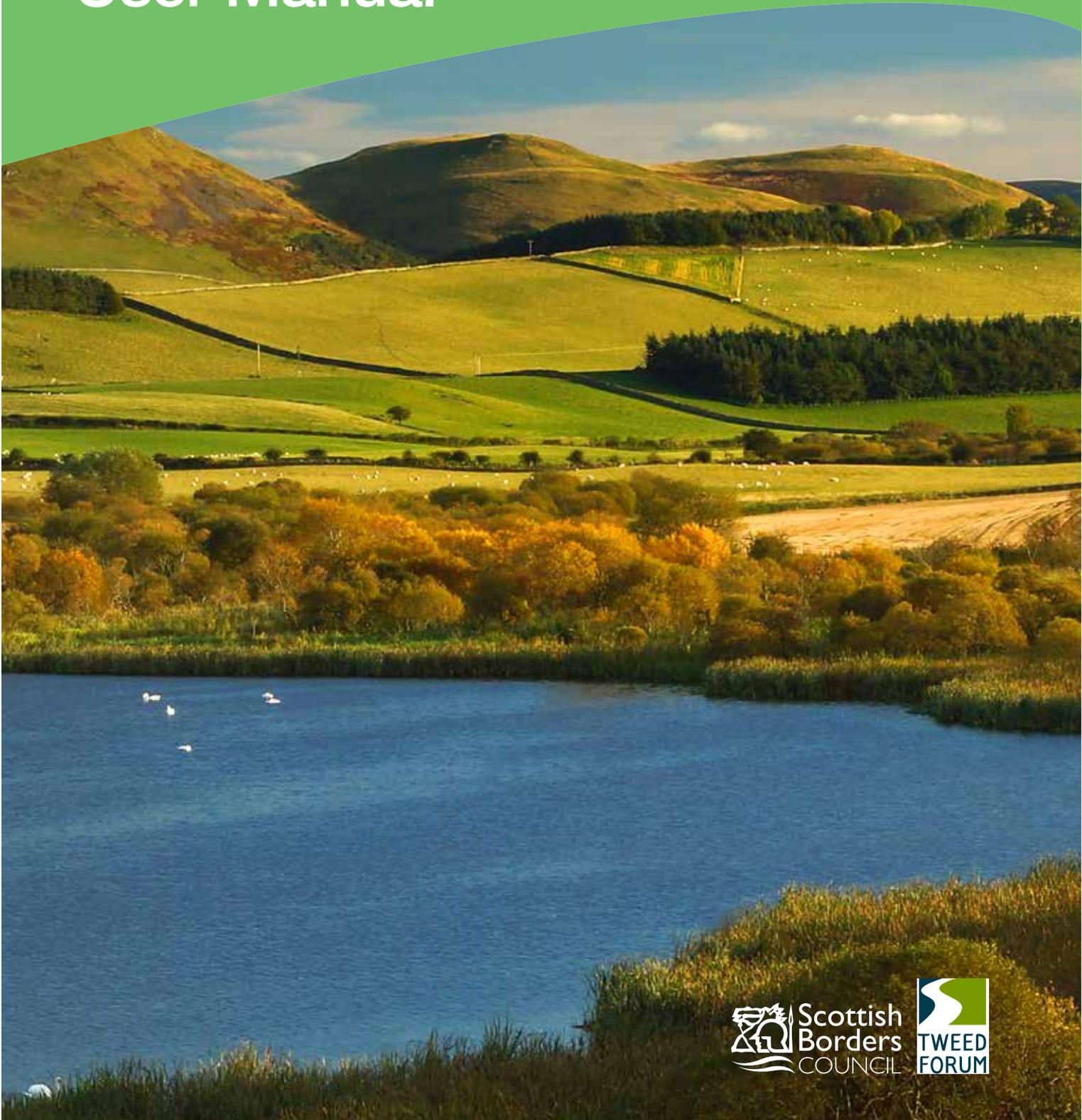


scottish borders regional land use framework mapping tool

User Manual

REGULATORY SERVICES



Introduction

The ecosystem service maps for the Scottish Borders are presented as an application on Find IT (Local View). An ecosystem is a biological community of interacting organisms and their physical environment. Ecosystem services are the benefits humans derive from the natural environment. The focus lies on four different ecosystem services:

