middle)</td>
<td>GB107042022670</td>
<td>Good</td>
<td>Not Designated</td>
<td>A/HMWB</td>
</tr>
<tr>
<td>R. Test (Upper)</td>
<td>GB107042022710</td>
<td>Moderate</td>
<td>Fish (Moderate)</td>
<td>Not Designated</td>
</tr>
<tr>
<td>River Test (Middle)</td>
<td>GB107042022700</td>
<td>Moderate</td>
<td>Fish (Moderate)</td>
<td>Not Designated</td>
</tr>
</tbody>
</table>
Where the SSSI/SAC objectives are higher than those for the WFD, it is the SAC/SSSI objectives that must be met. Consequently, further action is needed to meet the objectives for the SAC/SSSI. The river restoration strategy needs to be implemented in order to contribute to achieving favourable condition, contributing to UK Biodiversity 2020 targets, Habitats Directive and Water Framework Directive objectives.

Aside from simply achieving these legislative targets, it is also important to ensure these rivers are restored and enhanced to their full potential. This would increase their resilience to future pressures (such as climate change, flood risk and abstraction pressures) whilst maintaining their wider commercial and amenity value and the ecosystem services that they provide.

1.3. Project aim and objectives
The aim of this project is to appraise the geomorphological condition of the rivers, identifying the condition of the rivers in relation to their ‘natural’ benchmark. From this starting point river restoration, rehabilitation and conservation/enhancement actions are identified that could be put in place to restore the SSSI/SAC and bring it into favourable or unfavourable (recovering) condition. This includes the following specific objectives:

1. Determine the impacts of physical modifications on the geomorphology and ecology of the river
2. Provide an outline restoration plan for the river on a reach by reach basis
3. Identify potential delivery mechanisms to help achieve this

The focus of the restoration project is on ensuring the condition of habitats rather than the preservation of species directly, with the principle being that the presence of habitats that are characteristic, natural and unconstrained are more likely to support the characteristic flora and fauna.

Although this project is primarily aimed at in-river and riparian characteristics, it is also recognised that the land management adjacent to river channels has the potential to affect the quality of the in-river habitat and as such has been given due consideration throughout this project.

It is also important to note that the term “River Restoration” does not mean returning the rivers to their natural historic course through the valley. The objective is to restore the rivers to a condition such that they can support the biodiversity that is characteristic of their river type, and thereby achieve favourable condition and Good Ecological Status or Potential. By addressing the geomorphological condition through altering the physical form and functioning of the river, the in-channel features are able to adapt to achieve this more naturally over time.

It is intended that this plan will provide a framework for the improvement of both SSSIs over the next 20 to 30 years.

1.4. Aims and objectives of the technical report
This technical report is for the use of the regulatory bodies (specifically the Environment Agency and Natural England) and river managers as supporting information for the accompanying Management Report. The aim of the technical report is to present the findings of the geomorphology assessment and ecological interpretation of the physical impacts on the river, and determine the types of restoration measures required to rectify these pressures. The report will be completed between January and March with sections on the ‘Other Plans and Delivery Mechanisms’ and prioritisation and costing following comments from the Project Steering Group and second public consultation event.
2. Methodology

2.1. Overview of method

To gain a more complete picture of the condition of the geomorphology and ecology of the River Test and Itchen SSSIs a channel walkover survey was undertaken. The approach was based on a fluvial audit methodology; which originated as a technique that assessed sediment conditions of a particular problem reach in relation to the catchment as a whole, but is now increasingly being used for more strategic studies to provide support in wider river management activities particularly in relation to nature conservation (see Sear et al., 2010). The main objective of a fluvial audit is to develop a broad qualitative assessment of the sediment conditions through noting sediment sources, sinks and transfer zones within a catchment and using this information to gain an understanding of how the sediment system supports, and interacts, with functional habitats present in the channel, riparian zone and floodplain (Sear et al., 2010).

The fluvial audit method was tailored to fit the specific project objectives by categorising the reaches into a management option type and by identifying restoration options at specific locations or along whole reaches. There are two main parts of the fluvial audit, namely the desk study and the field survey, the various elements of which are detailed in section 2.3 and 2.4.

2.2. Study area

The strategic plan for the restoration of the Rivers Test and Itchen seeks to achieve ‘favourable condition’ of river reaches (or ‘units’) designated within the riverine SSSI and the fieldwork therefore focused on those specific reaches (see Figure 1 and
2.3. Desk Study

The desk study provides a background understanding of the catchment and involves assimilating a variety of documented information to gain a background understanding of the catchment, noting anything that has a particular impact on the channel geomorphology. A list of reports relevant to the River Test and Itchen will be detailed in Section 7.

Pressures impacting on the geomorphology, i.e. the channel form and function, may either be due to a natural phenomenon or a result of anthropogenic origins. These are known as ‘Potentially Destabilising Phenomena’ and act to increase or decrease sediment supply. Relevant examples of these pressures which increase sediment supply include bank collapse, straightening, and tributary input; and those that decrease sediment supply include bank protection, upstream weirs and dredging.
Figure 1: SSSI units for the River Test
Figure 2: SSSI units for the River Itchen
Information sources used in the desk study include:

- Reports on the Rivers Test and Itchen
- Historic maps
- Landscape character assessments
- SSSI notifications
- WFD Investigations
- South East River Basin Management Plan
- Historical records
- National Flood and Coastal Defence Database (NFCDD)

2.4. Field Survey

2.4.1. Overview

To gain a more complete picture of the condition of the geomorphology and ecology of the channel, a walkover survey of the full length of the River Test and River Itchen SSSIs was undertaken. The fieldwork was completed in two parts:

1. Between 2009 and 2012 Geodata undertook a geomorphological survey and ecological interpretation for nearly 67% of the riverine SSSI unit reach lengths. The bulk of this work was done between 2009 and 2010. Land access was problematic in some units and reaches were only assessed where permission had been granted. Full assessments could therefore not be carried out for any of the 14 SSSI units as a whole during this time.

2. During 2012 Atkins were commissioned to complete the remainder of the walkover survey which was conducted during two separate weeks in October and November 2012 (22\textsuperscript{nd} – 26\textsuperscript{th} October and 5\textsuperscript{th} – 7\textsuperscript{th} November). The majority of the remaining 30% of the SSSI unit reach lengths were assessed for the geomorphology and ecological interpretation. The assessment involved working downstream from the headwaters of the two rivers and assessing all reaches (within the SSSI units) that had not previously been assessed and for which the Environment Agency had obtained access. There remained a few short sections of channel where access was not granted. A future walkover survey would need to be undertaken to assess these reaches and identify opportunities in full.

The Geodata survey work involved taking hard copy notes out on site and transferring the information into a database. Atkins completed their fieldwork assessments with the aid of mobile mappers to note key geomorphological features and supporting information. The information recorded on different processes and forms was used to determine the contemporary geomorphological status of the river for each reach within the SSSI units. The reach number classification system developed by Geodata was integrated into the Atkins work for transparency. Common management actions were developed and used between the two different surveys to ensure consistency in the interpretation.

Features noted within the field survey cover the following broad areas:

- Survey details – Broad survey information and details for each particular reach defined
- Bank features – description of bank material and associated features such as riparian vegetation and shading
- Riparian zone and flood plain – evidence of flood plain connectivity.
- Bed features – description of bed material, vegetation cover, presence of Ranunculus and marginal silts
- Channel geometry – Planform and cross-sectional description
- Channel flow types – Summary of flow types observed
- Geomorphological process – evidence of incision, aggradation and stability
- Photograph locations – Location and direction of photographs undertaken in each reach
- Sediment dynamics – Marking of sediment sources and sinks at a point or line scale
- Presence of woody debris
- Presence of invasive species
- Locations of structures – including weirs, bridges, sluices, outfalls etc and their dimensions and impacts on the channel
- Presence of bank protection, embankments, erosion, management activities
- Management option type – “Restore”, “Rehabilitate”, or “Conserve and enhance”
- Restoration options at specific locations or along whole reaches
2.4.2. Reach definition
The rivers are delineated into geomorphological reaches per SSSI unit. Geodata completed a field assessment based on these reaches and these were broken down into appropriate sub-reaches. To ensure consistency Atkins followed the same methodology and only recorded data within the existing reach structure.

2.4.3. Field based interpretation
The fieldwork allowed an assessment of the modifications to the channel and gave the opportunity to assess the characteristics of the surrounding environment and the linked processes upstream and downstream of the reach. This helped to provide context for identifying restoration mechanisms.

2.5. Data analysis and reporting
This report presents the Atkins assessment of the desk study and an interpretation of all the field survey data collected by both Geodata and Atkins. Pressures impacting on the River Test and Itchen catchments have been described in individual summary sections accompanied by photographs (Section 5). Restoration actions per reach length have been collated from the Geodata database and from the Atkins mapper dataset and are presented in tables (Appendix B). In Appendix B it has also been highlighted which reaches were surveyed by Geodata and which were surveyed by Atkins. Atkins has also produced maps (Appendix A) showing the spatial location of these actions – some of which are applied at a reach basis, and some at spatially specific locations. It should however be noted that the locations of actions along the Atkins surveyed reaches are spatially specific compared to the Geodata surveyed reaches primarily because of the method of data collection used. As the strategy moves forward the raw data collected as part of the two surveys can be used, alongside site visits, to help identify the spatially specific actions aligned to the strategy at a reach level. Several photographs have been included in the report as examples of reach characteristics, pressures, and restoration works undertaken. Not all photos taken during survey work are however presented within this report. The restoration plan for the SSSI/SAC developed during this study is outlined in the accompanying River Test and Itchen SSSI/SAC Management report. This sets out the vision for the long term restoration of the SSSI/SAC and provides a series of reach by reach proposals. It includes figures summarising the type of restoration classification into restore, rehabilitate, and conserve and enhance.

2.6. Developing the restoration vision and detailed plans
This report provides the final restoration plan that has been produced per SSSI Unit. It has been developed using a combination of:

- Geodata datasets from previous fieldwork carried out in 2010;
- Geomorphological and ecological expertise regarding the type of features the river channel and environment should have in a low human impact environment;
- Reference to River Community Type reference conditions for specific river types found within the SSSIs;
- Guidance for the restoration of physical and geomorphological favourable condition on River SSSIs in England, Natural England, 2010;
- Guiding principles for morphological restoration to deliver Water Framework Directive Environmental Objectives, v2.1, Environment Agency, July 2011b; and

The individual restoration measures have been categorised as follows. Those that:

- Are necessary to improve the condition of the SSSI helping to achieve favourable condition; and
- Deliver WFD outcomes.

A consultation event has also been undertaken in early March 2013 to take into account various views of local landowners and river keepers. Consultation responses to the plan have been taken into consideration when finalising the reports, where appropriate and compatible with the objectives of the strategy. In parallel to this exercise, potential delivery mechanisms for the range of measures identified and associated indicative costings have been developed. The findings of which are presented in this report and the final river restoration plan outlined in the accompanying management report.
3. **Test and Itchen SSSI**

3.1. **Test and Itchen designations and ecological features**

3.1.1. **River Community Types**

Holmes et al. (1999) defined “river community types” as a way of describing and classifying the range of rivers present in the UK, in terms of the variety of species and expected habitats present that typify any given river or stream. This is a widely adopted and recognised descriptive management tool for UK rivers.

Across both rivers, two classes of river community types are present:

**River Community Type I**
Lowland, low gradient rivers, naturally eutrophic (high in nutrients) rivers with a high base flow where they flow over the clay dominated reaches – these occur in the lower reaches of the Test and Itchen. These may be dominated by sand and silty beds over gravels and have meandering course with more active channel movement.

**River Community Type IIb**
Chalk rivers: base rich, low energy, lowland rivers and streams, generally with a stable flow regime that occur over most of the Test and the Itchen channels and tributaries, typically with a high groundwater flow, and stable flow regime. These channels typically have a meandering course, which may be multi thread channels, with clean gravel beds but with infrequent bars and ripples. They have a rich and diverse in-channel vegetation and fauna and marginal vegetation.

These river types provide a good description of the morphological variety and expected habitats and features that should typify these rivers. They are also used in Natural England’s assessment of SSSI status, where favourable condition is assessed in relation to the river community type. They therefore set a useful benchmark for restoration expectations.

It is however recognised that every river is different, in terms of its natural characteristics and anthropgenic pressures. The Rivers Test and Itchen are regarded as the ‘home’ to fly fishing and have huge commercial value as fisheries as well as for public water supply. These factors need to be considered in developing and implementing the restoration plan.

3.1.2. **The River Test SSSI**

The Test SSSI is 142 km in length and comprises the River Test from Overton to the Normal Tidal Limit below Testwood and the River Dever from Wonston to its confluence with the Test at Bransbury Common SSSI (Figure 1). The River Test was notified as one of a number of whole river SSSIs in 1996, but unlike the River Itchen is not designated as Special Area of Conservation.

The Test SSSI boundary incorporates the multiple river channels within the floodplain and significant areas of semi-natural vegetation colonising on the floodplain. As a consequence, the SSSI supports some extensive areas of floodplain grassland, fen, reed bed, wet woodland and scrub in addition to the areas of open water. The key features of the SSSI are similar to those on the Itchen, and although larger and longer than the Itchen (and subsequently more diverse in terms of habitat), the Test provides another important example of a classic Chalk stream, species rich lowland river.

Aside from the notable habitats listed above, the River Test is designated as a SSSI for an extensive number of species. Overall, the Test is more species rich than most other lowland rivers, with the most diverse communities being found in the lower reaches where substrate is more varied. In total over 100 species of flowering plant, moss and liverwort have been recorded. While species vary moving downstream on the Test, *Ranunculus spp.* is dominant throughout the river where flow and substrate conditions are appropriate, together with bluntflowered water-starwort (*Callitriche obtusangula*) and fools water cress (*Apium nodiflorum*). The Test is also of particular invertebrate interest, with over 232 invertebrate taxa being recorded (Natural England, 1997).

The Test and its associated vegetation provides valuable wetland habitat for birds, including kingfisher (*Alcedo atthis*), grey wagtail (*Motacilla cinerea*) and little grebe (*Tachybaptus ruficollis*). The Test has developed a very important recreational game fishery, making it internationally recognised as the home of fly
fishing. This has resulted in the addition of rainbow trout, grayling and hatchery-reared brown trout, and the removal of other species. However, in the middle to uppermost reaches of the Test native populations of brown trout (Salmo trutta) are believed to persist, and populations of bullhead (Cottius gobio) and brook lamprey (Lampetra planeri) also make up the natural fish fauna. Otters (Lutra lutra), have been sighted at various locations on the Test and water voles (Arvicola terrestris) are common in places (Natural England, 1997).

As a result of historical management practises and the commercial uses of the river, similar to that of the Itchen, the River Test has also been extensively modified throughout history. There are numerous impoundments, mill leats and water meadow off-takes, as well as many sections that are realigned, over widened and over deepened for fisheries, as well as land drainage and flood defence purposes. There are several commercial fish farms in operation along the river, and some active water cress farms in the headwaters. There has also been a long term and widespread practice of extensive bank side and in-channel vegetation management undertaken specifically to provide desired access to the river for fishing activities. This practice is changing with time, resulting in some sections showing evidence of more sympathetic management practices than others. The resulting character of different sections of this river is therefore highly variable.

3.1.3. The River Itchen SSSI/SAC

The Itchen SSSI is approximately 89 km in length and includes branches in the headwaters from Cheriton from the south, New Alresford to the west (River Arle) and Abbotstone from the north (Candover Stream) and all converge between New Alresford and Itchen Stoke. The river then takes its course in multiple channels (both the River Itchen and the Itchen Navigation channel) through the city of Winchester and then broadly in a south westerly direction to its confluence with the Itchen Estuary SSSI (Figure 2).

The Itchen is also designated as a Special Area of Conservation (SAC) because it supports Habitats Directive Annex I habitats and Annex II species, primarily Ranunculion fluitantis and Callitricho-Batrachion vegetations, as well as the populations of southern damselfly (Coenagrion mercuriale) and bullhead (Cottius gobio).

There is significant overlap between reasons for SSSI and SAC designation on the River Itchen. The site is given SSSI notification for its classic Chalk stream and river, fen meadow, flood pasture and swamp habitats. In-channel vegetation is particularly important within this site, being dominated by Ranunculus spp. Habitats adjacent to the river channels are also important features supporting designations, such as the extensive water meadows, ditches and side channels as well as areas of wet woodland.

The designated habitats of the Itchen support the following qualifying species:

- Southern damselfly (Coenagrion mercuriale);
- White-clawed crayfish (Austropotamobius pallipes) (one of the few remaining populations in southern England);
- Otter (Lutra lutra);
- Water vole (Arvicola terrestris);
- Bullhead (Cottius gobio);
- Brook lamprey (Lampetra planeri); and
- Atlantic salmon (Salmo salar).

As well as these notable in-channel and riparian species, the extensive water meadow floodplain is also cited because of avian features including breeding birds – the tufted duck (Aythya fuligula), pochard (A.ferina) and shoveler (Anas clypeata). The site is also important for wading species including the lapwing (Vanellus vanellus), redshank (Tringa totanus) and snipe (Gallinago gallinago). Wetland passerines are also present including sedge warbler (Acrocephalus schoenobaenus), reed warbler (A.scirpaceus) and Cetti’s warbler (Cettia cettia).

The Itchen is also world renowned for game fishing, largely provided by brown trout, and to a lesser extent salmon and sea trout. Almost the entire river is managed to maintain and facilitate fishing for brown trout, with fishing for sea trout and Atlantic salmon (Salmo salar) also taking place along the lower reaches. Associated management has included the addition of grayling and hatchery-reared brown trout, and the removal of other species. In the uppermost reaches of the Itchen native populations of brown trout (Salmo trutta) are believed to persist, and bullhead (Cottius gobbio) and brook lamprey (Lampetra planeri) are notable elements of the natural fish fauna and of European importance.
The Itchen valley is also important in terms of its historic landscape, having extensive water meadows and associated historic landscape features, structures and mills. The water meadows are still used extensively for agriculture, although they are not generally ‘floated’ in the same way as they would have been traditionally. In the headwaters upstream of Itchen Abbas, multiple watercress beds still operate commercially, and there are also a number of fish farms in operation. This river is also internationally renowned for the quality of its fishing, mainly for brown trout (wild populations), salmon and sea trout.

As a result of its historic, commercial and amenity value, the river has been progressively and extensively managed and modified over time, and now comprises a complex array of multiple channels with mill races and an historic Itchen Navigation channel between Southampton and Winchester. The banks and in-channel vegetation are, in large sections, heavily maintained for ease of access for fishing activities, although the views and practises on this are progressively changing with approaches to in-stream and riparian vegetation management gradually becoming more sympathetic to the riverine habitat.

### 3.2. SSSI/SAC condition status

There are 14 SSSI riverine units on the Test and Itchen; eight on the Test and six on the Itchen. The most recent published assessment of the riverine units on the River Test was in March 2006. On the River Itchen the six riverine units were assessed in March 2010.

On the River Test, five of the eight riverine SSSI units assessed were deemed to be in unfavourable-declining condition and three assessed as unfavourable-no change. On the River Itchen all of the riverine SSSI units were assessed as unfavourable-no change.

These 14 riverine SSSI units have been assessed as being in unfavourable condition for several reasons, including:
- modification to the channel itself, dividing the flow between multiple artificial channels, which are often straight and over deepened;
- the presence of structures, causing ponded flow and increased siltation;
- the management of the banks and riparian zone;
- water pollution from agriculture/run off and other discharges; and
- abstraction pressures.

Failure to meet favourable condition shows that the unit is not meeting one of more of the standards required. This is also reflected in the WFD classification; under the WFD the River Test and Itchen range from Good to Poor Ecological Status. The aim is to achieve Good Ecological Status by 2015. If this is not achievable the River Basin Management Plans have a 6 year cyclical process so improvements towards Good Ecological Potential/Status can be made in other rounds of the plans.

Of the attributes considered in the condition assessment, siltation and channel structures are particularly relevant to this study. The March 2006 condition assessment of the River Test SSSI found all of the riverine units assessed to be in unfavourable condition, in part due to inappropriate weirs, dams and other structures, and siltation, alongside wider issues of bank and channel management. This study examines structures, sediment conditions and management practises, along the entire reach of the River Test and Itchen, allowing a more comprehensive assessment of these issues.

While water quality data on the Test generally meet the pass mark for the water quality element of the condition assessment, poor water quality is a reason for adverse condition on the River Itchen. Alongside issues of poor water quality, adverse condition is associated with riparian management and inappropriate scrub control, and inappropriate water levels and structures. In addition, the condition assessment for all six units highlights abstraction as having the potential to significantly reduce flows, and concern about impacts of signal crayfish on native crayfish, a key designated feature.