- [Natural Flood Management](#) The ability of the land to temporarily store water and help prevent flooding
- [Water Quality](#) The ability of the land to filter pollutants and excess nutrients out of the water, providing clean water
- [Carbon Storage \(Soil\)](#) The ability of the land to mitigate climate change effects by storing carbon, instead of releasing it into the atmosphere
- [Biodiversity](#) The variety of plant and animal life in an area; high biodiversity is important for the delivery of all other ecosystem services

For each ecosystem service, a map series of four maps exists:

- A multi-benefits map, showing where enhancing this service would benefit additional ecosystem services
- An opportunities map, showing where this service could be enhanced
- An interactions map showing where and how opportunities to enhance the service interact with agriculture, identifying possible land use constraints
- A stock map, also referred to as Natural Capital map, showing where a service is currently delivered

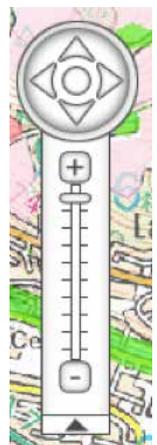
The multi-benefits and opportunities maps are of particularly high value for land management decisions, as they show the opportunities to enhance the land of the Scottish Borders, whilst the stock (Natural Capital) maps show what is already there, whilst the interaction maps show where enhancing one service might result in the loss of another service, notably agriculture and food production.

Navigating the online portal:

Upon opening, the full area of Scottish Borders is displayed, with only the basemap, visible. However, when accessing the map via a hyperlink, the relevant layer will already be visible.

There are 5 ways of zooming and moving on the map:

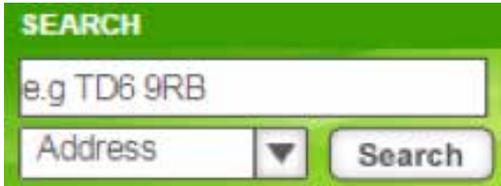
- You can zoom with the mouse wheel and change the location by dragging the map while holding the left mouse button
- You can pan and zoom by using the tools in the top left corner of the map
- You can adjust the map to the scale you would like; just enter the right scale and click the little sideways arrow to apply the scale to the map.



- You can zoom to pre-defined bookmarks for river catchment areas in the Scottish Borders



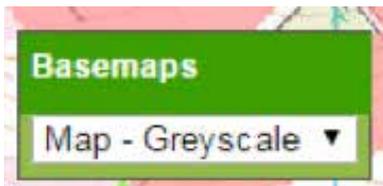
- You can search for an address.



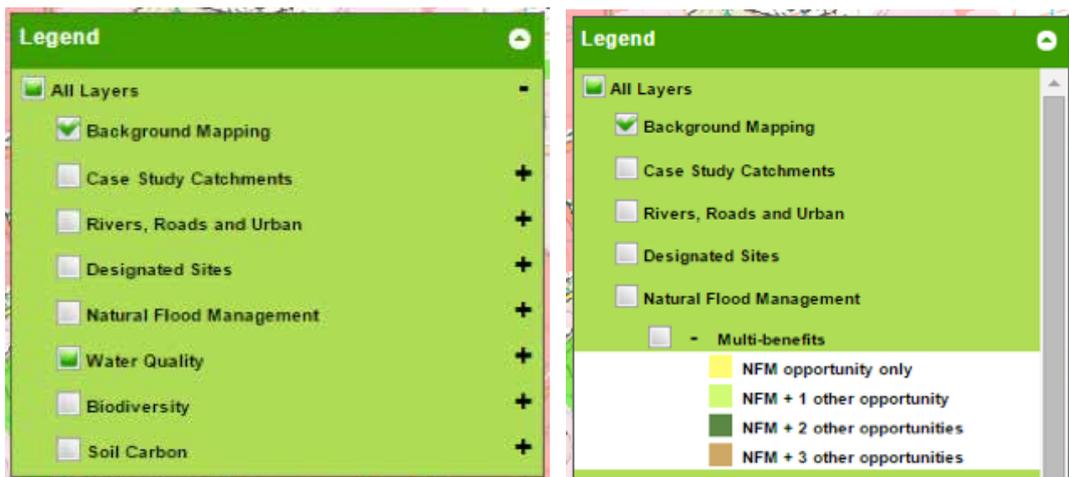
Note: The maps are indicative and so should be viewed at a local landscape or sub-catchment scale rather than individual farm or land holding. The scale is limited to zoom down to 1:25,000 only.

Changing what is displayed on the map:

- The basemap, e.g. the map displayed in the background for context, can be adjusted to greyscale, colour, or aerial photography



- In the Legend box, you can choose which layers to display and view the symbols used to show them.
- Within the legend box individual layers are grouped together. Use the '+' symbol on the right to expand a groups so you can see the individual layers. Expanding an individual layer using the '+' on the left displays the legend for this layer.

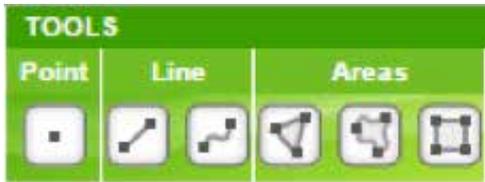


Note: In some browsers the legend box may have scroll bars. You might have to scroll to the side to see the '+' to expand the groups. We recommend using Internet Explorer.

- Use the tick boxes to turn on layers on the map; you can either switch on a whole group of layers or just an individual layer. For visual clarity, we strongly recommend you expand the group and only turn on one layer at a time.

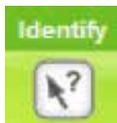
Interacting with the map

- You can add points, lines, or areas to the map, to highlight areas of interest; additionally, the exact coordinates (point), distance (lines) and area will be displayed. Any things you add are not saved, they will be lost when you end the current session. To keep them, you can print the map to make a PDF or jpeg image.

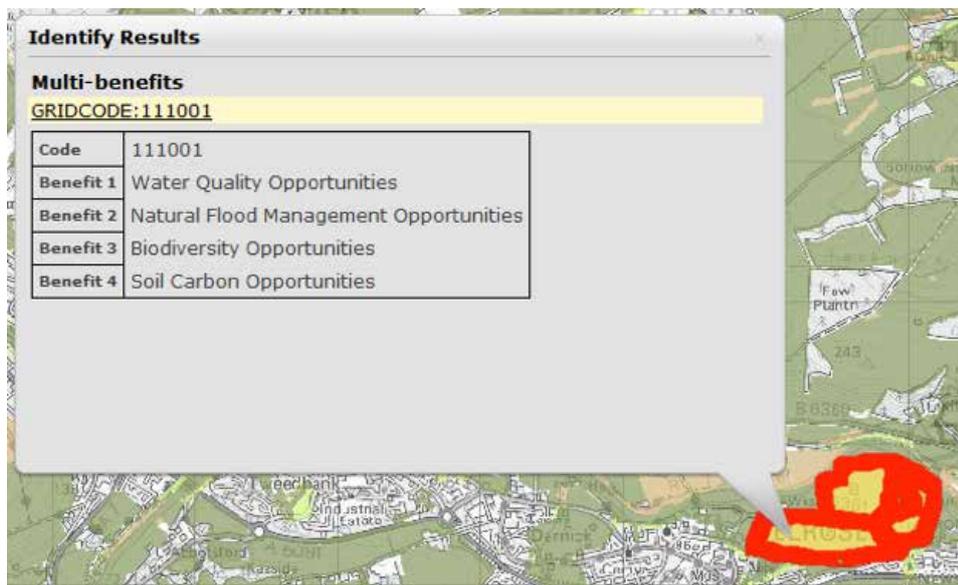


Interrogating the map

- When looking at the multi-benefit maps you can find out which ecosystem services are enhanced by selecting the 'Identify' tool and clicking on your area of interest. This only works on the multi-benefit maps.



- In the pop-up click on the 'GRIDCODE' to view the benefits table.



Sharing the map

- You can share a link to the map you are seeing; when you do, the scale of the map is preserved, as is your selection of layers. Things you have drawn on the map are not preserved.



Printing the map

- You can export the map (including anything you've drawn on it) to a PDF or image file by pressing the Print button.



- Select Portrait or Landscape. Add a title and description of what the map shows (optional). Select the quality and format options you want. Press Print.
- The result will appear in a new tab/window of the browser. Go to File > Save as to save the file on your computer. The keyboard shortcut Ctrl+S also saves the file.

Print Options ✕

Choose a print layout:

A4 Landscape
A4 Portrait

Print Details:

Title: Biodiversity Stock Map

Description: Areas around the Eildon H

Map area: Maintain extent ▼

Print Quality: High ▼

Output format: PDF ▼

Print

Natural Flood Management (NFM)

During rainfall, some types of soil and vegetation act like sponges: They take up water, store it temporarily, and gradually release it after rainfall. This process is referred to as natural flood management, as the temporary storage of water in the natural environment after a large rainfall event slows the water flowing towards rivers and limits river swelling and subsequent flooding.