A summary of the condition assessment and reason for adverse condition (where applicable) is given for the Test and Itchen in Table and Table below.
### Table 3: River Test SSSI Condition Assessment (Natural England 2006)

<table>
<thead>
<tr>
<th>Unit</th>
<th>Last assessed</th>
<th>Condition</th>
<th>Reason for adverse condition</th>
<th>Assessment condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>84: Source to Bourne</td>
<td>March 2006</td>
<td>Unfavourable – declining</td>
<td>Inappropriate water levels, inappropriate weirs dams and other structures, invasive freshwater species, siltation, water pollution – agriculture/run off, water pollution – discharge</td>
<td>Doesn't comply with water quality chemical targets; Doesn't comply with some aspects of channel and banks habitat structure; Doesn't comply with naturalness of macrophytes target and or native macrophyte species target.</td>
</tr>
<tr>
<td>85: Bourne to Dever</td>
<td>March 2006</td>
<td>Unfavourable – declining</td>
<td></td>
<td></td>
</tr>
<tr>
<td>86: Dever</td>
<td>March 2006</td>
<td>Unfavourable – no change (R. Dever)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>88: Anton to Wallop</td>
<td>March 2006</td>
<td>Unfavourable – declining</td>
<td></td>
<td></td>
</tr>
<tr>
<td>89: Wallop to Dun</td>
<td>March 2006</td>
<td>Unfavourable – declining</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90: Dun to Romsey</td>
<td>March 2006</td>
<td>Unfavourable – declining</td>
<td></td>
<td></td>
</tr>
<tr>
<td>87: Dever to Anton</td>
<td>March 2006</td>
<td>Unfavourable – no change</td>
<td>Inappropriate water levels, inappropriate weirs dams and other structures, siltation, water pollution – agriculture/run off, water pollution – discharge</td>
<td>Doesn't comply with water quality chemical targets.</td>
</tr>
<tr>
<td>91: Romsey to Estuary</td>
<td>March 2006</td>
<td>Unfavourable – no change</td>
<td>Inappropriate water levels, inappropriate weirs dams and other structures, invasive freshwater species, siltation, water abstraction, water pollution – agriculture/run off, water pollution – discharge</td>
<td>Doesn't comply with flow target; Doesn't comply with water quality chemical targets; Doesn't comply with some aspects of channel and banks habitat structure; Topmouth gudgeon and barbel present.</td>
</tr>
</tbody>
</table>
Table 4: River Itchen SSSI Condition Assessment (Natural England, 2010)

<table>
<thead>
<tr>
<th>Unit</th>
<th>Last assessed</th>
<th>Condition</th>
<th>Reason for adverse condition</th>
<th>Assessment condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>103: Cheriton Stream</td>
<td>March 2010</td>
<td>Unfavourable – no change</td>
<td>Inappropriate scrub control, inappropriate water levels, improper weirs dams and other structures, siltation, undergrazing, water pollution – agriculture/run off, water pollution – discharge</td>
<td>The Cheriton Stream is not as heavily modified as other parts of the catchment but it is desirable to restore more natural flow characteristics.</td>
</tr>
<tr>
<td>104: River Alre (sic)</td>
<td>March 2010</td>
<td>Unfavourable – no change</td>
<td>Inappropriate cutting/mowing, inappropriate scrub control, inappropriate water levels, improper weirs dams and other structures, siltation, water abstraction, water pollution – agriculture/run off, water pollution – discharge</td>
<td>There are no indications of excessive siltation, but Old Alresford Pond (on-line but not in the SSSI) is heavily silted up. Parts of the River Arle have been heavily modified, particularly in relation to water cress production. Some work has been carried out to restore the natural course.</td>
</tr>
<tr>
<td>105: Candover Brook</td>
<td>March 2010</td>
<td>Unfavourable – no change</td>
<td>Inappropriate water levels, water abstraction, water pollution – agriculture/run off, water pollution – discharge</td>
<td>There is no significant abstraction in this unit. The Candover Stream is not as heavily modified as other parts of the catchment. However, parts are modified and several structures are in place. It is desirable to restore more natural flow characteristics. This is identified in the water level management plan for the river.</td>
</tr>
<tr>
<td>106: Upper Itchen (Itchen Stoke to Easton)</td>
<td>March 2010</td>
<td>Unfavourable – no change</td>
<td>Inappropriate scrub control, inappropriate water levels, improper weirs dams and other structures, invasive freshwater species, siltation, water abstraction, water pollution – agriculture/run off, water pollution – discharge</td>
<td>The flow regime is broadly characteristic of the river type and there is no significant abstraction in this unit. This part of the Itchen is not as heavily modified as other parts of the catchment. However, parts are modified and several structures are in place. It is desirable to restore more natural flow characteristics. This is identified in the water level management plan for the river.</td>
</tr>
</tbody>
</table>
### Table: Unit, Last assessed, Condition, Reason for adverse condition, Assessment condition

<table>
<thead>
<tr>
<th>Unit</th>
<th>Last assessed</th>
<th>Condition</th>
<th>Reason for adverse condition</th>
<th>Assessment condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>107: Middle Itchen (Easton to Highbridge)</td>
<td>March 2010</td>
<td>Unfavourable – no change</td>
<td>Inappropriate scrub control, inappropriate water levels, inappropriate weed control, inappropriate weirs dams and other structures, invasive freshwater species, siltation, water abstraction, water pollution – agriculture/run off, water pollution – discharge</td>
<td>Parts are affected by excessive siltation arising from run-off and other point sources. Key problem areas have been identified. This part of the Itchen is heavily modified as it includes the Itchen Navigation. Control structures are frequent and natural flow characteristics absent from many sections. This reduces suitability of the habitat for species such as bullhead and lamprey, and means many parts fail the target for habitat structure. These issues are identified in the water level management plan and various works have been undertaken to reduce effects of past modification.</td>
</tr>
<tr>
<td>108: Lower Itchen (Highbridge to Wood Mill)</td>
<td>March 2010</td>
<td>Unfavourable – no change</td>
<td>Inappropriate water levels, inappropriate weirs dams and other structures, invasive freshwater species, siltation, water abstraction, water pollution – agriculture/run off, water pollution – discharge</td>
<td>This section includes the Itchen Navigation. Control structures are frequent and natural flows absent from many sections. This reduces habitat suitability for species such as bullhead, and means many parts fail the target for habitat structure. These issues are identified in the water level management plan and various restoration works have been undertaken to reduce impacts. Water chemistry is different to the upper sections with the change in underlying geology. This affects water quality though this is a natural reflection of the geological variation rather than artificial inputs.</td>
</tr>
</tbody>
</table>

### 4. Catchment characteristics

#### 4.1. Geology and topography

Chalk outcrops the majority of both the Test and Itchen catchments, estimated at 90% and 80% Chalk respectively. In the lower valleys to the south of the catchments, clays and sands of the Tertiary deposits overlie the Chalk. The Chalk, which was once classified into Upper, Middle and Lower, has recently been reclassified by the British Geological Survey into eight classifications based on stratigraphical markers.

The Lower Chalk consists of the oldest Chalk, West Melbury and ZigZag. The Middle Chalk is made up of the Holywell Nodular Chalk and New Pit Chalk, which outcrop along the Bourne Rivulet and River Swift in the Upper Test. The Lower and Middle Chalk are only found in a localised area around Winchester.

The Upper Chalk consists of the Lewes Nodular, Seaford, Newhaven, Tarrant, and Culver Chalk; these deposits cover the majority of the Test and Itchen catchments. The Stockbridge Rock Member, towards the top of the Seaford Chalk Member has a significant influence on groundwater and baseflow discharge due to a series of high transmissivity fissure zones. This horizon outcrops most frequently near Chilbolton in the Middle Test. It also occurs at ground surface near Kings Worthy on the Itchen.

As stated, the Chalk is overlain by Tertiary deposits to the south of the catchment. The junction at which these deposits begin, runs from Bishops Waltham in the east to Salisbury in the west. The deposits in this area comprise the Readings Beds that directly overlie the Chalk and the London Clay and Bracklesham Beds. There are very few abstractions made from these areas. These units are relatively impermeable which causes rapid run off into the Test and Itchen and their tributaries in these areas (Environment Agency, 2012).
Ground elevations largely reflect the underlying geology, peaking at 290 m on the northern Chalk boundary. The eastern areas of Chalk are covered with Clay-with-Flints and form a high and flat plateau. The southern area of the catchment is a heavily urbanised, flat estuarine plain (Environment Agency, 2012).

4.2. Hydrology and flood risk

4.2.1. Hydrology

The River Test main channel is approximately 50 km in length and the surface catchment is estimated at 1260 km² (Environment Agency, 2010b). The River Itchen main channel is approximately 45 km in length with a surface catchment of around 470 km².

The Rivers Test and Itchen gain their water from the Chalk aquifer, which supplies most of the streams and rivers in the area, as well as most of the water abstracted in the area (Environment Agency, 2012). Chalk rivers are characterised by a baseflow dominant flow regime: the slow release of water from the aquifer attenuates rainfall events, providing a steady flow regime with a characteristic cycle. If the aquifer and land are saturated, some rainfall events can induce a more rapid response or where there are areas of impermeable deposits over the Chalk. Chalk rivers typically start to show a rise in water levels and river flow from mid to late winter following the onset of winter rains, until March or April. From this point flows start to decline over summer and autumn, reaching minimum flows in October until the onset of the rains begins again (Atkins, 2012).

Typically, Chalk rivers tend to have relatively few tributaries on areas of Chalk outcrop. As a result, the drainage density is low due to minimal surface runoff. Sources for the smaller tributaries of the Test (particularly the Bourne Rivulet) often move depending on the groundwater levels. All of the River Test tributaries display relatively smooth seasonal hydrographs on account of their high Base Flow Index (BFI) (typically around 0.90) (Environment Agency, 2010b). The River Itchen has two principal tributaries, the River Arle and Candover Brook, and again is subject to a relatively stable flow regime due to a high BFI (CEH, 2008). There are few other permanent surface waters on the Chalk outcrop because the nature of the soils and depths to the water table are such that all rainfall either evaporates or infiltrates.

4.2.1.1. Gauged flows

The UK Hydrometric Register (CEH, 2008) lists two gauging stations on the Test and three stations on the Itchen. On the Test the Broadland gauging station is difficult to calibrate due to weed growth and an uneven velocity distribution and incorporates the effects of rapid runoff from the lower reaches of the Dun Catchment. On the Itchen, at the Highbridge and Allbrook station, a fish pass was installed in the winter of 1993. The site is subject to water resource pressures from groundwater abstractions and surrounding cress farms. Flows at the Riverside Park gauging station are artificially influenced by two 45 Ml/d surface water abstractions at Gaters Mill and Otterbourne and a large STW discharge at Eastleigh. Flows at all three gauging stations on the Itchen are sometimes augmented by groundwater during times of drought (CEH, 2008). Table below shows the Base Flow Index (BFI) for all the gauges highlighting a baseflow dominated regime across the catchment.

Table 5: Flow gauging stations

<table>
<thead>
<tr>
<th>River</th>
<th>Site Name</th>
<th>NGR</th>
<th>Period of record</th>
<th>BFI</th>
<th>Mean annual rainfall (mm)</th>
<th>Mean annual flow (m³s⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>Broadlands</td>
<td>SU354189</td>
<td>1957–2005</td>
<td>0.94</td>
<td>818</td>
<td>11.18</td>
</tr>
<tr>
<td>Test</td>
<td>Chilbolton</td>
<td>SU386394</td>
<td>1989–2005</td>
<td>0.97</td>
<td>817</td>
<td>5.63</td>
</tr>
<tr>
<td>Itchen</td>
<td>Highbridge + Allbrook</td>
<td>SU467213</td>
<td>1958–2005</td>
<td>0.96</td>
<td>857</td>
<td>5.40</td>
</tr>
<tr>
<td>Itchen</td>
<td>Easton</td>
<td>SU512325</td>
<td>1975–2005</td>
<td>0.98</td>
<td>872</td>
<td>4.30</td>
</tr>
<tr>
<td>Itchen</td>
<td>Riverside Park</td>
<td>SU445154</td>
<td>1982–2005</td>
<td>0.91</td>
<td>853</td>
<td>5.30</td>
</tr>
</tbody>
</table>


4.2.2. Flood risk

Under very wet conditions the headwaters of rivers and their tributaries can rise many kilometres upstream of where they would usually rise and groundwater flooding can occur (Environment Agency, 2012). For this
reason, the ephemeral tributaries to the Test pose a flood risk when groundwater levels are particularly high. In the winters of 1993/94, 1994/95 and 2000/01, groundwater levels were exceptionally high and many of these ephemeral streams rose much further up their valleys than normal, causing local flooding. The flooding in the winter of 2000/01 affected up to 300 properties. High groundwater levels caused flooding of properties throughout the catchment during this time, while river flooding was located in places such as Winchester and Romsey (Environment Agency, 2009b). In contrast, low winter rainfall in 1991/92 and 1996 caused very low groundwater levels and reduced river flows in the following drought summers (Environment Agency, 2010b).

The Catchment Flood Management Plan divides the Test and Itchen catchment into nine sub-regions based on level of flood risk and assigns each region an appropriate policy. If a region is assessed as being of low flood risk, this generally means the appropriate policy will emphasise a commitment to working with natural flood processes as far as possible. In the catchment the sub-region ‘River Dun and River Test to Romsey/Middle Itchen’ is assessed as being of lowest risk. This region implements Policy 6 – ‘areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits. We need to work sustainably with natural process to make space for water to reduce flood risk’ (Environment Agency, 2009b).

4.3. **Land use**

Across the area dominated by Chalk, the rivers flow through a landscape which is predominantly arable and pasture. The land alongside the river is largely pasture, with arable land over the remaining Chalk. The southern area, on the tertiary geology, is dominated by pasture, with large areas of woodland to the west of this area. Towns and villages are dotted across the catchments, with the most heavily urbanised areas being Winchester in the centre of the Itchen and the urban centres of Southampton, Romsey, Totton and Eastleigh to the south of the catchments (Environment Agency, 2012).

4.4. **Water resources**

4.4.1. **Water abstraction**

Within the Test and Itchen catchments nearly 75% of licensed abstractions are for non-consumptive uses. Fish farming makes up 61% and watercress farms accounts for 12% of all licensed abstractions.

Fish farming is a key industry within the Test and Itchen catchments and a significant user of water. There are 50 fish farms in the Test and Itchen. Most fish farms abstract water from the adjacent watercourse and discharge the water downstream. However there is some concern that abstractions impact the adjacent watercourse and downstream of fish farms. These abstractions are highlighted for consideration in the context of CAMS, the review of consents for the River Itchen SAC and the WFD (Environment Agency, 2012).

Of the total licensed abstraction, 73% is from surface water and 27% is from groundwater sources.

As mentioned in section 4.2.1.1 groundwater augmentation schemes licensed on the River Alre and the Candover Stream account for 2% of the licensed total. Flow from the groundwater augmentation is intended to mitigate the effects of a Waste Water Treatment Works (WWTW) near Eastleigh.

Public water supply makes up 23% of total licensed abstraction with the main abstractions being taken from Otterbourne and Gaters Mill on the River Itchen and Testwood on the River Test. The remaining 2% is used by agriculture, industry and licensed private domestic supplies.

Licences may be subject to changes including the addition of water resource efficiency changes. The public water supply abstraction at Testwood has a “hands-off flow” condition of 1.05 cumecs (Environment Agency, 2006b).

4.4.2. **Water quality**

Impacts on water quality are similar within both catchments. Land use in both catchments is predominately agricultural and as a result the main sources of groundwater pollution, in particular nitrates, result from agricultural activities. Nitrate levels have been shown to be increasing, especially in the Upper and Middle Test catchments. The issue is being tackled through the implementation of the Catchment Sensitive Farming Delivery Initiative and Nitrate Vulnerable Zone designation. In addition effluent from WWTWs at Andover and

Based on the 2010 assessment of the River Itchen SSSI all units achieved a Biological Class A for General Quality Assessment (GQA), and Class A or B for Chemical GQA, which falls under the classification of ‘Good’ or ‘Very Good’. However un-ionised ammonia exceeds the target of 0.02 mg/l for each unit, highlighting un-ionised ammonia as a particular water quality issue. Total reactive phosphorus slightly fails to meet the target for the upper reaches (target 0.04 mg/l as annual mean in upper reaches), but meets the target for the middle and lower reaches. Water quality results were not included in the latest SSSI unit assessment for the River Test as this was not available.

4.5. Fisheries

The Rivers Test and Itchen are largely regarded as the world’s premier dry fly trout fishery, with both rivers being classified as “Native Trout Water”. The Test and Itchen also support popular salmon fisheries, largely confined to their lower reaches: below Romsey on the Test and below Bishopstoke on the Itchen (Environment Agency, 2012). Both rivers are internationally renowned for the quality of their fishing.

Fishery surveys and monitoring show that salmonid recruitment takes place throughout the length of the River Test. Salmon were in decline until the early 2000’s, with the River Test failing to meet its conservation objectives. Since 2001 there has been a general increase in the number of salmon eggs deposited and the size of the salmon stock. Salmon are sensitive to low flows and higher water temperatures in the lower reaches of these rivers.

Another issue is the poor survival of salmonid eggs deposited in spawning gravels, which is considered a major impact on salmon stocks and thought to be associated with diffuse pollution and exacerbated by high flow conditions during egg incubation (Jan– Apr inclusive). On the river low flow issues are also a concern for the maintenance of the water crowfoot (Ranunculus sp) communities in favourable condition. Water crowfoot beds provide a key habitat for invertebrates, vital for sustaining dry fly fisheries (Environment Agency, 2006b). These macrophytes are considered of great importance for diversity of invertebrates and enable higher densities of juvenile salmon than would otherwise use this habitat.

Fish farming is a key industry within the Test and Itchen catchments and a significant user of water. There are numerous farms in the Test and Itchen catchments. Most fish farms abstract water from the adjacent watercourse and discharge the water downstream. However, there is some concern that abstraction impacts the adjacent watercourse through flow depletion and downstream reaches through water quality impacts. These abstractions are highlighted for consideration in the context of CAMS, the review of consents for the River Itchen SAC and the WFD (Environment Agency, 2012).

4.6. Historical changes and river modifications

There have been numerous (primarily human) impacts within both catchments which have had significant effect upon the form and function of the channel (see Table and Table ) Many of these modifications date back to the Domesday Book of 1086, or before and still have present day impacts on the current functioning of the river.

The river system has been modified over centuries by the construction of sluices, artificial channels for water meadows, mills and navigation. Many reaches have also been re-aligned and/or deepened for land drainage. Based on maps from 1803 (Oldmapsonline, 2010), the majority of the channel planform was significantly altered (i.e. bifurcated and straightened for mills and industry), even at this time. This historic modification has led to multiple, often straightened watercourses.

The present day number of structures on the Test and Itchen is 670 and 379, respectively (including all structures recorded by NFCDD including weirs, sluices, culverts, bridges, fords and outfalls) (see Appendix A for location map, A1 for the River Test and A2 for the River Itchen). It is difficult to capture the extent of the modifications made over the past millennia, however key dates have been recorded for both rivers below and an illustration of a view of East Acton Common SSSI, giving an example of extensive grazing and good connection between the fen and river in Figure 3.
Figure 3: Artistic view of the Test at Longparish 1891 (Wikipedia, 2012)
## 4.6.1. River Test

### Table 6: Time chart of catchment changes on the River Test

<table>
<thead>
<tr>
<th>Time</th>
<th>Pre 1600</th>
<th>1600–1700</th>
<th>1700–1800</th>
<th>1800–1900</th>
<th>1900–present</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structures</strong></td>
<td>Andover– 6 mills Overton– 4 mills</td>
<td>Whitchurch– site mill (Wikipedia)</td>
<td>Whitchurch– papermill</td>
<td>Whitchurch 1810– Nine springs Nursery weir for watercress beds (recorded as oldest in the world)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Whitchurch– 4 mills</td>
<td>Bullington (Dever)– 1 mill</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overton– 4 mills</td>
<td>Middle– 2 mills, fisheries for the hall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chilbolton– 2 mills</td>
<td>Middleton– 2 mills, fisheries for the hall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bullington (Dever)– 1 mill</td>
<td>Chilbolton– 2 mills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Middleton– 2 mills, fisheries for the hall</td>
<td>Bossington– 1 mill</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chilbolton– 2 mills</td>
<td>Leckford– 1.5 mills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bossington– 1 mill</td>
<td>Houghton– fishery, 4 mills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Leckford– 1.5 mills</td>
<td>Timsbury– 1 mill</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Houghton– fishery, 4 mills</td>
<td>Romsey– 4 mills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Works</strong></td>
<td></td>
<td></td>
<td>1865– Andover Canal between Chilbolton and Redbridge converted to railway</td>
<td>1975–1983 M27 opened in stages</td>
<td></td>
</tr>
<tr>
<td><strong>Channel change</strong></td>
<td></td>
<td>1665– Act of Parliament granted power to make the Test navigable</td>
<td>1822– Houghton fishing club founded (recorded as oldest in the world)</td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Land use change</strong></td>
<td>Andover– meadow, 18 acres; woodland at 100 pigs from pasturage.</td>
<td>1841–40% employed by agriculture</td>
<td>Real property, £5,076; of which £51 are in fisheries</td>
<td>2000–&lt;5% employed by agriculture &gt;60% employed in services</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Whitchurch– sheep farming</td>
<td>&gt;30% employed in services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flooding</strong></td>
<td></td>
<td></td>
<td></td>
<td>2000/01– extensive flooding in the Test and Itchen catchment affecting up to 300 properties. Fluvial flooding particularly affected Romsey on the Test.</td>
<td></td>
</tr>
</tbody>
</table>
## 4.6.2. River Itchen

### Table 7: Time chart of catchment changes on the River Itchen

<table>
<thead>
<tr>
<th>Time</th>
<th>Pre 1600</th>
<th>1600–1700</th>
<th>1700–1800</th>
<th>1800–1900</th>
<th>1900–present</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structures</strong></td>
<td>Around 1200– New Alresford– Great Weir (an embankment about 400 yards long and around 20 feet high forming an expanse of water about 200 acres in extent) was being built to create Old Alresford Pond as a fish pond for the Bishop's Palace at Bishop's Sutton and a reservoir for the mills along the Itchen. Mills recorded at: Easton–2 mills, Yavington–2.5 mills, Otterbourne–fishery and Twyford–6 mills.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Works</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Channel change</strong></td>
<td></td>
<td>1665– first Act of Parliament relating to the Itchen Navigation</td>
<td>1710– Trading commenced on the Navigation</td>
<td>1802– Act of parliament changed the Navigation from a Monopoly to Public Navigation</td>
<td>1830s– London and Southampton Railway built, which was direct competition to the Navigation and crossed the river at two places north of Eastleigh. 1861– Midhants Railways constructed– known as the 'Watercress Line' to transport cress from Alresford to Alvot</td>
</tr>
<tr>
<td><strong>Land use change</strong></td>
<td>Beginning 14th century– wool trade in decline</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flooding</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

1 http://www.visionofbritain.org.uk/place/place_page.jsp?p_id=5170
2 http://www.visionofbritain.org.uk/data_cube_page.jsp?data_theme=T_IND&data_cube=N_INDUSTRY_GEN&u_id=10056457&c_id=10001043&add=Y
3 http://www.houghtonlodge.co.uk/nivertest.html
4 http://www.domesdaybook.co.uk/
5 http://www.alresford.org/
6 http://en.wikipedia.org/wiki/Watercress_Line
7 http://www.whitenap.plus.com/itchen/itchen_hist.htm
5. Geomorphological and Ecological condition

5.1. Reference condition

5.1.1. River channel morphology

5.1.1.1. Chalk systems

The geomorphology of a river reflects a variety of conditions at a particular site. The main drivers for a fluvial system are sediment availability and water. The way in which these drivers affect a river will depend on a mix of other controls such as geology, topography, soil type, land use, vegetation and management practices. Thus the resultant forms and processes that exist in a river reach at a particular time is a result of both the temporal and spatial changes of these variables. A Chalk stream is considered to be a special river type due to its international rarity and unique geomorphological characteristics and flow regime. Chalk streams are fed by groundwater and will often have a winterbourne section which is only wet for a particular part of the year, usually spring/winter but most likely when groundwater levels are at their highest. Chalk streams often have a particular seasonal cycle termed the seasonal cycle of co-dominance which relates to the interrelationships between flow, vegetation and sediment. Chalk streams often have the highest flows in spring following winter recharge. Through the summer, flow levels will tend to drop and more sediment becomes deposited along the river margins particularly in areas where there is in-channel vegetation. Flows tend to be lowest in late autumn and in early winter. The sediment storage may in many cases be temporary as the flows rise again and vegetation dies back leading to the release of sediment. Sediment release is not always guaranteed as not all plant species experience the same level of die back though winter, so therefore not making the potential sediment store available for erosion or transport. Where vegetation cover does not decrease over winter there is a tendency for the sediment deposits along the margins to become more permanent features with increased stability over time.

Chalk streams have been historically modified for a variety of purposes such as mills, water cress beds, fisheries and agriculture. The various modifications have often led to the systems being over-widened, over-deepened, perched high on the floodplain side and impounded. In addition, these rivers can be impacted by over abstraction and fine sediment ingress as a result of land use management, roads and river crossings. All these modifications seek to change the specific character of chalk streams.

5.1.1.2. River Test and Itchen detail

Two types of river community type are present within the River Test and Itchen SSSIs (Geodata 2010), namely:

- **River Community Type I** (lowland, low gradient rivers, naturally eutrophic (high in nutrients) rivers with a high base flow where they flow over the clay dominated reaches) and **River Community Type IIIb** (Chalk rivers: base rich, low energy, lowland rivers and streams, generally with a stable flow regime).

Mainstone (2007) describes the Test and Itchen Rivers as key examples of River Community Type III rivers. The characteristics of this type of river that might be expected with limited human impact are summarised in (Table ) and example photos from the Test and Itchen are provided in Figure 4. The reaches which are more similar to River Community Type I are significantly less in extent. Characteristics are similar but as mentioned above the channels are more active and there is a predominance of finer sediments over gravels. Localised gravel habitat is important for a variety of invertebrates and fish but different species dominate ponded more silty reaches. This reference condition is what the field observations were assessed against to help determine restoration opportunities.

The River Test and River Itchen have historically undergone physical habitat modifications for water meadows, milling, fisheries and flood risk management. As noted by Geodata (2010) the types of features that would therefore be expected within a chalk river now in favourable condition would be (see Figure 4):

- Low levels of artificial impoundment with minimal interruption to the long profile of the river and movement of sediment and fauna.
- Natural and un-modified planform, cross-channel profiles, and channel dimensions typical of river type and adjusted to natural river flow conditions.
- Natural river bed of clean river gravels with low fine sediment content and unconstrained by artificial bank materials and protection.
- Channel and flow diversity creating varied habitats and ecological niches that sustain diverse plants and animal communities.
- A natural bank side vegetation cover with shallow marginal vegetation and riparian tree cover.
- A river channel connected to its floodplain.

Figure 4: Good examples of River Community type IIIb on (a) the Test and (b) the Itchen

Table 8: Characteristics of chalk River Community Type III rivers (based on Mainstone, 2007)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Ecological significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed</td>
<td>Distinct chalk bed channels, extensive gravel substrates, infrequent gravel shoals and exposed riverine substrates. Finer substrates become more dominant in the lower reaches.</td>
<td>A mosaic of beds of submerged plants and gravels is typically created. There is enhanced scour between the plant beds generating gravels low in silt. Gravel and in-channel vegetation provide a refugia for invertebrate fauna, including Mayfly (<em>Ephemeropta</em>), caddis fly (<em>Trichoptera</em>) and also gastropod mollusc species. Species shifts from the upper reaches to the lower reaches are evident; according to reductions in current velocity and progressive fining of bed substrates. The submerged plant cover is also important for the fish community as a refuge and feeding habitat. Finer silty substrates (either in the lower reaches or such as created behind log jams) are important to fish species such as lampreys. Highly biologically active hyporheic zone including within the gravel substrate.</td>
</tr>
<tr>
<td>Flow types</td>
<td>Low longitudinal frequency of riffles and pools (dominated by glides. Natural structures (such as log jams) are present with increasing frequency downstream. Chalk rivers are winterbournes and so the head of the river migrates during drier periods.</td>
<td>Shallow cross sectional profile and low scouring energy of the river leads to abundance of plants: in-channel specialists including water-crowfoots (<em>Ranunculus spp.</em>.) and starworts (<em>Callitriche spp.</em>). The fish community shows a longitudinal transition dependent largely on current velocity and substrate types. Salmonids dominate the upper reaches and middle reaches, using gravels for spawning and the growth of juveniles. Downstream rheophilic cyprinids (including dace and chub) are more predominant. These also use the gravels for spawning. Winterbournes constitute a distinctive habitat hosting plant and animal species resistant to drying out.</td>
</tr>
</tbody>
</table>
### Feature Description

**Planform and banks**
Sinuous channel form and shallow cross sections.

**Riparian zone**
Marginal vegetation characteristically encroaches into the channel as flows recede from Spring through Summer, thereby reducing effective channel width and maintaining current velocities in the channel. Over winter this vegetation is scoured out and the process begins again in spring.

Semi continuous lining of the channel by riparian trees.

**Ecological significance**

Shallow banks (particularly the inside of meander bends) allow a zone of transition for plant species.

Active marginal vegetation including water-cress (*Rorippa nasturtium-aquatica*), brooklime (*Veronica beccabunga*) and water forget-me-nots (*Myosotis spp.*). The marginal vegetation provides important habitat for the invertebrate fauna, as mentioned above.

Riparian trees are a vital habitat component generating submerges exposed root systems that provide in-channel habitat for fish and invertebrates such as white clawed crayfish (*Austropotamobius pallipes*). A potential holt and resting space for otters (*Lutra lutra*) and a source of woody debris and leaf litter for the channel. Trees also vary the light and temperature regime adding to the habitat diversity. Other riparian plants also provide habitat for otter and bird species such as warblers and reed bunting.

The co-occurrence of wooded and open margins allows diurnal movement of several invertebrate species between the two habitats.

Highly biologically active hyporheic zone including lateral connectivity into the riparian zone.

### 5.1.2. Ecology

The Test and Itchen are typical Chalk rivers with exceptionally species-rich and abundant Chalk stream plant communities. The majority of these plants are present throughout the system on the Itchen, with a greater transition on the Test with the most diverse communities being found in the lower reaches where the substrate is more varied.

Both chalk rivers support abundant and species-rich aquatic vegetation; water crowfoots (*Ranunculus spp.*) and blunt-fruited water-starwort (*Callitriche obtusangula*) are abundant throughout both river systems, where flow and substrate conditions suit. Lesser water-parsnip (*Berula erecta*) and fool's water-cress (*Apium nodiflorum*) also dominate the in-channel environment.

In the deeper middle to lower reaches mare’s tail (*Hippurus vulgaris*), branched bur-reed (*Sparganium erectum*) and common club-rush (*Schoenoplectus lacustris*) are more abundant. River water dropwort (*Oenanthe fluviatilis*), a nationally rare plant, was also observed. Extensive growth of blanket weed (*Chladophora agg.*) was observed on the Test, highlighting water quality issues associated nutrient enrichment potentially compounded by low flows. However, concerns surrounding water quality have reduced as a result of Environment Agency monitoring between 2006 and 2012, which has shown that water quality has improved.

Along the Test and Itchen marginal vegetation is largely dominated by sedges (*Carex spp.*), interspersed with stands of common reed (*Phragmites australis*), common club-rush (*Schoenoplectus lacustris*), and great reed mace (*Typha latifolia*), especially in areas where vegetation is left unmanaged.

Tree cover varies considerably along the extent of both rivers. Trees are a key feature of a naturally functioning riparian corridor; bankside roots provide stability as well as important habitat for fish, crayfish, and aquatic insects. Adult white-clawed crayfish utilise tree roots and rocks in the banks to provide shelter, whilst juveniles shelter in vegetation and grass growing out of the river banks (Jacobs, 2012). Overhanging bows provide cover for fish and a diversity of water temperatures. In addition fallen trees provide a source of woody debris which can act to locally improve habitat heterogeneity which is important within previously modified reaches of the river.
Bed substrate is dominated by course gravels in the faster flowing sections, with silt deposits generally occurring upstream of structures and in slower flowing, modified reaches. A coarse substrate alongside in-channel vegetation provides valuable habitat niches for bullhead (Cottus gobio), a species of primary reason for SAC designation. Bullhead require good water quality, extensive beds of submerged vegetation that act as a refuge for the species, and coarse sediments that are vital for spawning and juvenile development (JNCC, 2012). Much of the in-channel vegetation required is provided by communities of Ranunculus spp. and Callitriche obtusangula, both also key qualifying features for the SAC and SSSI notification.

Both rivers are world renowned for game fishing, largely provided by brown trout, and to a lesser extent salmon and sea trout. The rivers are managed for trout (brown and rainbow) with fishing for sea trout and Atlantic salmon also taking place. In the middle to the uppermost reaches of both rivers native populations of brown trout are believed to persist, and bullhead and brook lamprey are notable elements of the natural fish fauna.

The species and habitats that qualify the River Itchen for SAC designation are given in Table below. The features which qualify the rivers for SSSI designation include fen and wetland habitats as described in sections 3.1.2 and 3.1.3. The requirements of these species reflect the geomorphological characteristics of lowland rivers such as the Test and Itchen Table.
### Table 9: The habitat requirements of qualifying species found within the Itchen SAC

<table>
<thead>
<tr>
<th>Reason for site selection</th>
<th>Species</th>
<th>Habitat requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annex I habitats that are a primary reason for selection of this site</strong></td>
<td>Water courses of plain to montane levels with the <em>Ranunculion fluitantis</em> and <em>Callitricho-Batrachion</em> vegetation</td>
<td>Grows on gravel riffles where flow is relatively swift and shallow (ideally 0.3–0.5 m/s). Requires good light for photosynthesis so is sensitive to siltation and shade and does not occur in deep slow flowing areas. There needs to be at least 5 cm of water over riffles in summer (when flows are lower).</td>
</tr>
<tr>
<td><strong>Annex II species that are a primary reason for selection of this site</strong></td>
<td>Southern damselfly <em>Coenagrion mercuriale</em></td>
<td>Specialised habitat requirements, being confined to shallow, well-vegetated, base-rich runnels and flushes in open areas or small side-channels of Chalk rivers. Most sites are on wet heath.</td>
</tr>
<tr>
<td>Bullhead <em>Cottus gobio</em></td>
<td></td>
<td>Small bottom-living fish that inhabits a variety of rivers, streams and stony lakes. It appears to favour fast-flowing, clear shallow water with a hard substrate (gravel/cobble/pebble) and is frequently found in the headwaters of upland streams. However, it also occurs in lowland situations on softer substrates so long as the water is well-oxygenated and there is sufficient cover. It is not found in badly polluted rivers.</td>
</tr>
<tr>
<td><strong>Annex II species present as a qualifying feature, but not a primary reason for site selection</strong></td>
<td>White-clawed (or Atlantic stream) crayfish <em>Austropotamobius pallipes</em></td>
<td>Lives in a diverse variety of clean aquatic habitats but favours hard-water streams and rivers. Non-native species of crayfish are a major threat to the native white-clawed crayfish. White-clawed crayfish habitats include crevices in rocks, submerged plants and tree roots or features which provide shelter from predators. They feed on all manner of live and dead organic matter (fallen leaves, vegetation, worms, insect larvae, small fish and other crayfish).</td>
</tr>
<tr>
<td>Brook lamprey <em>Lampetra planeri</em></td>
<td></td>
<td>Requires clean gravel beds for spawning and soft marginal silt or sand for the ammocete larvae. It spawns mostly in parts of the river where the current is not too strong.</td>
</tr>
<tr>
<td>Atlantic salmon <em>Salmo salar</em></td>
<td></td>
<td>Spawning requires shallow gravelly areas in clean rivers where the water flows swiftly. Atlantic salmon also require sufficient depth and an unobstructed channel to migrate downstream as a smolt and upstream as an adult to spawning grounds. Appropriate nursery habitat is also an important requirement.</td>
</tr>
<tr>
<td>Otter <em>Lutra lutra</em></td>
<td></td>
<td>Semi-aquatic mammal, which occurs in a wide range of freshwater and coastal areas. Inland populations utilise a range of running and standing freshwaters. Suitable habitat includes vegetated river banks, islands, reed beds and woodland (used for foraging, breeding and resting).</td>
</tr>
</tbody>
</table>

*Source: Jacobs, 2012 and JNCC, 2012*
5.2. Contemporary river characteristics

5.2.1. Bed

The bed material of both the Rivers Test and Itchen is primarily composed of coarse gravels covered by varying amounts of fine sediment in the form of both sand and silt. In general terms, in sections where the river has been impounded by structures downstream, flows are relatively slow and uniform upstream of the structure, causing sediment deposition, while localised increase in energy causes scour downstream.

Many of the control structures on both the Test and Itchen are redundant and are associated with the historic management of the river for water meadows and cress beds (Figure 5(f)). These structures create an impoundment leading to sediment deposition upstream. These flow control structures and associated tributary water meadow carriers can also be a source of sediment input to the main channels. This point source input of fine sediment, largely reflects issues of wider catchment management. A number of cases these carriers can provide good habitat for invertebrates and spawning fish, as a result of gravel beds, and appropriate depths and velocities.

Channel maintenance is observed to influence the character of the bed material. Annual in-channel vegetation cutting largely reduces the encroachment of marginal vegetation (Figure 5(b)). This effectively leads to over-widening that limits the development of marginal silts, thereby preventing the establishment of marginal vegetation and a more natural flow regime, responsible for a more natural bed structure. In effect, it also creates an environment whereby deposition will occur across the channel cross-section which affects the quality of the spawning habitat.

Rehabilitation work to raise the bed level through gravel addition has been undertaken in a number of modified reaches, particularly those managed for fishing. Bed raising reinstates a more natural bed substrate and overall width-depth ratio. However, the works usually only result in localised improvement and often impounds the flow upstream of the works so an understanding of the bed gradient is critical to the success of this measure.

In a few more natural reaches, marginal vegetation seasonally narrows the effective width of the channel, causing a diversity of flow types and a gravel substrate which is low in silt, characteristic of chalk river systems (Figure 5(a)).
Figure 5: Examples of bed variation on the Test

(a) a more natural reach where marginal vegetation is narrowing the flow (b) an over deepened, ponded section of channel with a silty bed (Geodata, 2010). Photo (c) shows uniform flows and a silt laden bed on the Bourne, and (d) highlights bank poaching by livestock on the Test. Pictures (e) on the Test and (f) on the Test, show drainage ditches and side carriers associated with the historic management of the river and a potential source of accelerated sediment input.

5.2.2. Banks
The walk over survey of the Test and Itchen indicated that banks are relatively uniform, often with a symmetrical cross-section, even at the bends of the river where a greater degree of variation across the cross-section would be expected. The symmetrical banks are characterised by steep, often vertical, sides, leading to an abrupt transition between the marginal and bank side habitats. These steep-sided banks are likely to have been put in place during historic straightening or re-sectioning of the channel and result in a reduced marginal habitat, causing uniform flows. This has caused reduced habitat for flies to lay their eggs and loss of refuge for fish.
It should be stated that there are exceptions to this overall uniform trend (as in Figure 6 photo (a) on the Test below), where deposition has occurred on the inside of bends and there is a more gradual transition from aquatic to terrestrial vegetation. There is also evidence of recovery of river banks, primarily due to vegetation colonisation and localised scour caused by variation in flow.

Bank erosion has occurred as a result of some forms of traditional management. In particular, bank erosion is taking place downstream of impoundments which have caused localised scour. In addition, erosion can occur in heavily re-aligned sections where the bend is unnaturally sharp. Furthermore, bank collapse was observed to be a widespread feature on the Test, with the river undercutting the softer banks particularly where it has been exacerbated by poaching from people, dogs, and livestock causing the bank to collapse. Bank erosion has also occurred in more natural locations on bends, where flow is concentrated on the outside of the bank. This is a natural feature of river systems but due to the low energy conditions on the Test and Itchen this is less common than on rivers with different typologies.

The banks are generally composed of earth/alluvium or fine sediments, which does not reflect the composition of the largely gravel bed. The lack of coarse sediment or gravels in the bank is likely to be the result of historic engineering of the channel and/or its long term evolution. This absence of coarse sediment means that a natural supply of gravel to the channel is minimal. Where vegetation has been allowed to establish, it is present along the bank face, reflecting the stability of the system and the cohesive bank material.

Bank erosion is a naturally occurring process and provides a source of sediment to the river which contributes to the diversity of flow and substrate downstream. Eroding banks also provide a habitat for crayfish, mammals and birds. However, where bank erosion is accelerated due to land use, traditional management, or structures in the channel, this may have adverse impacts i.e. accelerated sediment input or pose a threat to the stability of infrastructure.

Figure 6: Examples of banks on the Test and Itchen

(a) past deposition on the inside of a bend (b) a gradual transition from wet to dry habitats (Geodata, 2010). Photos (c) and (d) show uniform cross sections with steep-sided banks on (c) the Test and (d) a meander on the Itchen.
5.2.3. Riparian zone and floodplain

The riparian zone and floodplain along both the Test and Itchen has been extensively modified by surrounding land use pressures. Under historic conditions it is likely that the river banks would have been a mixture of fens, wet grassland, and wet woodland. Today, areas of fen and wet woodland are minimal, with limited stretches of wet woodland in the upper Test and Itchen where it has been left unmanaged. Clearance of the woodland and land drainage for agriculture has resulted in a progressive and significant reduction in the width of the riparian zone, with tree-lining often being confined to a single line of trees (Figure 7, photo (e) below), where present.

In many sections of the river the riparian zone lacks trees and riparian vegetation altogether (Figure 7, photo (f)). In a natural river system the riparian zone would show a transition from wet to dry, with marginal in-channel plants, to wetland species, followed by terrestrial plants i.e. grasses, tall herbs, bushes and trees, most similar to photo Figure 7 (a). Changes in land use of the wider floodplain, and changes to the use of the rivers themselves have dramatically decreased the land available and the fluctuations in water levels that would have maintained a mosaic of different habitats.

Draining of the floodplain results in a few key impacts including reduction in the variety of habitats particularly fens and wet woodland. This in turn reduces important habitat for bird species and otter offered by fen and bank side scrub. The loss of wet woodland reduces cover for fish and crayfish; habitat for foraging and breeding; supply of organic debris; roots to stabilise the banks; and a reduction in the source of woody debris. Floodplain drainage results in increased efficiency of movement of water from the soil to the river during rainfall events. Cultivated land, the product of land drainage, is more susceptible to erosion and will increase the supply of sediment to the channel (Jacobs, 2012). In addition drainage works and lack of management have led to fens being removed, drying out or being lost to wet/dry woodland.

In addition many reaches of the river are perched or embanked, making the river in these sections disconnected from the floodplain. These sections are often highly modified sections of the river which could be targeted for restoration.
5.2.4. Flow

5.2.4.1. Flow types

Variation in flow needs to be considered in context of the flow conditions at the time of survey. When the survey was undertaken by Atkins flow conditions were higher than usual, with a number of instances where flows had overtopped the bank. These conditions could result in higher energy flow types than would usually be observed and often meant the water was too turbid to observe the substrate.
Based on the snapshot data that was recorded at the time of survey, generally the variation in flows along the Test and Itchen coincided with the variation observed in bed substrate; with riffle sections of unbroken standing waves with a substrate of coarse gravels and vegetation encroachment (Figure 8(b)).

However, the predominant flow type recorded was ‘smooth’ flow, which more often than not reflected other factors, rather than the bed substrate or gradient. These other factors include channel width, depth, planform, the presence of structures and the occurrence of woody debris and marginal vegetation. These factors are largely due to present and historic river management, where over-widening, dredging and water control structures, have all caused slow, uniform, smooth flows (see Figure 8(a)). It is within these reaches with uniform flow that for restoration and rehabilitation efforts could be prioritised.

Figure 8: Flow variability

a) Uniform flow caused by a downstream impoundment on the Test and (b) flow variation largely as a result of in-channel vegetation on the Itchen.

5.2.4.2. Woody debris

As stated in section 5.1.2 woody debris can assist a previously modified section of river to re-establish more natural features, including greater flow variation. It is recognised as one of the key features that can improve the quality of salmonid habitat. The Atkins survey recorded all locations of woody debris and whether or not they had a hydraulic effect. The results of the survey found that there were relatively few accumulations of woody debris along both the Test and Itchen, but where they were present they usually had an effect on flow.