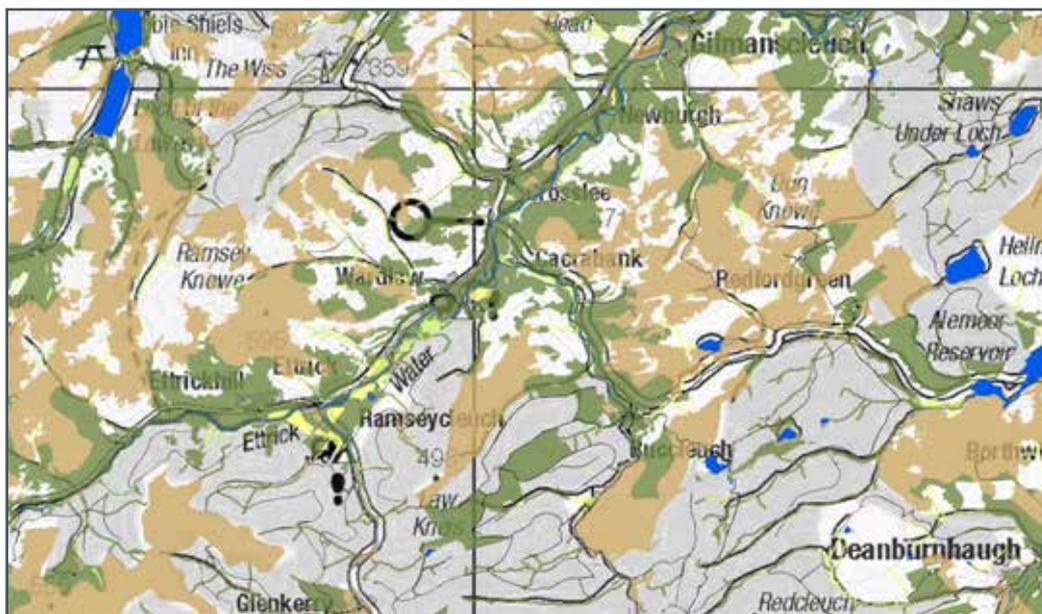
The main mapping output for this service is the multi-benefit map, which is of high value for land management decisions. This map is based on stock (Natural Capital) and opportunities maps. Detailed information regarding interaction between this service and agriculture can be obtained from the interactions map.

Multi-benefits map

This map shows areas where measures to enhance the ability of the land to temporarily store water could additionally benefit other important ecosystem services.

This map shows:

- Areas, where management for natural flood control could yield benefits for one (light green), two (dark green), or three (brown) other ecosystem services
- Areas, where management for natural flood control would not yield additional benefits (yellow)



How multi-benefits were evaluated:

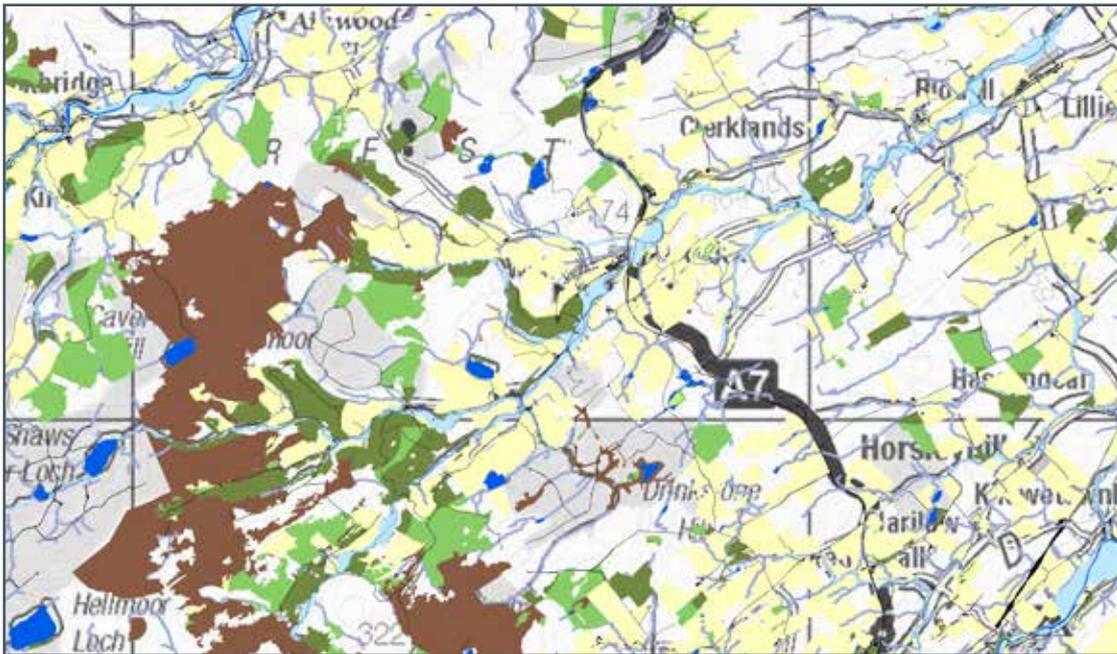
- Areas providing multi-benefits were identified by looking at the areas identified as opportunity areas for natural flood control; multi-benefits exist where opportunities for natural flood control exist in the same areas as opportunities for enhanced biodiversity, improved water quality, and/or enhanced soil carbon.