The amount of woody debris in the channel is likely to reflect a combination of the absence of flows sufficient to transport wood downstream and promote accumulations, land-use pressures resulting in a lack of trees in the riparian zone, and to a greater extent, the maintenance regime. Channel maintenance was largely observed to keep the channel clear of obstructions and the marginal vegetation to a minimum. This was highlighted by unmanaged reaches that had a greater number of woody debris accumulations (see photo (a) and (b) below in Figure 9).
Figure 9: Woody debris

Woody debris causing flow variation on (a) the Itchen and the (b) Candover stream (part of the Itchen SAC) (Geodata, 2010). Photograph (c) shows a modified section of river on the Test that would benefit from the addition of woody debris and (d) log deflectors that have been used to create flow variation on the Test (Geodata, 2010).

5.2.5. Planform and cross section

The channel planform of both the Test and Itchen varies considerably, from more natural meandering sections (Figure 10, photo (d)), to sections where the channel is completely straight (Figure 10, photos (a) and (b)), to reaches where the channel splits between multiple channels (Figure 10, photo (c)), where the main channel may remain more sinuous while multiple, artificial and straight off take channels run alongside. This complicated network of channels would not have formerly existed and are the result of historic modification for industry and agriculture e.g. mills, water meadows, and cress beds.

While straight sections of river do exist naturally, this is unusual for lowland rivers for any significant length. Generally reaches on the Test and Itchen that possess a predominantly straight channel are the result of historic modification. The majority of both rivers were recorded to be subject to some kind of modification, with straightening and realignment being the most common.

There are many sections of channel which may have been historically realigned, but have slowly re-adjusted to establish more natural features. Additionally, artificial carriers and drainage ditches, which are often completely straight and far from reflecting natural river planforms, provide valuable wetland habitat. Where a channel has been modified or is wholly artificial the development of in-stream features means that the channel can have some degree of morphologically diversity even though this can be limited. Furthermore, some of the meandering sections of the river are relatively uniform in their cross section; this is likely to be the result of historic channel realignments and the low energy nature of the Test and Itchen. This prevents active erosion and deposition from occurring and impoundments downstream also create low energy conditions.

The channel cross-section of the Test and Itchen indicate that extensive re-sectioning as well as realignment and straightening was undertaken. Channel deepening, through dredging to improve land...
drainage, primarily involves the excavation of fine sediment from the bed, but may also involve gravel removal. The main dredging of the Test, to improve land drainage, was undertaken downstream of the confluence with the River Anton. Dredging upstream of that point is likely to have been carried out for fisheries purposes. Excavation of the bed was undertaken, which included gravel removal, to make the channel deeper and enable the shallow channels to hold larger fish. Only limited areas of the main Test were protected from dredging. This historic and present day modification is likely to contribute to a low width to depth ratio.

Figure 10: River planforms

Straightened section on (a) the Itchen and (b) the Test. Photograph (c) shows an artificial section with multiple channels on the Test and (d) a meandering section of river on the Itchen.

5.3. River Modifications

5.3.1. Weirs

Weirs and structures in the channel are generally linked with negative impacts on the physical and ecological condition of the river (Figure 11). Firstly, structures can significantly alter the depth of water and velocity of flow, leading to over deepened impounded reaches upstream, altering the habitat characteristics. Secondly, structures affect the rivers ability to transport sediment downstream, again altering habitat characteristics. Finally, structures in the channel impact upon the biological connectivity of the river, preventing fish and invertebrate passage.

Structures on the Test and Itchen and their resulting impact on the apportionment and type of flow are considered one of the greatest pressures on the physical naturalness of the river (Geodata, 2010). There are numerous impoundments on both the Test and Itchen, some of which are redundant and are associated with the historic management of the river. The extent of the in-channel structures on the Test and Itchen is illustrated in Appendices A.1 (Test) and A.2 (Itchen). The significance of their impact will depend on a number of factors including, the length of impoundment, the degree of interruption to biological connectivity, and the impact on the morphology of the channel. Those reaches where the impact is assessed to be the
greatest should be targeted for removal or partial removal /lowering. In developing potential options, constraints such as historic environment, flood risk management and water level management for adjacent wetland interests need to be considered.
Figure 11: Structures

Photos (a), (b), (c), and (d) show structures on the Test. Photograph (e) is an off-take on the Dever (f) and (g) show historic structures on the Itchen and (h) shows a weir downstream of a bridge.

5.3.2. Bank protection

Bank protection is not extensive along the SSSIs as a whole, which highlights the passive nature of both rivers. However, there are localised areas of bank protection interspersed across both rivers (Figure 12). The most widely observed bank protection was full bank, timber or sheet piling, used on the outside of meanders. Another widespread type of bank protection is concrete reinforcement, evident upstream and downstream of structures and to protect infrastructure through urban centres. The exception to this general trend is the Itchen Navigation, throughout which bank protection is extensive and necessary to maintain the perched system.
5.3.3. Embankments

There are few formal flood defence embankments on either the Test or the Itchen. There are however intermittent stretches of earth embankments on both rivers ranging from 0.5–1.5 m high. Embankments are often bordering pasture or arable land, limiting livestock access and preventing flooding (particularly on the fringes of urban areas). The majority of the Itchen Navigation channel is perched, with embankments built up to raise the banks above the floodplain, see photo (d) in Figure 13 below.
5.3.4. Maintenance

As discussed, both the Test and the Itchen have been extensively modified and managed through mill weirs, mill ponds and sluices, water abstraction for agriculture, former water meadows and cress beds (Geodata, 2010). A number of these modifications and structures are now redundant. The principal management of the rivers are now for fisheries, which emphasises the need for appropriate vegetation management of channel bed and banks.

The maintenance regime on both river systems is extensive, with vegetation management being the most dominant element (See Figure 14). The techniques applied to vegetation management affect the diversity of habitats present, through severe vegetation management practices, which in turn results in over-widened, uniform reaches. This creates sediment depositional zones and affects the rivers ability to re-establish a more natural flow regime and its ability to recover naturally. At the time of the survey, vegetation management was recorded as an issue on the majority of reaches, particularly those managed for fishing. A typical fisheries reach had little emergent vegetation with a narrow marginal strip (usually sedge) of approximately 0.5 m, beyond this was a wide mown strip, 2–3 m wide. In addition, there are a number of fisheries managed sections where little or no margin is left over the winter period which is commonly known as ‘putting the river to bed.’

In-channel vegetation cutting was also extensively undertaken. While in-channel vegetation re-establishes relatively quickly, severe management techniques again affects the rivers ability to recover naturally, with weed cutting being a practice that requires careful management. Tree management and the removal of woody debris was also evident, with a limited number of accumulations of woody debris recorded. The only location where coarse woody debris was prevalent to any significant degree was in sections of river where management of the riparian corridor was limited.
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The result of this intensive management is a lack of habitat diversity, over-wide sections with uniform flows and a reduction in the rivers ability to re-establish natural features that would be expected on a Chalk river system. A reduction in habitat diversity directly affects the species that rely on these habitats for instance, a reduced marginal vegetation results in a loss of fly life and a loss of refuge for fish. There were exceptions to this type of management; on some reaches lighter management techniques were employed whereby vegetation was selectively removed, resulting in greater variation across the channel. In a number of locations reaches were left largely unmanaged, which allowed the river to establish pools, riffles, variation in substrate, and a mosaic of different habitats across the channel.

Limited in-channel work such as dredging and bank reinforcement had recently been undertaken, which can impact the channel’s morphology and ability to recover. This type of in-channel work requires prior consent from the Environment Agency.
Figure 14: Riparian maintenance

Appropriate riparian maintenance on (a) the Test and (b) the Itchen and (c) the Itchen Navigation. Inappropriate maintenance is shown in photos (d) and (e) on the Test, (f) and (g) on the Itchen and (h) on the Itchen Navigation. The photograph shown on (d) shows vegetation management which was undertaken for water vole mitigation as a result of a weir removal at the end of the reach.

5.3.5. Key pressures

Within two river systems there were a variety of different pressures identified which affects the physical form and functioning of the channels which in turn determines the associated ecological functioning of these rivers. Principal pressures include:

Riparian Zone
- Modified by land use pressures leading to a reduction in tree cover in total area and width of riparian strip.
- Degradation of buffer strip leading to a reduction in complexity of the riparian corridor.

Banks
- Uniform banks due to historic re-sectioning of the channel leading to near vertical sides in places and an abrupt transition between marginal and bank side habitats.
- Limited complexity of marginal strip due to marginal vegetation management practices.
- Heavily poached in places leading to accelerated fine sediment input into the river. This is related to livestock pressure as well as human and dog access.

Bed
- Reduction in habitat diversity due to dredging, weed cutting practices and removal of coarse woody debris.
- Over-widening leading to significant lengths of channel which are prone to deposition.

Planform
- Channel straightening and re-sectioning has led to a reduction in longitudinal and lateral habitat complexity.
- Both rivers are perched in places with embankments on either side due to historical legacy of mills, water meadows, fish farms and watercress beds.

Flow (types and velocity variability)
- Both rivers are low energy systems but flow variability is reduced due to historic modifications affecting channel planform (straightening, widening and re-sectioning) and longitudinal connectivity (impoundments and deepening).
- The lack of coarse woody debris within the rivers reduces flow and velocity variability.

The pressures exist throughout the two rivers and across the various SSSI units. A summary of how these are geographically distributed is detailed in Table 10. An assessment of the scale of the pressure on each SSSI unit is also made to determine whether it was a) present, b) localised (<10%) and c) Extensive (>60%) on the various reaches within the SSSI units.
<table>
<thead>
<tr>
<th>River</th>
<th>SSSI Unit</th>
<th>Bed</th>
<th>Banks</th>
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<tr>
<td></td>
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<td>Reduction in bed diversity through dredging, weed cutting and removal of coarse woody debris</td>
<td>Uniform banks</td>
<td>Poached channel</td>
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</tbody>
</table>

**KEY** - P: Present (<10%), L: Localised (>10%<60%), E: Extensive (>60%) and '-' Not present
5.4. Previous restoration on the Rivers Test and Itchen

During the walkover surveys some previous restoration and enhancement works were observed at various locations throughout both catchments which included (see examples in Figure 15):

- the addition of gravels at certain locations to locally raise the channel bed and improve habitat;
- gravel cleaning to improve fish spawning potential (short-term enhancement solution to improve spawning habitat);
- the removal of small weir structures to improve channel continuity;
- sluice alterations connecting the main channel to side carriers as part of water level management works for surrounding water meadow SSSI units;
- the diversion of side carriers to flow back into the channel at different locations for the benefit of fisheries management;
- insertion of deflectors to narrow the channel and improve flows as part of improved fisheries management;
- a move towards more ‘wild’ fisheries management i.e. letting the channel develop naturally by limiting mowing all the riparian zone of marginal habitat and by not removing woody debris;
- coppicing works to allow more light to penetrate through to the channel;
- fencing and the installation of cattle access points to prevent widespread poaching and large volumes of sediment entering the channel; and,
- notices at several fisheries clubs to warn and prevent the spread of alien/invasive species.
Examples of restoration (a) a small carrier on the Test where overhanging branches are periodically cut back – the work soon to be undertaken again (b) gravel cleaning on the Test, (c) the diversion of a carrier into the main River Test to create a riffle feature and improve connectivity for fish habitat and (d) a cattle access point along a fenced section of the Test, (e) assumed that new channel had been cut and a small island created on the main Itchen near to Eastleigh STW, (f) weir removal on the River Test, (g) basic deflectors on the main River Itchen to narrow the channel and improve flows, (h) bed level raising to create longitudinal diversity on a small side channel of the Itchen, (i) gravel re-profiling on a side channel of the River Itchen to create habitat diversity, (j) a move towards a more wild type of approach to management on the River Test at Broadlands.

In addition to the work already undertaken there were several locations where Environment Agency staff, river keepers or landowners mentioned that restoration works or alteration of management practices were being planned, progressed or were soon to be carried out. Where possible this information has been incorporated within the strategy.
One section of channel where it was evident that large amounts of restoration work had been completed fairly recently (over the last few years) was on the Itchen Navigation channel. In 2007 Atkins prepared a report entitled ‘Detailed design of bank protection works on the Itchen Navigation’ for the Hampshire and Isle of Wight Wildlife Trust for the purpose of planning where soft bank protection works were necessary along the Navigation channel (Atkins, 2007). Following a site investigation to understand the opportunities and constraints of each reach, 19 reaches were prioritised for localised detailed design and implementation. These reaches either had erosion that was impacting on structural integrity of the channel banks, footpath and habitat or where limited action could result in significant benefits.

Although an artificial watercourse, the Itchen Navigation Channel was still very much accessible to the public and there was emphasis on public engagement and education so that the community would understand why the restoration works were being carried out and what techniques were being used (Figure 16).

Figure 16: The Itchen Navigation channel downstream of Shawford

Along sections of the Itchen Navigation reach it was clear that works have now occurred. The majority of the works were undertaken by the Itchen Navigation Heritage Trail Project, a 5 year project to conserve the Itchen Navigation (http://www.hwt.org.uk/pages/itchen-navigation-2.html). Works included:

- embankment stabilisation by hard and soft engineering techniques;
- marginal planting;
- fencing to discourage dog access and therefore reduce poaching of the bank;
- provision of sections for dog access into the river, and
- footpath improvements.

Although the aim of the Itchen Navigation Restoration was not directly linked to improving the channel in terms of improving the condition assessment of SSSI units, the actions generally are in line with restoration aims of this strategy (see Figure 17). The strategy will seek to build on the work already completed on the Itchen Navigation channel. When undertaking detailed design for new actions along this reach in the future, lessons from previous works (such as where marginal habitat has been created and where fencing needed to be installed for continuous lengths to protect against erosion via dog poaching) should also be taken into account.
Figure 17: Actions undertaken on the Itchen Navigation channel

a) Reach downstream of Brambridge on the Itchen Navigation Channel where the bank has been stabilised, footpath improved and riparian and marginal planting carried out and subsequently fenced off to allow it to establish. Photograph (b) shows a structure to a side carrier installed downstream of Allbrook, (c) structure removal at a disused lock adjacent to Stoke Common and (d) wooden stakes as part of bank stabilisation bio-engineering techniques downstream of Shawford.
6. River Restoration Potential

6.1. Summary of restoration potential

Many pressures have been identified on the Rivers Test and Itchen and they often impact on both the physical form and function of the channel together within the same reach. For example, where artificial straightened channels have been created there are frequently structures in the vicinity and associated bank protection. Restoration of the channel should be undertaken using an overarching approach and seek to come up with a solution that takes account of the pressures influencing channel planform, banks and bed, continuity and the riparian zone together.

The main physical modifications identified on the Rivers Test and Itchen (which contribute to the unfavourable statutes of the SSSI) are the artificial channels and associated water level control structures. Some of these physical modifications can be locally examined and potentially modified, to change flow apportionment, or removed/ lowered to reduce impacts.

The most extensive pressure in terms of spatial extent which impacts on the physical naturalness of the channel is riparian and marginal (bank side) vegetation management practices. Improved practice is deemed to be achievable over a relatively short term, and assuming active and continued uptake over large areas, the diversity and continuity of riparian corridors would be improved. Benefits of better riparian management include a buffer from agricultural land helping to reduce fine sediment supply and nitrates to the channel. A buffer could also be provided by woodland, which would in turn provide a source of woody debris and habitat in the form of cover, shelter and shade for the various ecological receptors. Buffers in the form of restored fenland tussocky grassland and species rich damp meadows could also be introduced.

The river channel and riparian zone potential for each reach is summarised in Appendix B and outlined in greater detail in the maps in the same appendix showing River Test and Itchen Restoration Plan. Some key considerations for each key river characteristic are set out below.

6.1.1. Riparian Zone and Floodplain

Feasible actions such as lowering or removing embankments (to re-connect the channel to the floodplain) or the planting of trees (so that the channels revert to have semi-continuous tree lining) would help in re-connecting the river and the floodplain.

On a limited number of reaches at sporadic locations throughout the catchment, land-use of the riparian zone was for livestock and at some of these locations there was poaching of the banks where fencing had not been installed. Poaching was also an issue on the River Itchen Navigation where there was good public access and where it was heavily used by dog walkers. Grazing pressure management or fencing could be undertaken to reduce poaching pressure on the riparian zone. If fencing is installed, arrangements to manage the vegetation inside the fence line must be agreed with Natural England.

Within the more urban locations bank protection or culverts were identified which sometimes prevented marginal and riparian vegetation from developing. Although a relatively minor pressure in terms of its extent when compared to the entire length of the rivers, this is an issue that will need addressing in the future.

Actions required to improve the riparian zone will therefore vary depending on the land-use and type of pressure acting on the riparian zone.

6.1.2. Banks

The Itchen Navigation channel has partially been restored along specific sections and as part of this work bank profiles have been improved because of berm creation and marginal and riparian planting. This type of soft engineering approach has helped stabilise banks along prioritised reaches where recreational access was exacerbating bank collapse. Bank erosion across the catchments is not a widespread feature and tended to be particularly associated with poaching from dogs, humans and livestock. In addition bank erosion on the Test is caused by structures and over-deepened sections where the river undercuts the bank. There is potential to undertake some bank re-profiling works locally along some reaches, particularly in combination with marginal and riparian planting to create habitat.
6.1.3. Bed
Improving the diversity of the bed substrate and longitudinal topographic variation is critical to improving habitat. A key action would be to change the maintenance regime and the addition of woody debris to the channel, which would allow vegetation to establish that could support in the creation of flow variation and bed sorting. Equally important is the removal or lowering of structures, which would reduce the impoundment of flows and therefore sediment deposition in these ponded reaches. Removal would re-introduce free flowing sections upstream which would help mobilise sediment. In developing removal or lowering options, constraints such as historic environment, flood risk management and water level management for adjacent wetland interests need to be considered. Links to other strategies, such as the Water Level Management Plans should be considered as removal/lowering could conflict with past/planned Water Level Management Plan works. Localised de-silting could also be an appropriate measure in reaches that are suffering from significant levels of deposition. De-silting is not sustainable over the longer term, it is therefore recommended that localised de-silting be used in conjunction with trying to increase flow variability and measures to address this pressure. De-silting should be restricted to locations whereby the primary pressure is removed (e.g. weir removal) which could have a detrimental impact downstream if bed sitting was not undertaken in conjunction with the particular action.

6.1.4. Planform
Due to the historical management legacy there is a complicated network of channels on both rivers with some branches of the channel are perched and a few are embanked along some sections along with channel straightening and re-sectioning. It is often not possible to restore the channel planform because of land-use pressures. However, there is the potential to do in-channel works such as adding woody debris or deflectors to locally narrow the channel to improve the sinuosity within the constraints of the straightened reach. In other cases the flow apportionment along old tributary branches could be altered and redundant channels turned into wetland features. When suggesting this type of restoration, links to other strategies, such as the Water Level Management Plans should be considered because an option to restore a section of river could conflict with past/planned Water Level Management Plan works in the floodplain.

The Itchen Navigation channel runs parallel to the main Itchen and has an artificially straight planform. The canal has undergone restoration works over the last few years to, in part, narrow the channel using bioengineering techniques. This type of work has improved the channel sinuosity and additional work of this type can be undertaken along other reaches to further improve the diversity of hydromorphology along this reach.

6.1.5. Flow
It may be possible to remove, lower or alter a control structure to lessen the impounding nature of the structure on the flows. Localised occurrences of woody debris and dense marginal vegetation act to create flow variation and there is the potential to create greater flow variation through the addition of woody debris to the channel and altering the maintenance regime to selectively allow a greater area of in-channel vegetation to establish.

Some of the artificial secondary channels have been historically over-deepened by dredging which exacerbated the slow flows. Bed raising may be possible along some of these reaches. Occasional riffle features were observed along the main channel, often where gravel had been added or had been cleaned following gravel cleaning. Where side carrier channels rejoined the main channel, connecting two larger channels, there was often a steep gradient and these small channels provided good habitat because of their riffle sequences, albeit being artificial features.

6.2. Reach-scale restoration plans
The approaches to restoration vary from more significant restoration measures to actions to help natural adjustment or recovery where the energy and sediment is available, or management measures to conserve and enhance those reaches already exemplifying features in accordance with Favourable condition. These categories of action are set out below and illustrated spatially on maps in Appendix A (A.3 for the River Test and A.4 for the River Itchen). These actions have been assigned to the various reaches surveyed as part of the strategy.

6.2.1. Conserve and enhance
This category represents reaches where restoration or enhancement works are minimal. In these reaches actions to restore the morphology of the channel were deemed unnecessary. However despite a good morphology there is opportunity to make further improvements, often involving the management of the river.
Management actions such as control structure management and vegetation management would fall under this restoration activity, helping to mitigate failure to achieve Favourable condition or deterioration of the water body condition (adapted from Geodata, 2010).

### 6.2.2. Rehabilitate

This category covers those reaches where the channel shows evidence of adjustment to a more natural form, or potential to adjust, following historic modification. However pressures remain, affecting the in-channel and riparian habitats, which will prevent the river from recovering to support favourable condition. Typically actions to rehabilitate the river are focused around in-channel measures such as the addition of woody debris to narrow the channel or bed raising, which will assist the river in establishing more natural features. In instances where the riparian zone has been significantly degraded, measures associated with vegetation management are suggested. Improving the condition of the riparian zone through the introduction of grassland, fen and woodland will again assist channel recovery. An improved riparian zone will provide a buffer to the channel, bankside habitat, a supply of wood and marginal vegetation, creating variations in flow and leading to more varied channel morphology.

### 6.2.3. Restore

This category of restoration encompasses those reaches which are degraded and do not show evidence or the potential to naturally re-adjust and recover. These reaches require fundamental restoration measures in order to achieve favourable condition. Restoration measures include the removal/lowering of significant structures, and the re-naturalisation of planform. The latter option may require re-notification action to ensure that the new channel alignments have statutory protection (Geodata, 2010).