Opportunities map

This map shows areas where the ability of the land to temporarily store water can be enhanced through one of several types of habitat modification.

Types of habitat modification evaluated are:

- Tree (and woodland) planting to reduce surface water run-off (shades of green)
- Wetland creation (dark blue)
- Restoration of upland habitats, such as ditch blocking on deep peat areas (brown)
- Increase of water storage in the flood plain, e.g. through pond establishment (beige)
- Increase of infiltration in other habitats (light blue)



All of these describe measures that would increase the ability of the land to temporarily store water.

How the opportunities are evaluated:

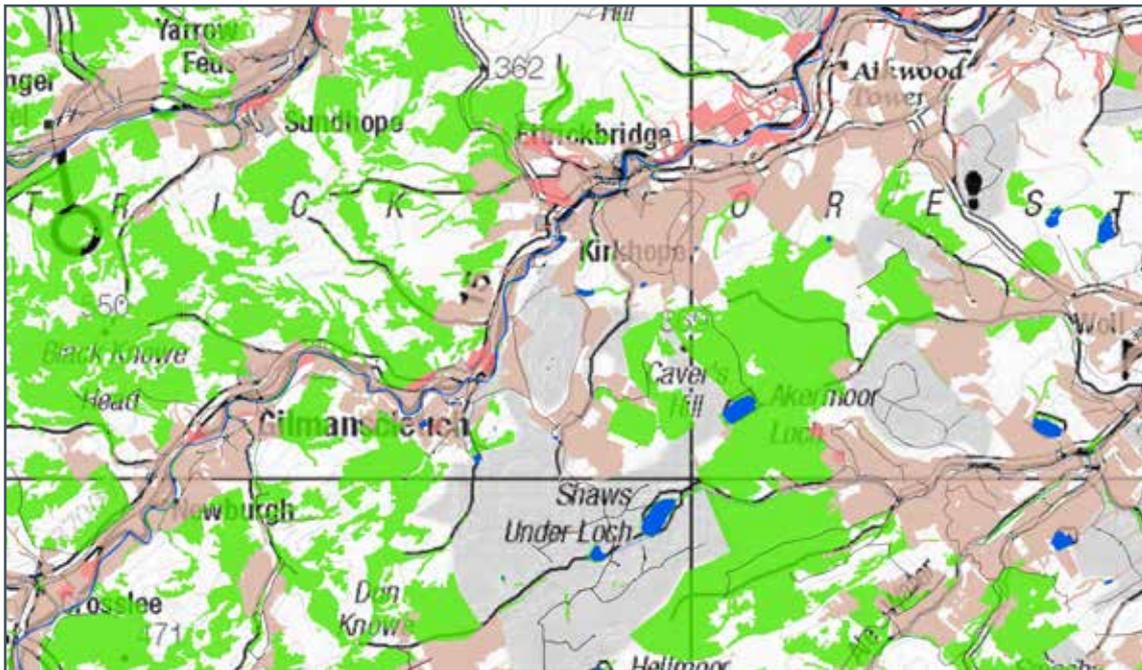
- The opportunity for tree planting exists in areas with habitats that indicate that tree growth could generally be supported. Areas where tree planting is possible around rivers are particularly good opportunity areas, as inflow of water into the river would be slowed down.
- Areas with habitats valuable for natural flood control that are currently degraded are considered to offer opportunity for habitat restoration
- Areas containing drainage channels are opportunity areas for re-wetting, particularly when located close to rivers

Interaction map

This map shows how opportunities to enhance the ability of the land to temporarily store water interact with, and might be constrained by, the presence of land used for agriculture.