### 6.3. Stakeholder engagement

The actions set out in the accompanying Restoration Plan need to be undertaken to achieve favourable condition in the SSSIs. This Restoration Plan is seen as the framework for the improvement of both riverine SSSIs over the next 20–30 years and as such will inform future decision making by Natural England and the Environment Agency with respect to prioritisation and funding of measures and the suitability of management actions proposed on the two rivers.

It is widely recognised that successful implementation of any plan such as this requires positive engagement with landowners, land managers, river managers and key stakeholders, and this is even more critical with these two rivers given their local commercial, political and social importance.

To facilitate the involvement of key stakeholders, the project has taken a proactive, positive and inclusive approach to stakeholder engagement, by taking the following steps:

1. Distributing a newsletter to stakeholders to introduce the project, the people working on it, and the opportunities to be involved. (October 2012)
2. Establishing a Test & Itchen River Restoration website, with information and contact details available to the public. (October 2012)
3. Undertaking ad hoc stakeholder engagement throughout the initial site visits (undertaken by Atkins). (October/November 2012)
4. Holding a stakeholder consultation evening to present the project and gather views and concerns from stakeholders at the start of the project to help guide the direction of the strategy and promote an inclusive approach to stakeholder engagement. (November 2012)
5. Publishing the draft Restoration Plan on the project website. (February 2013)
6. Follow up event to gather stakeholder consultation feedback and answer questions following publication of the draft Plan (March 2013)

The first consultation event was held on the evening of 12th November in Sparsholt College, Hampshire. The Environment Agency invited all landowners, river keepers and potential stakeholders to the event and subsequently approximately 60 people attended, representing landowners, estates, river managers and key interest groups.

The evening was chaired by Tom Davis of the Test and Itchen Association who gave an introductory speech outlining his positive experiences of his involvement in the River Avon Restoration Plan. An initial presentation was then given by Heb Leman of the Environment Agency that introduced the project, outlined what it seeks to achieve and the timeframes involved. Atkins, as the environmental consultants working on the project, gave a further presentation that outlined the technical process involved and showcased some examples of successful restoration actions on other rivers undertaken as part of similar projects.
Following this, the presentation panel, consisting of representatives from the Environment Agency, Natural England and Atkins, took questions from the audience lasting approximately 1.5 hours.

This evening provided an excellent opportunity for those potentially affected by the project to raise any questions or concerns to representatives of the Environment Agency, and to meet other landowners and stakeholders to gauge a balanced viewpoint on the project. The opportunity to do this in advance of the production of the draft restoration plan has provided the option for these viewpoints to help shape the direction of the Plan.

The follow up meeting on 4th March 2013 was also held in Sparsholt College, Hampshire. Tom Davis of the Test and Itchen Association chaired the session. Firstly, Heb Leman of the Environment Agency provided a recap of the restoration strategy. Atkins followed by giving a presentation on the findings of their study. Finally, Jenny Wheeldon of Natural England gave a presentation on how other similar on other SSSI rivers have been implemented around the country.

The final plan will be published on the project website in April/May 2013. The Environment Agency and Natural England will then work with stakeholders to agree how best to deliver the Test and Itchen River Restoration Plan. The approach to implementation of the various measures within the plan will vary depending on the location and complexity of the actions, and there are also a number of different delivery mechanisms that can be used to help deliver these actions. As such, it is envisaged that an inclusive approach to working with stakeholders will be required throughout the lifecycle of the project, with the successful restoration of both rivers relying heavily on the involvement of the key stakeholders.

6.4. Restoration visions

The restoration measures identified together make-up a restoration vision, which defines how the river will function once the measures have been implemented. As the Test and Itchen have similar geomorphological characteristics, one restoration vision has been developed. Despite the highly modified nature of both channels, there are reaches along both water bodies that include sections that are largely natural and meet the requirements of favourable condition for physical habitat. These locations have been used as reference sites to help visualise the intended outcomes of restoration measures.

The following sections provide example visions of the restored Itchen and the Test. The aim of the vision is to increase the extent of the reference sites, making them dominant characteristics of the river. As a result, the diversity and availability of habitat and flow type will increase, making the channel more resilient to current pressures, such as extreme flows and temperature, water pollution and siltation.

6.4.1. The Rivers Test and Itchen

Both the Test and Itchen are classic Chalk rivers, meaning they are base rich, low energy, lowland rivers that do not change greatly in position over time. These channels typically have a meandering course with clean gravel beds, and few bars and riffles. Banks are generally fine grained and cohesive, making them resistant to erosion. Based on these typical characteristics of a chalk river, the features that would support favourable condition are summarised in Table 11 below.
<table>
<thead>
<tr>
<th>Feature and characteristics</th>
<th>Ecological benefit</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planform</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active channel recovery</td>
<td>Variations in channel cross-section associated with planform re-adjustment, contributing to habitat diversity.</td>
<td><img src="http://maps.google.co.uk/" alt="Planform Illustration" />. Reach upstream of the M27 bordering High Wood, Itchen</td>
</tr>
<tr>
<td>leading to a more sinuous channel planform.</td>
<td></td>
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</tbody>
</table>

<p>| <strong>Diverse bed and flow types</strong> | A diversity of bed and flow types should ensure suitable habitat for all life stages of characteristic species. This would include a varied invertebrate community relying on a diversity of bed material and flow types. Specific species include: | <img src="Itchen" alt="Diverse Bed and Flow Types Illustration" /> |
| Varied bed with shallow, fast flowing (riffle) sections with clean coarse gravels, characteristic of a Chalk river; deeper sections with glides and pools, with fine sediments; and areas of exposed gravels and marginal silts. | Water crowfoot and water starwort: grow on gravel riffles where flow is relatively swift and shallow. Bullhead favour fast-flowing, clear shallow water with a hard substrate or softer substrates so long as the water is well oxygenated and there is sufficient cover. White clawed crayfish: make up of crevices in rocks, submerged plants and tree roots or features which provide shelter from predators. Brook lamprey: requires clean gravel for spawning and marginal silts for larvae. Atlantic salmon: requires clean gravels with swift flow for spawning. | Itchen |</p>
<table>
<thead>
<tr>
<th>Feature and characteristics</th>
<th>Ecological benefit</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Varied bank profiles</strong></td>
<td>Banks that are varied with a generally reduced gradient leads to a more gradual transition from aquatic to terrestrial habitats, with marginal species such as water cress and water forget me not to wetland species such as canary grass, leading to more terrestrial rushes and finally grasses. More resilient to extremes of flow, provides refuge and cover for fish and fly life, feeding areas for water vole, and great diversity of marginal plants.</td>
<td></td>
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<td></td>
<td></td>
<td><img src="image" alt="Kimbridge, River Test" /></td>
</tr>
<tr>
<td><strong>Bank materials</strong></td>
<td>The benefit of softer bank materials, leads to sloping banks and a more gradual transition from the aquatic to terrestrial environments, with a range of habitats.</td>
<td><img src="image" alt="Kimbridge, River Test" /></td>
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<tr>
<td><strong>Undisturbed bank and riparian vegetation</strong></td>
<td>Submerged root systems provide a habitat for fish, particularly bullhead, white clawed crayfish and invertebrates. Trees provide woody debris and leaf litter to the channel, providing a source of food for invertebrates and contributing to flow variation. Tree lining provides diversity in-channel cover, further adding to habitat diversity and a habitat used by otters. Riparian scrub provides an important habitat for bird species, water voles and otter. Refuge and cover for fish and fly life, feeding areas for water vole, and great diversity of marginal plants.</td>
<td><img src="image" alt="Paper Mill Estate, River Test" /></td>
</tr>
</tbody>
</table>
### Feature and characteristics | Ecological benefit | Illustration
--- | --- | ---
**In-channel vegetation**  
Chalk rivers characteristically have a rich and diverse in-channel vegetation and fauna and marginal vegetation. | Water voles thrive in emergent vegetation. Insect fauna depend on a wetland margin for hatching, resting, feeding and mating, and a refuge during times of high flow. Invertebrates A diversity of bed and flow types should ensure suitable habitat for all life stages of characteristic species. This would include a varied invertebrate community relying on a diversity of bed material and flow types. Refuge and cover for fish, and clean spawning gravel between stands of vegetation.  
Specific species include:  
Southern damselfly: require well-vegetated, base-rich runnels and flushes in open areas or small side-channels of chalk rivers.  
White clawed crayfish: require shelter from submerged plants and tree and feed on live and dead organic matter including fallen leaves and vegetation.  
Otter: use reed beds for foraging, breeding and resting.  
Water-crowfoot and water-starwort: they may modify water flow, promote fine sediment deposition, and provide shelter and food for fish and invertebrate animals. | ![Illustration](Itchen)  
*Itchen*

### 6.4.2. Itchen and Navigation
The Itchen Navigation is an artificial channel covering approximately 17km. The Navigation is artificially straight throughout its length, resulting in limited options to improve the planform – largely due to land-use constraints. Despite this, there are a range of measures that could preserve and improve the remaining features of the channel, helping the waterway to meet favourable condition (Table 12 below).
<table>
<thead>
<tr>
<th>Feature and characteristics</th>
<th>Ecological benefit</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planform</strong>&lt;br&gt;As the channel is artificial measures to restore the channel planform have not been recommended.</td>
<td>N/A</td>
<td><img src="image1" alt="Planform Illustration" /></td>
</tr>
<tr>
<td><strong>Diverse bed and flow types</strong>&lt;br&gt;Despite this being an artificial channel, measures to increase the bed and flow variation would be of benefit, creating sections of riffle, pool, glide, with both silt and gravel substrate.</td>
<td>A diversity of bed and flow types should ensure suitable habitat for all life stages of characteristic species for which the river was designated, including:&lt;br&gt;&lt;br&gt;Water crowfoot and water starwort: grow on gravel riffles where flow is relatively swift and shallow.&lt;br&gt;Bullhead favour fast-flowing, clear shallow water with a hard substrate or softer substrates so long as the water is well oxygenated and there is sufficient cover.&lt;br&gt;White clawed crayfish: make up of crevices in rocks, submerged plants and tree roots or features which provide shelter from predators.&lt;br&gt;Brook lamprey: requires clean gravel for spawning and marginal silts for larvae.&lt;br&gt;Atlantic salmon: requires clean gravels with swift flow for spawning.</td>
<td><img src="image2" alt="Diverse Bed and Flow Types Illustration" /></td>
</tr>
<tr>
<td><strong>Varied bank profiles</strong>&lt;br&gt;As an artificial channel the cross-section is largely symmetrical, however measures to increase asymmetry, creating a cross-section with a variety of bank gradients, are recommended.</td>
<td>Banks that are shallow lead to a more gradual transition from aquatic to terrestrial habitats, with marginal species such as water cress and water forget me not to wetland species such as canary grass, leading to more terrestrial rushes and finally grasses. Soft bank protection techniques are considered more appropriate where they are necessary.</td>
<td><img src="image3" alt="Varied Bank Profiles Illustration" /></td>
</tr>
<tr>
<td>Feature and characteristics</td>
<td>Ecological benefit</td>
<td>Illustration</td>
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<tr>
<td>Bank materials</td>
<td>The benefit of softer bank materials, leads to sloping banks and a more gradual transition from the aquatic to terrestrial environments, with a range of habitats.</td>
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<tr>
<td>Undisturbed bank and riparian vegetation</td>
<td></td>
<td><img src="image1.jpg" alt="Image" /></td>
</tr>
<tr>
<td>Undisturbed bank and riparian vegetation</td>
<td>Submerged root systems provide a habitat for fish, particularly bullhead, white clawed crayfish and invertebrates. Trees provide woody debris and leaf litter to the channel, providing a source of food for invertebrates and contributing to flow variation. Tree lining provides diversity in-channel cover, further adding to habitat diversity and a habitat used by otters. Riparian scrub provides an important habitat for bird species, water voles and otter. Refuge and cover for fish and fly life, feeding areas for water vole, and a greater diversity of marginal plants.</td>
<td><img src="image2.jpg" alt="Image" /></td>
</tr>
<tr>
<td>In-channel vegetation</td>
<td>Insect fauna depends on a wetland margin for hatching, resting, feeding and mating, and a refuge during times of high flow. Water voles thrive in emergent vegetation. Southern damselfly: require well-vegetated, base-rich runnels and flushes in open areas or small side-channels of chalk rivers. White clawed crayfish: require shelter from submerged plants and trees and feed on live and dead organic matter including fallen leaves and vegetation. Otter: use reed beds for foraging, breeding and resting. Water-crowfoot and water-starwort: these plants may modify water flow, promote fine sediment deposition, and provide shelter and food for fish and invertebrate animals.</td>
<td><img src="image3.jpg" alt="Image" /></td>
</tr>
</tbody>
</table>
6.5. Restoration constraints

6.5.1. Land use

Land use is likely to present a constraint to restoration. As described in section 4.3, both rivers flow through a landscape which is predominantly productive agricultural land. As discussed in Floodplain and Riparian zone (section 5.2.3), it is largely the result of historic land use change i.e. the drainage of the surrounding floodplain for agriculture, which has confined or eradicated the riparian zone.

To restore the river to a truly natural state, extensive land use change would be required. This has not been suggested; however more minor changes to surrounding land use have the potential to make improvements to the riparian zone. For example, taking land out of arable production to create a wider riparian zone and buffer between the farmed land and watercourse would provide greater habitat diversity and help reduce agricultural run-off. Taking land out of production may present a financial barrier to the implementation of this option, in these instances incentive schemes such as agri-environment schemes should be pursued and discussed with the land owner/tenant farmer.

Changes to the surrounding land use may not always be an option. For example, Chilbolton Common on the River Test is common land for grazing and livestock access, resulting in heavy poaching for its extent. The historic significance of this common land may mean that is opposition to any recommendation to reduce stocking levels or erection of fencing. Similarly, increased tree cover to some locations may not be an option for a number of reasons including the presence of rare habitats, other SSSI designated features and the historic nature of the site. Changes to land use are not expected to be a widespread issue.

On the whole however, due to the historic and current management of both river systems (i.e. in-channel structures, historic engineering works, and present day vegetation management) land use is not the main constraint to restoration.

6.5.2. Fisheries management

As discussed both the Test and Itchen are internationally renowned for the quality of their fishing. Furthermore, fisheries are a very important financial asset to local land owners and the surrounding area.

Historically fisheries management along the Test and Itchen has led to intensive mowing of riparian vegetation to leave either a minimal or no riparian strip, by the cutting of marginal and in-channel vegetation, and the removal of woody debris. In addition, access to the river bank with space to cast rods is of high importance, which often means tree cover has been reduced to a low level. Fishing practices are changing with some river-keepers reverting more to management techniques associated with ‘wild fishing’, allowing the river to establish more natural features.

Largely due to current management practices, the measures most frequently recommended by the survey include ‘vegetation management by reducing mowing/cutting regime’, ‘riparian planting’, and ‘channel narrowing’. As a result, those reaches conventionally managed for fisheries could potentially present a constraint to restoration. For this reason it is critical that works be undertaken with the consent and support of local landowners and river-keepers.

6.5.3. Water level management

River restoration activities may be constrained in some locations as a result of requirements for appropriate water level management. Over the last decade, Natural England and the Environment Agency have been working closely with landowners and land managers to implement more appropriate regimes of water level management within the SSSIs to ensure adequate distribution of water across the floodplain. This has been particularly important on the River Itchen where it is both the river and the floodplain that achieves SSSI status as well as in some parts of the SAC.

To ensure the Restoration Plan doesn’t set out any conflicting objectives, the floodplain connectivity and water resource needs of the whole SSSI and SAC have been carefully considered throughout this project. Any river restoration actions that may alter main river water levels need careful consideration in the context of any floodplain water level management requirements and off-take structures present or planned.

6.5.4. Cultural heritage

Restoration and rehabilitation options may be constrained in some locations where they impact on cultural heritage interests. The Test and Itchen valleys are important in terms of historic landscape and cultural
heritage. Particularly important on the River Itchen is the historic value of the water meadow system and associated structures. Restoration options will need careful consideration of any constraints presented by these cultural factors, particularly when suggesting any alteration or removal of structures or changes to landscape features in the water meadows that have significance within the historic landscape of the valley. In some cases, structures and features may need to be preserved for their historic value and restoration implementation will have to find a compromise to balance all interests. Even those weirs that are associated with the historic management of the river are likely to have present day amenity/cultural value, which could present an obstacle to restoration. They may also support valuable habitats within the leats and artificial channels.

6.5.5. Development and infrastructure

Development and infrastructure, entailing, buildings, roads, services and industry are likely to pose a fixed obstacle to restoration. As stated in section 4.3, towns and villages are dotted across the catchment, with the most heavily urbanised areas to the south. In general terms development on the floodplain is limited and does not present a widespread barrier to restoration. The impact of these urban centres on restoration is particularly prevalent in the following areas:

- Whitchurch - the river is canalised through a concrete channel through the town;
- Timsbury road bridge - the river is impounded upstream;
- The A3057 road bridge (upstream of the Mayfly pub) – the river is impounded upstream of the bridge;
- Romsey;
- Winchester centre; and
- Eastleigh.

6.5.6. Flood risk

Flood risk management will need to be considered when any management action is undertaken that has the potential to reduce the capacity of the river to hold water. In some areas increasing flood risk may not be an issue, and potentially can be encouraged for sustainable flood risk management and habitat enhancement purposes. However, in reaches of channel which lie close to urban centres flood risk will be a major constraint to restoration or enhancement works. In addition, flood risk may equally be an important issue in areas that are in highly productive agricultural land. Only some of the proposed actions are likely to have any impact on flood risk. These will be restricted to major structure modifications (which could reduce flood risk), changes to embankments or any bed raising in sensitive areas. Localised accumulations of sediment are not likely to lead to increased flood risk but significant quantities of coarse woody debris could be an issue if it accumulates immediately upstream of structures. As with all these cases, the particular flood risk would need to be assessed at a project level as the strategy is implemented on the ground.

6.6. Summary of River Restoration actions

Each reach has been individually assessed for its primary pressures and management actions have been identified to address these pressures at a reach level. It is important to note that this does not mean that the measure will be undertaken along the whole reach, just that parts of this reach would benefit from this specific management action. The details would need to be determined at a project level. The management actions were selected from the list outlined Table 13. Details per reach are set out in the Restoration Summary Table in Appendix B and are outlined on each river (with tributaries separated). In addition to this table which outlines the various actions at a reach level Appendices A.3 and A.4 include maps that illustrate the location and reach classification of each of the reaches. Appendices A.5 and A.6 include maps showing the actions and spatial extent of them along each of the reaches.

It is important to note that between the start of the surveys undertaken by Geodata (2009) and the completion of the surveys by Atkins in 2012 various restoration works may have been undertaken on the ground. The strategy may thus not have picked these changes up (if the reach was surveyed before the works were undertaken). If works have been done by individuals, or groups, it would be useful the Environment Agency could be informed so that the strategy documents could be updated as this is taken forward.

Where access was not granted during the course of this study, the specific reach was marked as being inaccessible. This would need to be surveyed at a later date and any future management actions that are undertaken on these reaches would still need to be aligned to the primary visions for each river and actions undertaken comparable to those outlined in Table 13.
For each map outlined in Appendix A.5 and A.6 the location of it relative to the rest of the Test and Itchen is illustrated below on Figure 18 and Figure 19. The map outputs have been divided using an upstream to downstream approach.

**Figure 18: Test overview map for restoration figure outputs**
Figure 19: Itchen overview map for restoration figure outputs
### Table 13: Generic management actions to improve river habitat

<table>
<thead>
<tr>
<th>Restore Structure (i.e. weir, sluice, bridge)</th>
<th>Rehabilitate or conserve and enhance riparian zone</th>
<th>Conserve and enhance</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Removal</td>
<td>• Riparian planting</td>
<td></td>
</tr>
<tr>
<td>• Partial removal/lowering</td>
<td>• Vegetation management by reducing mowing/cutting regime</td>
<td></td>
</tr>
<tr>
<td>• Change sluice control to restore channel</td>
<td>• Reduce tree shading</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Create riparian corridor along channel</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Restore channel planform</th>
<th>Rehabilitate channel</th>
<th>Modify channel maintenance operations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Bank re-profiling</td>
<td>• Reduce dredging</td>
</tr>
<tr>
<td></td>
<td>• Channel narrowing by marginal planting</td>
<td>• Alter weed cutting management practices</td>
</tr>
<tr>
<td></td>
<td>• Channel narrowing by in-channel measures e.g. deflectors or adding woody debris</td>
<td>• Conserve woody debris features</td>
</tr>
<tr>
<td></td>
<td>• Bed level raising</td>
<td>• Remove some woody debris where channel is choked</td>
</tr>
<tr>
<td></td>
<td>• Create riffles</td>
<td>• Remove trash</td>
</tr>
<tr>
<td></td>
<td>• Create backwater</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Remove bank protection</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Restore continuity with the floodplain</th>
<th>Reduce poaching pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Set back embankments</td>
<td>• Grazing pressure management (reduce livestock)</td>
</tr>
<tr>
<td>• Lower embankments</td>
<td>• Install fencing to prevent livestock access</td>
</tr>
<tr>
<td>• Remove embankments</td>
<td>• Install fencing to reduce dog/human access to channel</td>
</tr>
</tbody>
</table>

| Restore old channel | De-silt particular reach |

<table>
<thead>
<tr>
<th>Other</th>
<th>Modify hatch control operations to enhance channel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Other</td>
</tr>
</tbody>
</table>
7. Other plans and programmes

Improvement works are continually being undertaken along both rivers, some of which are aligned with key Environment Agency and Natural England led projects and plans. Sections 7.1 to 7.8 summarise the larger programmes of work underway on the rivers, including programmes undertaken by the Environment Agency, Natural England, Southern Water and the Hampshire and Isle of Wight Wildlife Trust. Aside from these main programmes of work there are numerous smaller scale projects that have been undertaken, or are planned, on both rivers. Much of this locally-led work is being undertaken by local interest groups, landowners, river keepers, Wildlife Trusts and farmers, and each of these are captured in section 7.9.