In this map:

- Dark pink areas show opportunities on current arable land
- Light pink areas show opportunities currently on improved pasture
- Green areas show opportunities on other types of pasture



How the interactions are evaluated:

- Arable land, where food production is the priority in land management, is considered to limit opportunities for natural flood management the most
- High quality grazing land is sometimes considered to limit opportunities for natural flood management. However, there is often some opportunity for NFM by integrating appropriate management into current land use
- Other types of pasture, e.g. high grazing and rough pasture, are considered to limit natural flood management least and these areas can offer significant potential to integrate management enhancing natural flood control into current land use

Stock (Natural Capital) map

This map shows areas, where rainwater is temporarily stored in the vegetation and soil and then slowly released. This sponge effect mitigates downstream flooding, as it leads to little rainwater being added to the river over a longer time period, as opposed to lots of water reaching the river all at once. This will keep downstream river levels more stable over time.

In this map:

- Areas with darker blue colouring contribute more to flood control
- Red hatched areas are at very high flood risk; this layer is provided by SEPA as those areas at risk of flooding with a 1 in 200 year risk.



How the provision of this service is evaluated:

- Dense vegetation benefits this service, as rain falling on trees and plants reaches the ground more slowly, is taken up through tree roots or evaporates before reaching the ground.
- Soils with properties that allow for water to freely seep into the ground benefit this service, as water in the soil takes longer to reach rivers and/or reaches groundwater stores or is used by plants
- Gentle slopes benefit this service, as the water flows more slowly and has a higher chance of seeping into the soil

Water Quality

When rainwater flows through the landscape, particularly agricultural land or areas like old industrial sites or eroding peat, it picks up pollutants and excess nutrients. These can damage water habitats and even be harmful for humans. However, other types of habitats feature vegetation and/or soil that filter these contaminants from the water before it reaches rivers and streams. This process is referred to as water quality regulation and provides healthy aquatic habitats and clean drinking water.

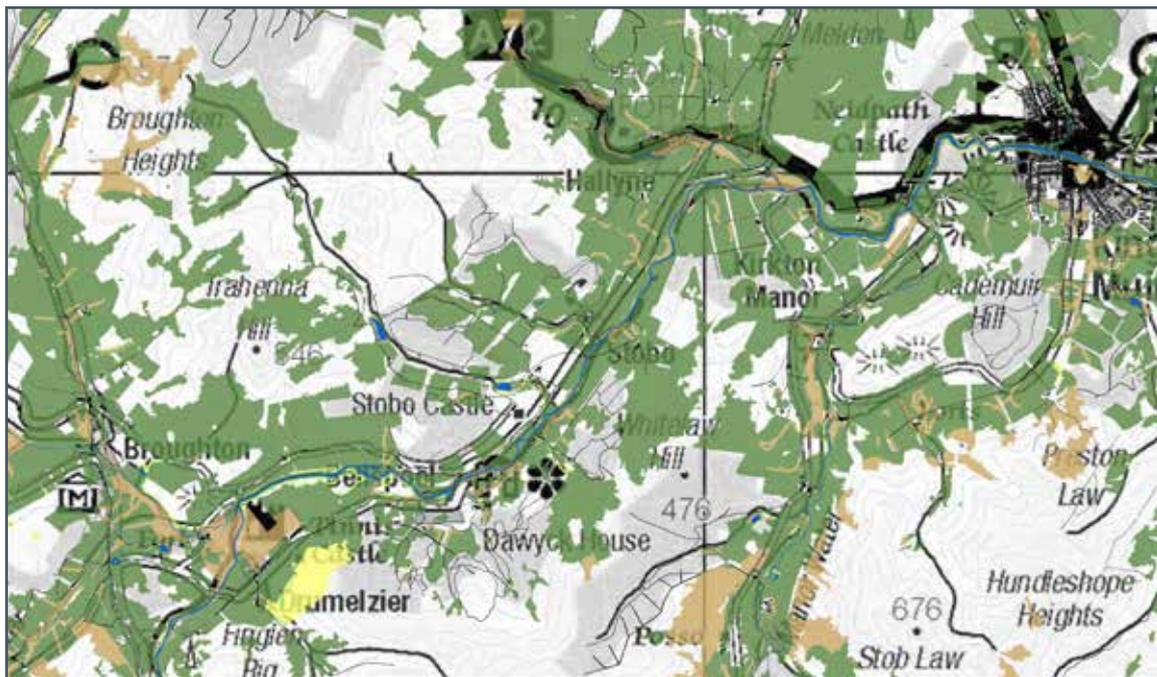
The main mapping output for this service is the multi-benefit map, which is of high value for land management decisions. This map is based on stock (Natural Capital) and opportunities maps. Detailed information regarding interaction between this service and agriculture can be obtained from the interactions map.

Multi-benefits map

This map shows areas where measures to enhance the ability of the land to remove pollutants or excess nutrients from the water may additionally benefit other important ecosystem services.

This map shows:

- Areas, where management for water quality could yield benefits for one (light green), two (dark green), or three (brown) other ecosystem services
- Areas, where management for water quality would not yield additional benefits (yellow)



How multi-benefits were evaluated:

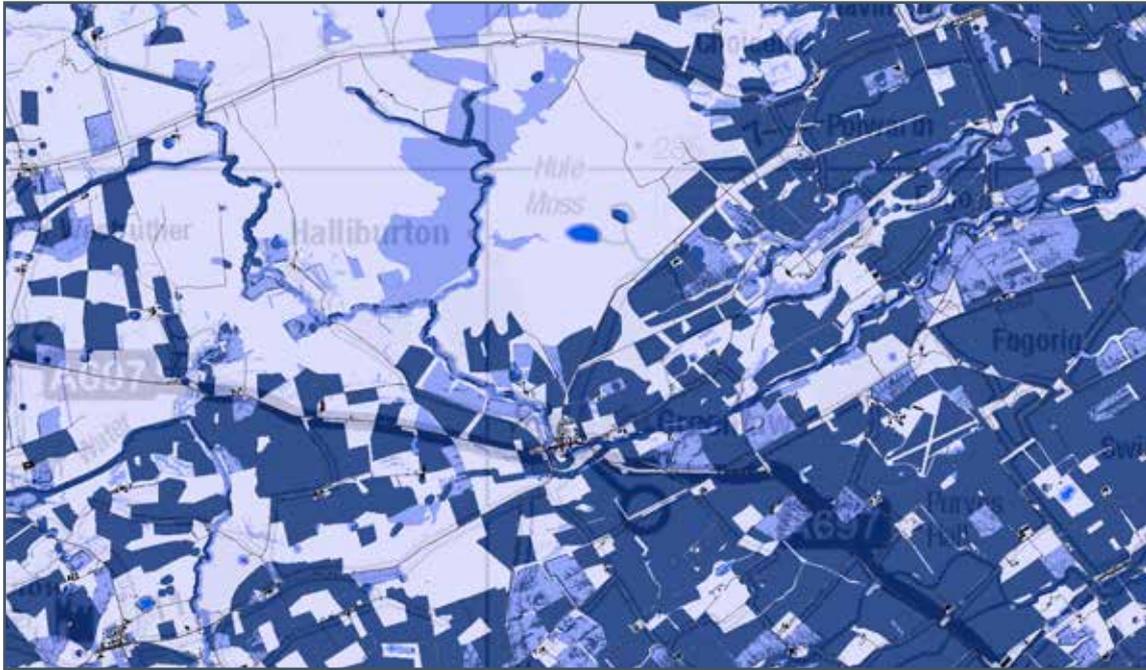
- Areas providing multi-benefits were identified by looking at the areas identified as opportunity areas for water quality; multi-benefits exist where opportunities for water quality exist in the same areas as opportunities for enhanced biodiversity, improved natural flood control, and/or enhanced soil carbon.

Opportunities map

This map shows areas where the ability of the land to remove pollutants and excess nutrients from the water column could be enhanced, thereby increasing the provision of clean water.