In taking the strategy forward, it is important to consider other work programmes and projects that are ongoing or planned to ensure that situations of conflicting objectives are not overlooked. In addition to this there may also be opportunities for mutual benefits to be realised between the Strategy and other plans.

The following sections briefly introduce some of the larger plans and programmes in place on the two rivers. It is not the intention to detail the site specific objectives of these other plans and programmes of work on the river herein, rather to outline their scope and highlight any constraints they may present when taking this strategy forward.

7.1. River Basin Management Plans

There are a total of 34 river water bodies in the Test and Itchen catchment and Figure 20 and Figure 21 show the classification in terms of whether they are designated as heavily modified or artificial or not and their current status under the Water Framework Directive. Those which are not classified as heavily modified or artificial are to achieve Good Ecological Status by 2027, and those which are heavily modified or artificial are to achieve Good Ecological Potential by 2027. Water bodies within a SAC should however aim to achieve Good Ecological Status by 2015.

Ten water bodies within the Test catchment and eight water bodies within the Itchen catchment correspond to the SSSI reaches surveyed. The WFD has a wider remit in that it also covers channels (water bodies) outside the SSSI designated channel network. Table 14 sets out the hydromorphological classifications and ecological status for the 18 water bodies. Four water bodies within the Itchen SSSIs and five within the Test SSSIs do not have a current Good Ecological Status; and there are a wide variety of quality elements that contribute to this assessment.

In order for relevant water bodies to achieve Good Ecological Status or Good Ecological Potential, relevant measures need to be put in place in time for the ‘solutions’ to have a positive impact. In the case of the Test and Itchen SSSIs, all elements should be improved to enable Good Ecological Status or Good Ecological Potential to be achieved by December 2027. The River Basin Management Plans list whether mitigation measures are in place, or not, for all heavily modified or artificial water bodies. These measures have been listed within Table 14. Cross referencing against these details will also help to define actions to help achieve SSSI favourable status. In addition, implementation of the Test and Itchen River Restoration Strategy would help to deliver improvements required under the WFD.
Figure 20: Water Framework Directive – ecological status for heavily modified and artificial water bodies and for non designated reaches of the Test (source Environment Agency)
Figure 21: Water Framework Directive – ecological status for heavily modified and artificial water bodies and for non designated reaches of the Itchen (source Environment Agency)
<table>
<thead>
<tr>
<th>Code</th>
<th>Water body ID</th>
<th>Name</th>
<th>Hydromorphological status</th>
<th>Current overall</th>
<th>Status objective</th>
<th>WFD ecological status</th>
<th>Biological and supporting elements and conditions that caused a less than good ecological status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fish</td>
</tr>
<tr>
<td>R1</td>
<td>GB10704 2022580</td>
<td>River Itchen</td>
<td>Heavily Modified Flood Protection, Urbanisation, Water Regulation (impoundment release)</td>
<td>Poor</td>
<td>Good by 2027</td>
<td>Poor (Uncertain – WOE)</td>
<td>Moderate</td>
</tr>
<tr>
<td>R2</td>
<td>GB10704 2022590</td>
<td>River Alre</td>
<td>Heavily Modified Water Regulation (strategic transfer)</td>
<td>Good</td>
<td>Good by 2015</td>
<td>Good</td>
<td>Moderate</td>
</tr>
<tr>
<td>R6</td>
<td>GB10704 2016330</td>
<td>River Alre</td>
<td>Heavily Modified Flood Protection, Urbanisation, Water Regulation (strategic transfer)</td>
<td>Moderate</td>
<td>Good by 2027</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>R11</td>
<td>GB10704 2016300</td>
<td>River Itchen</td>
<td>Not Designated A/HMWB</td>
<td>Good</td>
<td>Good by 2015</td>
<td>Good</td>
<td>Moderate</td>
</tr>
<tr>
<td>R14</td>
<td>GB10704 2022620</td>
<td>Candover Brook</td>
<td>Not Designated A/HMWB</td>
<td>Good</td>
<td>Good by 2015</td>
<td>Good</td>
<td>Moderate</td>
</tr>
<tr>
<td>R29</td>
<td>GB10704 2016630</td>
<td>Bow Lake</td>
<td>Heavily Modified Urbanisation, Water Regulation (impoundment release)</td>
<td>Poor</td>
<td>Good by 2027</td>
<td>Poor (Quite Certain – WOE)</td>
<td>Moderate (Quite Certain)</td>
</tr>
<tr>
<td>R49</td>
<td>GB10704 2016670</td>
<td>River Itchen (Chariton Stream)</td>
<td>Not Designated A/HMWB</td>
<td>Good</td>
<td>Good by 2015</td>
<td>Good</td>
<td>Moderate</td>
</tr>
<tr>
<td>R50</td>
<td>GB10704 2016680</td>
<td>Arle – Upstream of Drove Lane</td>
<td>Not Designated A/HMWB</td>
<td>Moderate</td>
<td>Good by 2027</td>
<td>Moderate (Uncertain)</td>
<td>Moderate (Uncertain)</td>
</tr>
<tr>
<td>R10</td>
<td>GB10704 2016460</td>
<td>River Test</td>
<td>Heavily Modified Flood Protection</td>
<td>Moderate</td>
<td>Good by 2027</td>
<td>Moderate</td>
<td>Poor (Very Certain)</td>
</tr>
<tr>
<td>17</td>
<td>GB10704 2022660</td>
<td>Test (Upper)</td>
<td>Not Designated A/HMWB</td>
<td>Good</td>
<td>Good by 2015</td>
<td>Good</td>
<td>Moderate</td>
</tr>
<tr>
<td>R18</td>
<td>GB10704 2022680</td>
<td>River Dever</td>
<td>Not Designated A/HMWB</td>
<td>Good</td>
<td>Good by 2015</td>
<td>Good</td>
<td>Moderate</td>
</tr>
<tr>
<td>R19</td>
<td>GB10704 2022690</td>
<td>River Dever</td>
<td>Not Designated A/HMWB</td>
<td>Good</td>
<td>Good by 2015</td>
<td>Good</td>
<td>Moderate</td>
</tr>
<tr>
<td>R23</td>
<td>GB10704 2022750</td>
<td>River Test</td>
<td>Not Designated A/HMWB</td>
<td>Good</td>
<td>Good by 2015</td>
<td>Good</td>
<td>Moderate</td>
</tr>
<tr>
<td>R24</td>
<td>GB10704 2022770</td>
<td>River Dever</td>
<td>Not Designated A/HMWB</td>
<td>Moderate</td>
<td>Good by 2027</td>
<td>Moderate (Quite Certain)</td>
<td>Moderate (Quite Certain)</td>
</tr>
</tbody>
</table>

Table 14: Water bodies and their hydromorphological and ecological status along the SSSI
<table>
<thead>
<tr>
<th>Code</th>
<th>Water body</th>
<th>Name</th>
<th>Hydromorphological status</th>
<th>Current overall</th>
<th>Status objective</th>
<th>WFD ecological</th>
<th>Biological and supporting elements and conditions that caused a less than good ecological status</th>
</tr>
</thead>
<tbody>
<tr>
<td>R34</td>
<td>GB10704 2016840</td>
<td>Test (Lower)</td>
<td>Not Designated A/HMWBI</td>
<td>Poor</td>
<td>Good by 2027</td>
<td>Poor (Quite Certain – WoE)</td>
<td>Moderate (Quite Certain) Poor (Very Certain) Does not Support Good (Uncertain)</td>
</tr>
<tr>
<td>R46</td>
<td>GB10704 2022670</td>
<td>River Test (Middle)</td>
<td>Not Designated A/HMWBI</td>
<td>Good</td>
<td>Good by 2015</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>R47</td>
<td>GB10704 2022710</td>
<td>River Test (Upper)</td>
<td>Not Designated A/HMWBI</td>
<td>Moderate</td>
<td>Good by 2027</td>
<td>Moderate (Uncertain)</td>
<td></td>
</tr>
<tr>
<td>R52</td>
<td>GB10704 2022700</td>
<td>River Test (Middle)</td>
<td>Not Designated A/HMWBI</td>
<td>Moderate</td>
<td>Good by 2027</td>
<td>Moderate (Uncertain)</td>
<td>Moderate (Uncertain)</td>
</tr>
</tbody>
</table>

Table 15: Water bodies along the SSSI which have mitigation measures listed

<table>
<thead>
<tr>
<th>Code</th>
<th>River WB Code</th>
<th>Mitigation measures and whether they are in place</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>GB107042022580</td>
<td>Ensure there is an appropriate baseline flow regime downstream of the impoundment. In Place Appropriate water level management strategies, including timing and volume of water moved In Place Educate landowners on sensitive management practices (urbanisation) Not In Place Appropriate techniques to align and attenuate flow to limit detrimental effects of these features (drainage) Not In Place Sediment management strategies (develop and revise) Not In Place Retain marginal aquatic and riparian habitats (channel alteration) Not In Place Operational and structural changes to locks, sluices, weirs, beach control, etc Not In Place Preserve and where possible enhance ecological value of marginal aquatic habitat, banks and riparian zone Not In Place Structures or other mechanisms in place and managed to enable fish to access waters upstream and downstream of the impounding works. Not In Place Re-opening existing culverts Not In Place Increase in-channel morphological diversity Not In Place Preserve and, where possible, restore historic aquatic habitats Not In Place Removal of hard bank reinforcement/revetment, or replacement with soft engineering solution Not In Place Remove obsolete structure Not In Place</td>
</tr>
<tr>
<td>R6</td>
<td>GB107042016330</td>
<td>Appropriate techniques to align and attenuate flow to limit detrimental effects of these features (drainage) Not In Place Retain marginal aquatic and riparian habitats (channel alteration) Not In Place Operational and structural changes to locks, sluices, weirs, beach control, etc Not In Place Preserve and where possible enhance ecological value of marginal aquatic habitat, banks and riparian zone Not In Place Structures or other mechanisms in place and managed to enable fish to access waters upstream and downstream of the impounding works. Not In Place Increase in-channel morphological diversity Not In Place Preserve and, where possible, restore historic aquatic habitats Not In Place Remove obsolete structure Not In Place</td>
</tr>
<tr>
<td>R29</td>
<td>GB107042016630</td>
<td>Appropriate channel maintenance strategies and techniques – woody debris In Place Appropriate channel maintenance strategies and techniques – minimise disturbance to channel bed and margins In Place Appropriate techniques (invasive species) In Place Appropriate timing (vegetation control) In Place Appropriate vegetation control technique In Place Selective vegetation control regime In Place Operational and structural changes to locks, sluices, weirs, beach control, etc Not In Place Preserve and, where possible, restore historic aquatic habitats Not In Place Increase in-channel morphological diversity Not In Place Re-opening existing culverts Not In Place Alteration of channel bed (within culvert) Not In Place Flood bunds (earth banks, in place of floodwalls) Not In Place Set-back embankments Not In Place Improve floodplain connectivity Not In Place</td>
</tr>
<tr>
<td>R10</td>
<td>Test GB107042016460</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Removal of hard bank reinforcement/revetment, or replacement with soft engineering solution</strong> Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preserve and where possible enhance ecological value of marginal aquatic habitat, banks and riparian zone Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educate landowners on sensitive management practices (urbanisation) Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retain marginal aquatic and riparian habitats (channel alteration) Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate techniques to align and attenuate flow to limit detrimental effects of these features (drainage) Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structures or other mechanisms in place and managed to enable fish to access waters upstream and downstream of the impounding works. Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Appropriate channel maintenance strategies and techniques</strong> – woody debris In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate channel maintenance strategies and techniques – minimise disturbance to channel bed and margins In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate vegetation control technique Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removal of hard bank reinforcement/revetment, or replacement with soft engineering solution Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preserve and, where possible, restore historic aquatic habitats Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in-channel morphological diversity Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Re-opening existing culverts Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structures or other mechanisms in place and managed to enable fish to access waters upstream and downstream of the impounding works. Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Preserve and, where possible, enhance ecological value of marginal aquatic habitat, banks and riparian zone</strong> Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Remove obsolete structure</strong> Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Selective vegetation control regime</strong> Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Increase in-channel morphological diversity</strong> Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Appropriate timing (vegetation control)</strong> Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Retain marginal aquatic and riparian habitats (channel alteration)</strong> Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Appropriate water level management strategies, including timing and volume of water moved</strong> Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate techniques to align and attenuate flow to limit detrimental effects of these features (drainage) Not In Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operational and structural changes to locks, sluices, weirs, beach control, etc Not In Place</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7.2.  Itchen Navigation Strategy

Restoration works were carried out as part of the Itchen Navigation Strategy (led by the Hampshire and Isle of Wight Wildlife Trust) following a site investigation in 2006 to understand the opportunities and constraints of each reach. 19 reaches were classified as high priority and using heritage lottery and partnerships funding a number of works were carried out which included:

- embankment stabilisation by hard and soft engineering techniques;
- marginal planting;
- fencing put in place to discourage dog access and therefore reduce poaching of the bank; and
- footpath improvements.

Works along some of the reaches have only recently been completed in 2012 and all high priority actions are now complete. The aims of the strategy were generally in line with restoration works proposed in this Test and Itchen River Restoration strategy, however there was more emphasis on public accessibility and education, as well as heritage conservation. The strategy document lists a number of actions for reaches classed as medium or low priority, and although there are no current plans, should a funding stream come available, work could be done to implement some of these remaining strategy actions. Implementation of some of these actions could be done in partnership with some of the river restoration actions listed in this strategy.

7.3.  Water Level Management Plans

Over the last 10 years, the Environment Agency and Natural England have been addressing the issue of inappropriate water level management within the SSSIs through implementation of Water Level Management Plans (WLMP) on both the River Itchen (which has been completed) and the River Test.

A WLMP is a written statement of water level management objectives for a given area of the SSSI and considers the means by which these objectives can be achieved. Typically, the WLMP identifies areas where the biodiversity of the SSSI is in unfavourable condition due to either a lack of water, or too much water, and proposes actions to remedy this. These actions could range from simple un-blocking of water meadow ditches and implementing hatch operating protocols for off-take structures, to constructing new main river off-take structures to provide water to a SSSI unit, all with the aim of better redistribution of water across the SSSI.

The WLMP is implemented by the Environment Agency and Natural England in close partnership with landowners and river keepers. The delivery mechanism for the initial works is via the Environment Agency’s Flood Risk Management route, which can fund capital expenditure on flood management structures that are either on a main river, or affect main river water levels. Ongoing support in the long-term, for example for better management of structures, is available through Natural England’s Agri-Environment schemes which make funding available for suitable measures within the SSSIs.

Although the delivery mechanism for River Restoration activities is different to that of Water Level Management, the two projects are often closely aligned and have the potential to complement each other. As such, in taking this strategy forward it is imperative that the projects take account of implemented WLMP actions, and liaises on planned future WLMP works. Additionally, where actions have been identified under river restoration that can be delivered in parallel with the WLMP, there may be opportunities for both projects to benefit.

7.4.  National Environment Programme Investigations

Over the last two years, the Lower Test has been subject to a National Environment Programme (NEP) Water Resource Investigation. Undertaken by Southern Water, with a Steering Group that also comprises the Environment Agency and Natural England, this project has focused on understanding the potential effects of Southern Water’s Testwood abstraction on the hydrology and ecology of the Lower Test (including the River Test SSSI and Test Valley SSSI). This study has looked at available hydrology and ecology data to understand if the historical abstraction regime at Testwood has had any detectable effects on the hydro-ecology of the river including the fish populations, and additionally whether there are likely to be any further effects if Southern Water were to utilise the current
abstraction licence in full. The focus has therefore been mainly on the reach of the Great Test downstream of the Testwood abstraction.

The technical scope of this project included quantifying potential flow effects for a range of abstraction scenarios and the development of a hydraulic model to look at the interaction between river flows, channel management and river structures on the flow regime (i.e. water depths and velocities) in the Great Test. It also examined the potential impact of abstraction and other river management issues on fish migration, habitats (including the floodplain habitat to a certain degree) and other species and the potential benefits of some river management and abstraction interventions.

There does seem to be potential for benefits to be realised in this area with river restoration interventions, which may help to increase the resilience of the river in general, including greater resilience against periods of low flows, whether influenced by abstraction or not. This should be kept in mind when taking the Strategy forwards into implementation. The work of the River Restoration strategy is clearly distinguishable and separate from that needed to mitigate the impacts of the abstraction.

7.5. River Test and Itchen Shading Strategy

The Environment Agency, in partnership with Natural England has produced a Climate Change Strategy for the rivers’ Test & Itchen, with specific reference to shading from trees. Conceived in 2010, LIDAR and aerial photography has since been used to document the existing extent of tree shading and identify areas where tree planting could be considered. The ultimate aim of the project is to undertake tree planting where practical, and appropriate, to provide the maximum amount of shade to help reduce solar heating of the water. This would benefit salmonid species that are not tolerant to rising water temperatures, primarily salmon and brown trout.

However, a careful balance against other SSSI/SAC objectives is needed, such as the floodplain and bank side requirements for wading birds and Southern Damselfly. So far, 98 reaches have been identified where native trees could be planted either on the river bank or set back from the river to provide a moving shadow.

The next stages of this project will be to incorporate the climate change mapping into the Test and Itchen River Restoration Strategy. This will ensure the objectives of the two work programmes are suitably aligned.

Natural England will then take forward tree planting in the agreed sites where new HLS agreements are being set up and through partnership working to continue to work with landowners to get tree locations agreed for planting next winter.

In addition to this, the Environment Agency has also been producing guidance to support tree planting activities for riparian shading, written to explain the benefits of riparian shade and provide consistent advice on creating riparian shade to support the Environment Agency’s initiative on Keeping Rivers Cool.

7.6. Diffuse Water Pollution Plan

Natural England and the Environment Agency have been consulting on the Diffuse Water Pollution Plans (DWPP) for the Test and Itchen (started 2010). SSSI units covered within this Plan include: The River Test, SSSI units 84–91; the River Itchen SSSI units 103–108; and Alresford Pond SSSI unit 1.

The Plan seeks to identify where diffuse pollution is preventing SSSIs from achieving favourable condition and furthermore it identifies remedies, potential delivery mechanisms, timeframes involved and evidence gaps to address.

As diffuse pollution is a significant issue on both rivers, and more specifically sedimentation is a primary concern in the context of geomorphology pressures, it is important that any River Restoration strategy actions being taken forward consider the objectives and aspirations of the DWPP. There may be opportunities for mutual benefits to be realised between the two work programmes.
7.7. Review of Consents

The Environment Agency has completed a Habitats Directive Stage 4 review of consents as part of its assessment of the licensed abstractions from the River Itchen SAC. This highlighted the need for modifications to several licences for public water supply so that the volume of water abstracted from the SAC is limited during summer months. Furthermore, the Environment Agency has imposed a “hands off flow” that means all abstraction needs to stop when the flows fall below a certain critical level with the specific purpose being to protect the environment during low flows.

7.8. Restoring Sustainable Abstraction

In addition to the Review of Consents programme on the Itchen SAC, the Environment Agency is also looking at all licensed abstractions as part of the Restoring Sustainable Abstraction (RSA) programme. The purpose of this is to review existing abstraction licences and the potential effects these may be having on the environment.

The EA then work with abstractors to review the licence conditions and requirements of abstractors to find a balance between their requirements, the downstream requirements of people, businesses and industry and the needs of the environment so that a sustainable level of abstraction is ensured into the future.

Licences are currently being reviewed on both rivers and it will be important to keep this in mind when taking the restoration strategy forward and working with landowners whose licences may be under review or recently altered.

7.9. Other improvement programmes

At the initial Test and Itchen River Restoration Strategy Steering Group, a mini workshop task was undertaken to identify, at a high level, known works being conducted, planned or recently completed on both rivers. Information was also supplemented during the desk study phase from data provided by the Environment Agency. The information gathered in this task was transposed from the hard copy maps into Table 16. (It is however recognised that this workshop may not have captured all the small scale works that have been undertaken or are being undertaken).

When taking the Restoration Strategy forward, consideration needs to be made of the other improvement programmes listed in the table below. In some cases, these programmes may present potential conflicting objectives, and in others there may be opportunities for mutual benefits to be realised (either ecological or in terms of funding mechanism).

<table>
<thead>
<tr>
<th>Strategy/Plan / Project/Group name</th>
<th>Date started or published</th>
<th>Owner or lead body</th>
<th>Summary of aims relevant to the Test and Itchen Strategy</th>
<th>Has it already been implemented?</th>
</tr>
</thead>
<tbody>
<tr>
<td>T&amp;I Catchment scale</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Rivers Test and Itchen Weed</td>
<td>April 2008</td>
<td>Environment Agency</td>
<td>To examine weed cutting practices on the Rivers Test</td>
<td>Unknown</td>
</tr>
<tr>
<td>Management Review</td>
<td></td>
<td></td>
<td>and Itchen. Recommendations of the review include</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>establishing trial sites, producing research for</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>dissemination, quantifying ribbon weed, reviewing</td>
<td></td>
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<td></td>
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<td></td>
<td>published literature on ribbon weed and macrophytes,</td>
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<td></td>
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<td></td>
<td>and disseminating information on methods of</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>controlling the effects of swan grazing to river</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>managers.</td>
<td></td>
</tr>
<tr>
<td>Strategy/Plan / Project/Group name</td>
<td>Date started or published</td>
<td>Owner or lead body</td>
<td>Summary of aims relevant to the Test and Itchen Strategy</td>
<td>Has it already been implemented?</td>
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<td>-----------------------------------</td>
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<td>----------------------------------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Test and Itchen Association</td>
<td>-</td>
<td>-</td>
<td>This body regulates fishing and related matters on the Test and Itchen under powers delegated from the Environment Agency.</td>
<td>NA</td>
</tr>
</tbody>
</table>
| Test and Itchen Catchment Flood Management Plan | December 2009 | Environment Agency | The plan provides an overview of the flood risk in the Test and Itchen catchment and sets out the management approach for sustainable flood risk over the next 50 to 100 years. Proposed actions include:  
  - seeking funding and partnership opportunities (such as the River Anton strategy) to open up river corridors in connection with new development and improvements.  
  - consider options for development of more open river corridors through Andover in the long-term.  
  - influence land management (such as on the Pill Hill Brook), to reduce flood risk and instances of muddy flooding. | Yes (Action implementation ongoing) |
<p>| The Test and Itchen Catchment Abstraction Management Strategy | March 2006 | Environment Agency | This strategy helps to manage the water resources of the catchment at the local level. It sets out the abstraction licensing policy for the catchment for surface and groundwater. Post CAMS actions included several hydro-ecological studies on Test and Itchen tributaries between 2006 and 2009. | Yes (Action implementation ongoing) |
| Your Test Valley Plan             | January 2008              | Test Valley Partnership | This is a community plan with the aim to reflect the needs, wishes and aspirations of all local people. Aims relevant to the Test and Itchen include a clean and attractive environment. The document states that it is for everyone in the local community to take personal responsibility for maintaining the local environment and keeping the Test Valley a beautiful place to live. | Ongoing                         |</p>
<table>
<thead>
<tr>
<th>Strategy/Plan / Project/Group name</th>
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<th>Owner or lead body</th>
<th>Summary of aims relevant to the Test and Itchen Strategy</th>
<th>Has it already been implemented?</th>
</tr>
</thead>
</table>
| Obstructions to fish passage presented by EA Gauging weirs | October 2008 | Environment Agency (2008b) | This report assesses the degree to which Environment Agency gauging weirs in the Solent and South Downs area prevent the movement of fish (salmonids, coarse fish, eels)
On the Itchen, at Allbrook an Elver pass is planned, at Highbridge bristle boards have been installed. No comment was made to solutions on the River Test. | NA |
| Monitoring the vegetation of the R Itchen. | March 2009 | Environment Agency | The River Itchen has been designated as a Special Area of Conservation (SAC) at least partly due to its Ranunculion fluitantis and Callitricho-Batrachion vegetation. This report presents the results of a study to review the use of data collected using the Mean Trophic Rank (MTR) method to monitor the condition of this community. The conclusion is reached that whilst it may be possible to develop standardised methods to monitor the vegetation of the river, a simplistic assessment by specialists and taking into account associated habitats, particularly within the floodplain could provide more useful information. | Ongoing |
| WWF Rivers on the Edge | December 2010 | WWF | WWF’s Rivers on the Edge will:
– Encourage the public to save water, by helping them to understand the impacts of water use, and by reconnecting them with nature.
– Urge the Government and its regulators to introduce incentives for the industry to meet DEFRA’s Future Water target of 130 litres per person per day.
– Work with the water industry to introduce efficiency schemes, retrofit thousands of homes with water efficiency appliances, and improve water management. | Ongoing |
<table>
<thead>
<tr>
<th>Strategy/Plan / Project/Group name</th>
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<th>Summary of aims relevant to the Test and Itchen Strategy</th>
<th>Has it already been implemented?</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the Itchen catchment it will:</td>
<td></td>
<td></td>
<td>– Independently review the evidence of ecological impacts of abstraction.</td>
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<td></td>
<td></td>
<td></td>
<td>– Work with water companies to ensure that water efficiency is part of the solution to a sustainable reduction in abstraction.</td>
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<td></td>
<td></td>
<td></td>
<td>– Work with local stakeholders to ensure that any new housing in the region does not add additional pressure to water resources.</td>
<td></td>
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<tr>
<td>Local scale – Test</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>– To draw attention to some of the key factors adversely affecting the river corridor and its biodiversity interests;</td>
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<td></td>
<td></td>
<td></td>
<td>– To identify and raise awareness as to how it could be improved;</td>
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<td></td>
<td></td>
<td></td>
<td>– To identify ways in which the river and its biodiversity could be enhanced;</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>– To stimulate interest and action to make such improvements happen;</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>– To improve existing public access to the river with the aim of linking Charlton Lakes in the North and Rooksbury Mill in the south by a riverside walk;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>– To seek endorsement and support from the wider community for the objectives of this strategy;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>– To ensure that the River Anton’s full potential as a chalk river habitat is realised and secured into the future.</td>
<td></td>
</tr>
<tr>
<td>Action plan includes:</td>
<td></td>
<td></td>
<td>– Ecological survey and</td>
<td></td>
</tr>
<tr>
<td>Strategy/Plan / Project/Group name</td>
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<td>Summary of aims relevant to the Test and Itchen Strategy</td>
<td>Has it already been implemented?</td>
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<td>---------------------------------</td>
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<td>---------------------------------------------------------</td>
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</tr>
<tr>
<td>Monitoring</td>
<td></td>
<td></td>
<td>Monitoring – River and its biodiversity can be enhanced</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>– Education and awareness to encourage public participation and develop public ownership of the scheme</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>– Coordinate improvements to existing access along the Anton.</td>
<td></td>
</tr>
<tr>
<td>Stockbridge River Restoration Strategy</td>
<td>October 2009 (Draft)</td>
<td>National Trust</td>
<td>A survey detailed proposals for river restorations at Stockbridge Marsh.</td>
<td>No – Works not completed because of H&amp;S concerns</td>
</tr>
<tr>
<td>Romsey’s Waterways and Wetlands Enhancement Strategy (Draft)</td>
<td>December 2012</td>
<td>Test Valley Borough Council</td>
<td>The document seeks to bring together the public organisations with interests in the Romsey waterways and to coordinate priorities and actions to achieve real enhancements to the features. This includes, improving public access, the ecology, the heritage features, awareness and appreciation of the watercourses, co-ordination of flood defences, and the landscape setting of the waterways. The strategy is (during January 2013) still out for consultation.</td>
<td>No – at consultation phase</td>
</tr>
<tr>
<td>Mottisfont bed raising</td>
<td>2006</td>
<td>Environment Agency</td>
<td>Bed raising undertaken as part of river restoration</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Local scale – Itchen**

<table>
<thead>
<tr>
<th>Strategy/Plan / Project/Group name</th>
<th>Date started or published</th>
<th>Owner or lead body</th>
<th>Summary of aims relevant to the Test and Itchen Strategy</th>
<th>Has it already been implemented?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winnall Moors Project</td>
<td>October 2009</td>
<td>Hampshire and Isle of Wight Wildlife Trust</td>
<td>To improve the habitat and management of four specific reaches within Winnall Moors nature reserve.</td>
<td>Yes</td>
</tr>
<tr>
<td>Itchen Valley Grazing Project</td>
<td>Unknown</td>
<td>Hampshire and Isle of Wight Wildlife Trust</td>
<td>The Itchen Valley Grazing Project is working with landowners by providing advice and assistance with grazing management on land of high, or potentially high, conservation and landscape value in the Itchen Valley, Test Valley, and at the gateway to the new South Downs National Park, as part of the Wildlife Trust’s</td>
<td>Unknown</td>
</tr>
</tbody>
</table>
### 7.10. Delivery mechanisms and sources of funding

Implementation of river restoration strategies on the catchment scale requires careful coordination and multi partner approach to implementation. These two rivers are a significant part of the commercial and political landscape of Hampshire and much work has already been undertaken to improve the habitats they provide. It is important to build upon this in an all-inclusive approach to implementation of measures.

It is also important to remember that some actions are inexpensive and easily implemented, such as those that are about changing the way things are currently done (e.g. a reduced approach to vegetation management) or simple measures that can be done by volunteers and fisheries supported by River Trusts. Larger actions, requiring more financial or resource support will mostly require funding mechanisms.

There is no single source of funding for this type of restoration activity but various funding mechanisms are available to different groups leading on implementation of restoration measures. The sources of this funding depend on the nature and timeframe of the measures and who is undertaking the improvements. In seeking funding, it is important to consider not only the initial capital layout, but also the ongoing operational and maintenance responsibility, often applicable over decades. Depending on these timescales, a mosaic of funding mechanisms may be required for current and future implementation of measures.

Some sources of funding are more established than others and available long-term, for example the Environmental Stewardship Schemes implemented by Natural England (Higher Level Stewardship (HLS) and Entry Level Stewardship (ELS)—Note the current schemes are under review), the Environment Agency's Flood and Coastal Risk Management (FCRM) capital and maintenance budgets and Catchment Restoration Funds.

Less established funding mechanisms include opportunistic bidding opportunities to funds such as those under European Restoration Programmes (such as the EU LIFE Programme) as well as special projects being undertaken by NGOs such as Wildlife groups and Rivers Trusts.

Different funding and delivery mechanisms will be available depending on the particular restoration measure, the geographical extent at which it applies, the priority and timing of any potential works and the lead party involved in implementation. The latter aspect will be vital in identifying the primary funding source. The range of groups involved in implementation could therefore include:

- The Test and Itchen Association;
- Salmon & Trout Association
- Angling clubs and syndicates;
Test and Itchen River Restoration
Technical report

- Private landowners & river keepers;
- National Farmers Union;
- Country Land and Business Association (CLA);
- Hampshire and Isle of Wight Wildlife Trust;
- Natural England; and
- The Environment Agency.

The following sections outline the key delivery mechanisms currently in place that could be considered when taking the strategy forward into implementation.

7.10.1. Water Framework Directive Improvement Fund
In April 2011, the Secretary of State announced the allocation of £92 million over four years with the specific objective to improve the health of our rivers, lakes and estuaries by addressing water quality issues, removing barriers to fish migration and removing invasive non native species to help achieve Water Framework Directive objectives. This money will be allocated to projects that contribute towards WFD outcomes and are implemented between 2011 and 2015. Projects considered for funding include those that: remove invasive non native species; clear up pollution; and remove barriers to fish migration.

7.10.2. Catchment Restoration Fund
£28m of funding has been allocated by DEFRA over three years (from 2012/13) to the Catchment Restoration Fund (CRF) to civil society groups for implementation of water body improvement projects. These projects will contribute to bringing water bodies to Good Status and are over and above measures in River Basin Management Plans.


The CRF opens up the funding to bids from third sector organisations in the hope to encourage businesses, local authorities and community groups to join forces with charitable organisations in order to secure funding for improvement ideas on rivers. The CRF is currently closed to bids for 2013– see http://www.environment-agency.gov.uk/research/planning/136182.aspx for the latest information on the fund.

7.10.3. Planning Control and Developers Contributions
Section 106 of the Town and Country Planning Act (1990) requires developers seeking planning permission to incorporate within their proposals supplementary plans that help meet the needs of the community by securing contributions towards community infrastructure. This includes financial contributions to community facilities such as open spaces, which can include riparian land.

This mechanism could be used to deliver some restoration enhancements along each river, and would require consultation with Test Valley, Eastleigh District and Winchester City Planning Departments.

7.10.4. European Funding
The European Commission fund a number of other large scale programmes, including: LIFE+; Regional Convergence; Competitiveness and Cooperation (including INTERREG); and Framework Programme.

http://ec.europa.eu/environment/funding/intro_en.htm

Funding is available through the European Regional Development Fund (ERDF) for Water Management projects that: Improve the quality of water supply and treatment, including cooperation in the field of water management; Support integrated, sustainable and participatory approaches to management of inland and marine waters, including waterway infrastructure; and adapting to climate change effects related to water management.
7.10.5. Environmental Stewardship Schemes
The Environmental Stewardship Schemes (ESS) is part of the Rural Development Programme for England (RDPE). Administered by Natural England, it aims to provide support to land managers to maintain the land in a certain way that benefits the landscape, biodiversity or habitats. There are currently several levels of ESS: Entry Level Stewardship (ELS); Organic Entry Level Stewardship (OELS); Upland Entry Level Stewardship (UELS); and Higher Level Stewardship (HLS).

The current scheme particularly relevant to river restoration activities is Higher Level Stewardship which provides additional support for land management actions that are more relevant to the river restoration strategy, such as significant land use change, livestock management, fencing of water courses, wide riparian buffer strips, improved wetland riparian zones, scrub clearance and management, water level control structure operation, reinstatement of floodplain carriers and floodplain culverts and watercourse crossings. This delivery mechanism will be important to consider as it seeks to change the long term practices to those that are more suited to improving the quality and sustainability of existing wildlife habitats, whilst also creating new habitats where required. It should be noted that the current Rural Development Programme ends in December 2013 and the new programme is expected to start from January 2015 onwards.

http://www.naturalengland.org.uk/ourwork/farming/funding/default.aspx

7.10.6. England Catchment Sensitive Farming Delivery Initiative
The England Catchment Sensitive Farming Delivery Initiative (ECSFDI) is also funded through the Rural Development Programme for England, overseen by DEFRA, and implemented by a partnership between the Environment Agency and Natural England. Targeted to certain priority areas (which the Test and Itchen are considered to be), the ECSFDI is specifically focused on reducing diffuse pollution from agricultural practices through delivering advice to farmers and financial support for capital schemes. Advice is delivered through Catchment Sensitive Farming Officers (CSFOs) who visit farmers and offer advice on the various funding mechanisms and advise on the incentives that exist to help address environmental issues arising from farming practices. It should be noted that the current Rural Development Programme ends in December 2013 and the new programme is expected to start from January 2015 onwards. http://www.ecsfdi.gov.uk/


7.10.7. Environment Agency Flood Risk Management
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 or the FCRM “biodiversity outcome measures”, including restoration of Protected Areas. Actions here could include altering or removing major impounding structures and unblocking blocked channels and removing obstructions to flow.

7.10.8. Environment Agency Fisheries and Biodiversity
The EA fisheries and biodiversity team has a yearly budget to help undertake works on the rivers including restoration enhancements. Budget is variable between years, fairly limited and needs to be focused and prioritised carefully.

7.10.9. Natural England SSSI Funding
A small amount of money is available each year from Natural England for works within SSSIs. This includes funding through the Conservation and Enhancement Scheme which affords discretionary payments to fund costs of specific management to deliver favourable condition of the nature conservation interest on land of outstanding scientific interest. The mechanism can fund both capital works and management programmes (over a five year agreement period). This is a useful fund to consider where other sources of funding are not available e.g. outside HLS areas but it is important to note that 50% match funding is required for public bodies and some organisations.
7.10.10. Test and Itchen association

The Test and Itchen (T&I) Association is the body which regulates fishing and related matters on the two rivers under powers delegated from the Environment Agency. Support can be found through this route, either in the form of advice, sharing lessons from others, manpower support to implement actions and sometimes financial support.

7.10.11. Forestry Commission English Woodland Grant scheme

The English Woodland Grant Scheme provides financial support for establishment and maintenance of woodland schemes. Funding could be available for establishment of riparian woodland or other land-based planting schemes that serve to disrupt the pathway of sediment run off for example. Grants available are targeted at both improving existing woodland but also creating new woodland. This mechanism could be important in achieving the appropriate level of shading required for Good Ecological Status.

http://www.forestry.gov.uk/ewgs

7.10.12. Heritage Lottery Fund (HLF)

The Heritage Lottery Fund (HLF) uses money raised through the National Lottery to provide funding for projects that have “a lasting impact on people and places”. Administered through the National Heritage Memorial Fund (NHMF), funding of approximately £375 million is available each year to be invested in a wide range of projects including the natural environment. This funding mechanism was used to deliver some of the works undertaken as part of the Itchen Navigation Heritage Trail project.

7.11. Combining different delivery routes

Table 17 shows examples of how the different delivery routes discussed above can be combined to implement the various types of restoration works being proposed within the Strategy (please note this is indicative only, outlining the types of measures that could be considered through different mechanisms).

Over the proposed lifetime of the Strategy, these mechanisms may change, however if restoration actions are set out in the Strategy and priorities are defined thereafter within projects, momentum can be gained such that mechanisms can be taken advantage of when they emerge.
<table>
<thead>
<tr>
<th>Scale of works (in order of increasing scale)</th>
<th>Action</th>
<th>Restore / Rehabilitate / Conserve &amp; Enhance riparian zone</th>
<th>Delivery Mechanism (N.B. Can include provision of advice only, not just funding)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riparian Planting</td>
<td>WFD Improvements / Catchment Restoration Fund</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Vegetation Management by reducing mowing / cutting regime</td>
<td>Planning Control and Developers</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Reduce tree shading</td>
<td>European Stewardship</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Increase tree shading</td>
<td>Catchment Sensitive Farming</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Create riparian corridor along channel</td>
<td>EA Flood Risk Management</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Restore old channel</td>
<td>EA Fisheries &amp; Biodiversity</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Restore channel continuity (i.e. Weir, bridge, sluice)</td>
<td>N.E Conservation &amp; Enhancement</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Re-silt particular reach</td>
<td>EA Flood Risk Management</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Bank re-profiling</td>
<td>Scheme</td>
<td>*</td>
<td>*</td>
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<tr>
<td>Bank protection</td>
<td>Technical Association</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Install fencing to prevent livestock access</td>
<td>FC English Woodland Grant Scheme</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Install fencing to reduce dog / human access to channel</td>
<td>Heritage Lottery Fund</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Bank re-profiling</td>
<td>Private funding / trusts</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>
8. Prioritisation and costs

8.1. Prioritisation

Some restoration actions can be implemented immediately with no need for lengthy planning, consultation or consenting phases, and little or no external funding being required. This could include, for example, a reduced approach to vegetation management or slight alteration in the operation of an existing flow control structure. Within the restoration strategy, most of the common actions defined for many reaches include some degree of altered vegetation management and so changes such as these can be made immediately with existing advice and support from the Environment Agency and Natural England and could continue on into the future. The benefits of these actions for the SSSI would also be realised very quickly and are considered the “quick wins”, although it is understood that some consultation will be required between stakeholders such as those with fishing interests.

Larger scale actions will inevitably require feasibility and design stages, more planning and consultation and a higher level of support financially and these may take longer to bring about; particularly if there is uncertainty in the funding environment. Actions in this category could include alterations or removal of larger structures and long term land use change. Table 18 presents the restoration actions included in this strategy, the likely cost to implement and the timeframes over which they could be implemented (assuming funding is readily available). Please note these timeframes are indicative only, showing relative differences in timeframes for the various restoration actions.

Other important considerations in planning restoration activities (aside from scale of the works, likely cost and timeframes for funding mechanisms) are the following:

- Consenting process – Environment Agency Flood Risk Consent, Natural England SAC/SSSI consenting, consents related to transfer of water (Water Resource License), heritage consents and planning permissions etc.
- Post implementation monitoring

The lead in time for consents and permissions will largely depend on the scale of the works, the ecological and flood risks involved, and the level of stakeholder and statutory consultation required.

As an indication, Table 19 shows the time constraints posed by some of the designated species present in the SSSIs. Other species will also need to be considered in particular locations, such as the Southern Damselfly. These represent guidelines only and if planning works it is best to talk to the Environment Agency and Natural England as appropriate since the type and scale of works undertaken will influence what mitigation measures may be necessary.
<table>
<thead>
<tr>
<th>Scale of works (increasing)</th>
<th>Restore / Rehabilitate / Conserve &amp; Enhance</th>
<th>Action</th>
<th>Cost to implement</th>
<th>Timescale (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Riparian Planting</td>
<td>Low</td>
<td></td>
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<tr>
<td></td>
<td>Vegetation Management by reducing mowing / cutting regime</td>
<td>Saving</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Reduce tree shading</td>
<td>Low</td>
<td></td>
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<tr>
<td></td>
<td>Increase tree shading</td>
<td>Low</td>
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<tr>
<td></td>
<td>Create riparian corridor along channel</td>
<td>Low</td>
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<tr>
<td></td>
<td>Tackle invasive species</td>
<td>Low</td>
<td></td>
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</tr>
<tr>
<td>Conserve &amp; Enhance channel plan form by modifying channel maintenance operations</td>
<td>Reduce dredging</td>
<td>Saving</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alter weed cutting practices</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conserve woody debris features</td>
<td>Saving</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Remove some woody debris where channel is choked</td>
<td>Low</td>
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<tr>
<td></td>
<td>Remove trash</td>
<td>Low</td>
<td></td>
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<tr>
<td>Reconstruct &amp; Enhance channel continuity with floodplain by reducing poaching pressure</td>
<td>Grazing pressure management (reduce livestock)</td>
<td>Medium</td>
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<tr>
<td></td>
<td>Install fencing to prevent livestock access</td>
<td>Medium</td>
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</tr>
<tr>
<td></td>
<td>Install fencing to reduce dog / human access to channel</td>
<td>Low</td>
<td></td>
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<td></td>
<td>Bank reprofiling</td>
<td>Low</td>
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<td></td>
<td>Channel narrowing by marginal planting</td>
<td>Low</td>
<td></td>
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<tr>
<td></td>
<td>Channel narrowing by in-channel measures e.g. Deflectors or adding woody debris</td>
<td>Low</td>
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<tr>
<td></td>
<td>Bed level raising</td>
<td>Medium</td>
<td></td>
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<tr>
<td></td>
<td>Create riffles</td>
<td>Medium</td>
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<tr>
<td></td>
<td>Create backwater</td>
<td>Medium</td>
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<tr>
<td>Restore old channel</td>
<td>De silt particular reach</td>
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<td></td>
<td>Set back embankments</td>
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<td>Restore continuity with floodplain</td>
<td>Remove bank protection</td>
<td>Medium</td>
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<tr>
<td></td>
<td>Structure removal</td>
<td>High</td>
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<tr>
<td>Restore channel continuity (i.e. Weir, bridge, sluice)</td>
<td>Partial removal / lowering</td>
<td>High</td>
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<tr>
<td></td>
<td>Changing sluice control to restore channel</td>
<td>Low / Medium</td>
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### Table 19: Designated species survey and mitigation requirements

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<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
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<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
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<tbody>
<tr>
<td><strong>Birds</strong></td>
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<tr>
<td>Survey</td>
<td>Birds</td>
<td>Winter birds</td>
<td>Breeding birds/migrant species</td>
<td>Breeding birds</td>
<td>Breeding birds/migrant species</td>
<td>Winter birds</td>
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<tr>
<td>Mitigation</td>
<td>Tree clearance works may be conducted but must stop if nesting birds are found</td>
<td>Bird nesting season. No clearance or construction works</td>
<td>Tree clearance works may be conducted but must stop immediately if nesting birds are found</td>
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<tr>
<td><strong>Badgers</strong></td>
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<tr>
<td>Survey</td>
<td>All survey methods – best time is in spring and early autumn/winter</td>
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<td>Stopping up or destruction of existing sets permitted</td>
<td>No disturbance of existing sets</td>
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<tr>
<td>Survey</td>
<td>Inspection of hibernation, tree and building roosts</td>
<td>No surveys</td>
<td>Activity surveys and inspection of building roosts. Emergence counts</td>
<td>No surveys</td>
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<tr>
<td>Mitigation</td>
<td>Works on maternity roosts</td>
<td>Works on maternity roosts until mid May. Works on hibernation roosts from mid March</td>
<td>Works on hibernation roosts only</td>
<td>Least disturbance to breeding and hibernating roosts</td>
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<td><strong>Otters</strong></td>
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<tr>
<td>Survey</td>
<td>Surveys for otters can potentially be conducted all year round, though vegetation cover and weather conditions may limit success</td>
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<tr>
<td>Mitigation</td>
<td>Work can be carried out in any month, but it is likely to be restricted where otters are found to be breeding which can be in any month of the year</td>
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<tr>
<td><strong>Water Voles</strong></td>
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</tr>
<tr>
<td>Survey</td>
<td>Reduced activity</td>
<td>Initial surveys possible</td>
<td>All survey methods can be used though vegetation cover and weather conditions may limit success. Optimum time is March to June</td>
<td>Initial surveys possible</td>
<td>Reduced activity</td>
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<tr>
<td>Mitigation</td>
<td>Works in water vole habitat possible</td>
<td>Works in water vole habitat must be undertaken with appropriate mitigation measures</td>
<td>Works in water vole habitat possible</td>
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<td><strong>White Clawed Crayfish</strong></td>
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</tr>
<tr>
<td>Survey</td>
<td>Reduced activity</td>
<td>Surveys can be undertaken</td>
<td>Avoid surveys as females are releasing young</td>
<td>Optimum survey time</td>
<td>Reduced activity</td>
<td></td>
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</tr>
<tr>
<td>Mitigation</td>
<td>Avoid capture programmes. Low activity may lead to animals being easily missed</td>
<td>Exclusion of crayfish from construction areas</td>
<td>Avoid capture programmes</td>
<td>Exclusion of crayfish from construction areas</td>
<td>Avoid capture programmes. Low activity may lead to animals being easily missed</td>
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<tr>
<td><strong>Fish</strong></td>
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<tr>
<td>Survey</td>
<td>The timing of surveys will depend on the migration pattern of the species concerned. Where surveys require information on breeding, the timing of surveys will need to coincide with the breeding period, which may be summer or winter months depending on the species. Advice should be sought from the EA fisheries team</td>
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<tr>
<td>Mitigation</td>
<td>Protection of water courses is required at all times of the year. Work will need to be timed so as to avoid the breeding season of the species present. This varies from species to species</td>
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<tr>
<td>Survey</td>
<td>The timing of surveys will depend on the migration pattern of the species concerned. Where surveys require information on breeding, the timing of surveys will need to coincide with the breeding period, which may be summer or winter months depending on the species. Advice should be sought from the EA fisheries team</td>
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</tr>
<tr>
<td>Mitigation</td>
<td>No in-channel works in spawning areas</td>
<td>Works in spawning areas permitted</td>
<td>No in-channel works in spawning areas</td>
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</tbody>
</table>
8.2. Costs

Costs to deliver the river restoration strategy have been developed and are outlined in Table 20 and Table 21. Assumptions for the calculations are shown in Table 22. The costs have been developed on the assumption that all the measures identified in the reach scale restoration options will be required at the length outlined on the plans to get each of the reaches, and then the subsequent SSSI into favourable condition. The cost is therefore likely to be an over estimate of the fund necessary to deliver each of the SSSI towards favourable condition. The costs derived for each SSSI unit and the measures required in Table 20 and Table 21. A high and low estimate for the cost for delivering the Test and Itchen river restoration strategies was calculated based on a 20% variance above and below the cost estimated. Potential funding streams to deliver the actions and the prioritisation of them are detailed in Section 7.10 and Section 8.1, respectively.
<table>
<thead>
<tr>
<th>SSSI Unit</th>
<th>Action</th>
<th>Total Cost £ (Nearest Thousand)</th>
<th>Low Cost £ (-20%)</th>
<th>High Cost £ (+20%)</th>
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<td>84</td>
<td>Alter weed cutting management practices</td>
<td>7000</td>
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<td>Change sluice control to restore channel</td>
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<td>Channel narrowing by instream measures</td>
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<td>Channel narrowing by planting</td>
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<td>De-silting</td>
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<td>Modify hatch/slouce control</td>
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<td>Remove weirs</td>
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<td>Channel narrowing by instream measures</td>
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<td>Fencing – Livestock</td>
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<td>Grazing pressure management</td>
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<td>Channel narrowing by instream measures</td>
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<td>Grazing pressure management</td>
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<td>Channel narrowing by instream measures</td>
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<td>Create backwater</td>
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<td>Fencing – Humans/dogs</td>
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<td>Fencing – Livestock</td>
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<td>Modify hatch/slouce control</td>
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<td>Reduce tree shading</td>
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<td>Restore continuity with floodplain</td>
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<td>Vegetation management</td>
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<td>Change sluice control to restore channel</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channel narrowing by instream measures</td>
<td>615000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>De-silting</td>
<td>982000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce tree shading</td>
<td>7000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removal or partial removal/lowering of structure</td>
<td>6000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove weirs</td>
<td>9000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riparian planting</td>
<td>39000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetation management</td>
<td>34000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,955,000</strong></td>
<td><strong>3,164,000</strong></td>
<td><strong>4,746,000</strong></td>
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</tr>
<tr>
<td>Bed level raising</td>
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<tr>
<td>Channel narrowing by instream measures</td>
<td>187000</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Create backwater</td>
<td>882000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create riffles</td>
<td>1149000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fencing – Livestock</td>
<td>42000</td>
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<tr>
<td>Removal or partial removal/lowering of structure</td>
<td>4000</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Re-profiling channel banks</td>
<td>108000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restore continuity with floodplain</td>
<td>198000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riparian planting</td>
<td>79000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetation management</td>
<td>28000</td>
<td></td>
<td></td>
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<tr>
<td><strong>Total</strong></td>
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<td><strong>2,543,200</strong></td>
<td><strong>3,814,800</strong></td>
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<tr>
<td>Channel narrowing by instream measures</td>
<td>86000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove bank protection</td>
<td>20000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riparian planting</td>
<td>15000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tackle invasive species</td>
<td>26000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetation management</td>
<td>26000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>173000</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Total (Units 84, 85, 87, 88, 89, 90 and 91)</td>
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<td><strong>14,992,800</strong></td>
<td><strong>22,489,200</strong></td>
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<tr>
<td>Alter weed cutting management practices</td>
<td>28000</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Change sluice control to restore channel</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channel narrowing by instream measures</td>
<td>303000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>De-silting</td>
<td>57000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce dredging</td>
<td>-256000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce tree shading</td>
<td>14000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removal or partial removal/lowering of structure</td>
<td>6000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove bank protection</td>
<td>164000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restore channel planform</td>
<td>90000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riparian planting</td>
<td>18000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetation management</td>
<td>29000</td>
<td></td>
<td></td>
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<td><strong>Total</strong></td>
<td><strong>454000</strong></td>
<td><strong>363200</strong></td>
<td><strong>544800</strong></td>
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<tr>
<td>Dever Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Total</td>
<td><strong>19,195,000</strong></td>
<td><strong>15,356,000</strong></td>
<td><strong>23,034,000</strong></td>
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</table>
## Table 21: Cost for delivering the River Itchen river restoration strategy

<table>
<thead>
<tr>
<th>SSI Unit</th>
<th>Action</th>
<th>Total Cost (Nearest Thousand)</th>
<th>Low Cost (~20%)</th>
<th>High Cost (+20%)</th>
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</thead>
<tbody>
<tr>
<td>103</td>
<td>Channel narrowing by instream measures</td>
<td>143000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fencing – Livestock</td>
<td>37000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grazing pressure management</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Modify hatch/sluice control</td>
<td>31000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduce tree shading</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vegetation management</td>
<td>3000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>103 Total</td>
<td></td>
<td>215,000</td>
<td>172,000</td>
<td>258,000</td>
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<tr>
<td>105</td>
<td>Grazing pressure management</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>105 Total</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>106</td>
<td>Change sluice control to restore channel</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Channel narrowing by instream measures</td>
<td>299000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Create riffles</td>
<td>297000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fencing – Livestock</td>
<td>9000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Remove bank protection</td>
<td>56000</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Riparian planting</td>
<td>55000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vegetation management</td>
<td>7000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>106 Total</td>
<td></td>
<td>723,000</td>
<td>578,400</td>
<td>867,600</td>
</tr>
<tr>
<td>107</td>
<td>Bed level raising</td>
<td>1707000</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Channel narrowing by instream measures</td>
<td>501000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Channel narrowing by marginal planting</td>
<td>134000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>De-silting</td>
<td>1057000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fencing – Humans/dogs</td>
<td>13000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fencing – Livestock</td>
<td>23000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grazing pressure management</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Modify hatch/sluice control</td>
<td>88000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Removal or partial removal/lowering of structure</td>
<td>10000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Riparian planting</td>
<td>395000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vegetation management</td>
<td>35000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>107 Total</td>
<td></td>
<td>3,963,000</td>
<td>3,170,400</td>
<td>4,755,600</td>
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<tr>
<td>108</td>
<td>Channel narrowing by instream measures</td>
<td>219000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>De-silting</td>
<td>361000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fencing – Humans/dogs</td>
<td>9000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fencing – Livestock</td>
<td>58000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Install fencing to reduce erosion</td>
<td>18000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduce tree shading</td>
<td>2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Restore continuity with floodplain</td>
<td>41000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Riparian planting</td>
<td>174000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vegetation management</td>
<td>21000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>108 Total</td>
<td></td>
<td>903,000</td>
<td>722,400</td>
<td>1,083,600</td>
</tr>
<tr>
<td>Itchen Total (Units 103, 105, 106, 107 and 108)</td>
<td></td>
<td>5,809,000</td>
<td>4,647,200</td>
<td>6,970,800</td>
</tr>
<tr>
<td>105</td>
<td>Channel narrowing by instream measures</td>
<td>63000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fencing – Livestock</td>
<td>14000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grazing pressure management</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Restore channel planform</td>
<td>298000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Restore continuity with floodplain</td>
<td>162000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Riparian planting</td>
<td>33000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>105 Total</td>
<td>Candover Stream Total</td>
<td>569,000</td>
<td>455,200</td>
<td>682,800</td>
</tr>
</tbody>
</table>
### Channel narrowing by instream measures
- 104: 57000

### Channel narrowing by planting
- 104: 14000

### Create riparian corridor
- 104: 9000

### Fencing – Humans/dogs
- 104: 7000

### Reduce tree shading
- 104: 5000

### Restore channel planform
- 104: 46000

### Riparian planting
- 104: 33000

### Vegetation management
- 104: 2000

### Fencing – Livestock
- 104: 4000

**104 Total**

<table>
<thead>
<tr>
<th>Arle Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>177000</td>
</tr>
</tbody>
</table>

**Overall Total**

| Overall Total | 6,551,000 | 5,240,800 | 7,861,200 |
## Table 22: Cost assumptions for various proposed measures on the Test and Itchen

<table>
<thead>
<tr>
<th>ID</th>
<th>Action</th>
<th>Unit description</th>
<th>Rate used: £/m</th>
<th>Comments/assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Add soft bank protection</td>
<td>m</td>
<td>88</td>
<td>Faggot work narrowing 1 bank</td>
</tr>
<tr>
<td>2</td>
<td>Alter weed cutting management practices</td>
<td>m</td>
<td>−10</td>
<td>Boat + excav + boom: 1/2 costs</td>
</tr>
<tr>
<td>3</td>
<td>Bed level raising</td>
<td>m</td>
<td>270</td>
<td>Wensum* glide – no fine gravel</td>
</tr>
<tr>
<td>4</td>
<td>Change sluice control to restore channel</td>
<td>m</td>
<td>0</td>
<td>No change in costs</td>
</tr>
<tr>
<td>5</td>
<td>Channel narrowing by instream measures</td>
<td>m</td>
<td>88</td>
<td>Faggot work narrowing 1 bank</td>
</tr>
<tr>
<td>6</td>
<td>Channel narrowing by planting</td>
<td>m</td>
<td>60</td>
<td>Sub faggots for planted coir</td>
</tr>
<tr>
<td>7</td>
<td>Create backwater</td>
<td>m</td>
<td>416</td>
<td>Wensum *backwater cost</td>
</tr>
<tr>
<td>8</td>
<td>Create riffles</td>
<td>m</td>
<td>476</td>
<td>Wensum * glide</td>
</tr>
<tr>
<td>9</td>
<td>De-silting</td>
<td>m</td>
<td>145</td>
<td>Dredging cost</td>
</tr>
<tr>
<td>10</td>
<td>Fencing – Humans/dogs</td>
<td>m</td>
<td>16</td>
<td>Plain wire fencing</td>
</tr>
<tr>
<td>11</td>
<td>Fencing – Livestock</td>
<td>m</td>
<td>20</td>
<td>Sheep fencing</td>
</tr>
<tr>
<td>12</td>
<td>Fencing – Erosion</td>
<td>m</td>
<td>18</td>
<td>Barbed wire fencing</td>
</tr>
<tr>
<td>13</td>
<td>Grazing pressure management</td>
<td>m</td>
<td>0</td>
<td>No change as management time remains same</td>
</tr>
<tr>
<td>14</td>
<td>Modify hatch/sluice control</td>
<td>per m of control width</td>
<td>4400</td>
<td>Replace with penstock with civils work</td>
</tr>
<tr>
<td>15</td>
<td>Reduce dredging</td>
<td>m</td>
<td>−145</td>
<td>1/2 of re-calculated costs</td>
</tr>
<tr>
<td>16</td>
<td>Reduce tree shading</td>
<td>m</td>
<td>11</td>
<td>Wensum * tree trimming</td>
</tr>
<tr>
<td>17</td>
<td>Remove bank protection</td>
<td>m</td>
<td>156</td>
<td>Halcrow *derived cost</td>
</tr>
<tr>
<td>18</td>
<td>Remove weirs</td>
<td>per m of control width</td>
<td>720</td>
<td>Cost is per m river width</td>
</tr>
<tr>
<td>19</td>
<td>Removal or partial removal/lowering of structure</td>
<td>per m of control width</td>
<td>360</td>
<td>Cost is per m river width</td>
</tr>
<tr>
<td>20</td>
<td>Removal of trash blockages</td>
<td>per item</td>
<td>1285</td>
<td>Cost is per blockage</td>
</tr>
<tr>
<td>21</td>
<td>Re-profiling channel banks</td>
<td>m</td>
<td>58</td>
<td>Wensum * channel re-section</td>
</tr>
<tr>
<td>22</td>
<td>Restore channel planform</td>
<td>m</td>
<td>163</td>
<td>Wensum * channel realign</td>
</tr>
<tr>
<td>23</td>
<td>Restore continuity with floodplain</td>
<td>m</td>
<td>160</td>
<td>Wensum * remove spoil bank and add swale</td>
</tr>
<tr>
<td>24</td>
<td>Riparian planting</td>
<td>m</td>
<td>60</td>
<td>as per channel narrowing planting</td>
</tr>
<tr>
<td>25</td>
<td>Tackle invasive species</td>
<td>m</td>
<td>5</td>
<td>same as vegetation management</td>
</tr>
<tr>
<td>26</td>
<td>Weed screen removal/management</td>
<td>m</td>
<td>180</td>
<td>Cost is per m river width</td>
</tr>
<tr>
<td>27</td>
<td>Vegetation management</td>
<td>m</td>
<td>5</td>
<td>Hand work: 1/2 boat cost</td>
</tr>
</tbody>
</table>

*Note: Figures in relation to the River Wensum are based on the experience of implementing the River Wensum SSSI strategy on the ground with our partners the Environment Agency and Natural England. Halcrow refers to the spreadsheet on river restoration costings developed by Halcrow for the Environment Agency (Environment Agency, 2008b).
9. Conclusions

The geomorphological surveys conducted as part of this project collected information on the physical form and ecological characteristics of the River Test and Itchen SSSIs and compared the current characteristics against those expected for a natural river of this type. This comparison highlighted a variety of different pressures identified which affects the physical form and functioning of the channels which in turn determines the associated ecological functioning of these rivers. These pressures are typically present in both rivers and the principal pressures include:

Riparian Zone
- Land use pressures that modify the riparian zone and have led to a reduction in tree coverage over both width and area of the riparian strip;
- Degradation of the buffer strip leading to a reduction in complexity of the riparian corridor.

Banks
- Uniform banks due to historic re-sectioning of the channel leading to near vertical sides in places and an abrupt transition between marginal and bank side habitats;
- Limited complexity of marginal strip due to management of marginal vegetation;
- Heavy poaching in places leading to accelerated fine sediment input into the river. This is related to livestock pressure as well as humans and dog access.

Bed
- Reduction in habitat diversity due to dredging, weed cutting practices and removal of coarse woody debris
- Over-widening leading to significant lengths of channel which are prone to deposition

Planform
- Channel straightening and re-sectioning has led to a reduction in longitudinal and lateral habitat complexity;
- Both rivers are perched in places with embankments on either side due to historical legacy of mills, water meadows, fish farms and watercress beds.

Flow (types and velocity variability)
- Both rivers are low energy systems but flow variability is reduced due to historic modifications affecting channel planform (straightening, widening and re-sectioning) and longitudinal connectivity (impoundments and deepening);
- The lack of coarse woody debris within the rivers reduces flow and velocity variability.

These pressures exist throughout the two rivers and across the various SSSI units and are therefore considered “common themes” which form the basis for restoration recommendations within this strategy.

The approaches to restoration set out within this strategy vary from more significant restoration measures to actions to help natural adjustment or recovery where the energy and sediment is available, or management measures to conserve and enhance those reaches already exemplifying features in accordance with Favourable condition. The restoration actions are considered within three categories: Restore; Rehabilitate; and Conserve and Enhance.

Conserve and Enhance: This category represents reaches where restoration works are minimal. In these reaches actions to restore the morphology of the channel were deemed unnecessary. However despite a good morphology there is opportunity to make further improvements, often involving the management of the river. Management actions such as control structure management and vegetation management would fall under this restoration activity, helping to mitigate failure to achieve Favourable condition (Geodata, 2010). Most reaches that are considered to be in good status from a geomorphological perspective are still assigned the category of Conserve and Enhance as it is important to ensure that no deterioration in status occurs through the life of this strategy.

Rehabilitate: This category covers reaches where the channel shows evidence of adjustment to a more natural form, or potential to adjust, following historic modification. However pressures remain, affecting the in-channel and riparian habitats, which will prevent the river from recovering to support favourable condition.
Typically actions to rehabilitate the river are focused around in-channel measures such as the addition of woody debris to narrow the channel or bed raising, which will assist the river in establishing more natural features. In instances where the riparian zone has been significantly degraded, measures associated with vegetation management are suggested. Improving the condition of the riparian zone will again assist channel recovery by providing a supply of wood to the channel and marginal vegetation, which will create variations in flow and lead to a more varied channel morphology.

**Restore**: This category of restoration encompasses those reaches which are degraded and do not show evidence or the potential to naturally re-adjust. These reaches require fundamental restoration measures to meet favourable condition. Restoration measures include the removal/lowering of significant structures and the re-naturalisation of planform. The latter option may require re-notification action to ensure that new alignments have statutory protection (Geodata, 2010).

The specific actions falling within these categories are described in more detail in the accompanying River Test and Itchen Restoration Plan. Together with this technical report, these two documents form the restoration strategy/vision for the Test and Itchen which sets out the restoration aspirations over the next 20 to 30 years and the types of restoration actions that could be carried out to achieve favourable condition in the SSSIs/SAC. This document will be used in future to support decision making and prioritisation of work on both rivers. However, it is important to note that the types of measures contained herein are not definitive and do not obligate landowners/land managers/stakeholders to the specific actions. It is recognised that a lot of work needs to be done to bring about the changes set out within the strategy, and that this will require further feasibility investigations alongside effective, proactive and positive stakeholder engagement with landowners, land managers and other stakeholders. As the strategy progresses it will also be advisable that good practice actions and evidence of successful measures be shared around interested parties in the two catchments. This will ensure that learning lessons can be maximised and an evidence base for improvement measures be developed.

Further work needs to be undertaken to understand the specific constraints on the various restoration actions at a site level, such as those posed by commercial interests (such as fishing and farming) land use, flood risk, development, infrastructure and cultural heritage.

Following publication of the final plan, Natural England and the Environment Agency will work with stakeholders to take forward the actions within the plan. Whilst some options will be able to be implemented relatively quickly over the next few years, other measures will take longer to develop. This plan is a long-term restoration strategy likely to be realised over the next 20 to 30 years.
10. References


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Appendix A.  Figures

THE FOLLOWING APPENDIX A. FIGURES HAVE NOT BEEN INCLUDED IN THE MAIN TEST AND ITCHEN RESTORATION STRATEGY DOCUMENT. THEY ARE PROVIDED WITHIN AN ACCOMPANYING APPENDIX A FOLDER.

A.1.  Structures along the River Test

A.2.  Structures along the River Itchen

A.3.  Restoration category per reach – Test

A.4.  Restoration category per reach – Itchen

A.5.  Restoration actions per reach – Test

A.6.  Restoration actions per reach – Itchen
Appendix B. Summary of restoration potential per reach

B.1. Summary of restoration potential per reach on River Test

B.2. Summary of restoration potential per reach on River Itchen