In this map:

- Darker areas have more opportunity for enhancing this service



How the opportunities are evaluated:

- Areas where soil is particularly prone to being eroded away are good opportunity areas for this service, as management against erosion would benefit water quality
- Areas in close proximity to water courses can provide some opportunity; if natural features can intercept the water before reaching the river, water will be filtered
- Habitats that are currently degraded offer opportunity for restoration; this will increase the capacity of the soil to filter and cleanse water

Interaction map

This map shows how opportunities to enhance the removal of pollutants and excess nutrients, interacts with and might be constrained by, the presence of land used for agriculture. Interactions between agriculture and water quality are of particular importance, as agricultural fertilisers are one of the main contributors to increased nutrient levels.

In this map:

- Dark pink areas show opportunities on current arable land
- Light pink areas show opportunities on land currently in improved pasture
- Green areas show opportunities on other types of pasture

How the provision of this service is evaluated:

- Deep-rooted habitats, such as woodland, benefit this service, as they allow for water seepage into the soil
- Soil types with a high capacity to take up pollutants and excess nutrients, such as brown earth or neutral soils, benefit this service, as water is purified quickly when seeping through these soil types
- Gentle slopes benefit this service, as water on gentle slopes flows more slowly, which increases its chances to seep into the soil for purification

Soil Carbon

Many human activities release carbon dioxide, a greenhouse gas, into the atmosphere, where it contributes to climate change. Many natural environments can help mitigate this effect, by removing carbon from the atmosphere and storing it. Whilst carbon is also stored in living vegetation, carbon stored in the soil forms the largest terrestrial carbon pool and is, therefore, important in mitigating climate change. Carbon enters the soil as organic matter, for example dead leaves.

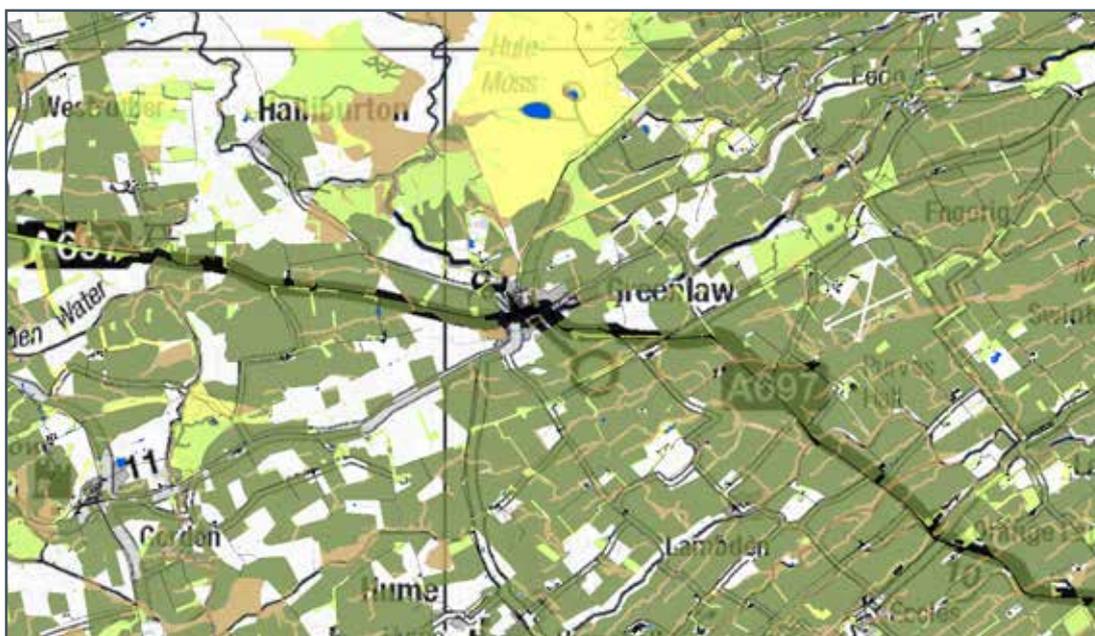
The main mapping output for this service is the multi-benefit map, which is of high value for land management decisions. This map is based on stock (Natural Capital) and opportunities maps. Detailed information regarding interaction between this service and agriculture can be obtained from the interactions map.

Multi-benefits map

This map shows areas where measures to enhance carbon storage in the soil will additionally benefit other important ecosystem services.

This map shows:

- Areas, where management for carbon storage could yield benefits for one (light green), two (dark green), or three (brown) other ecosystem services
- Areas, where management for carbon storage would not yield benefits beyond carbon storage (yellow)



How multi-benefits were evaluated:

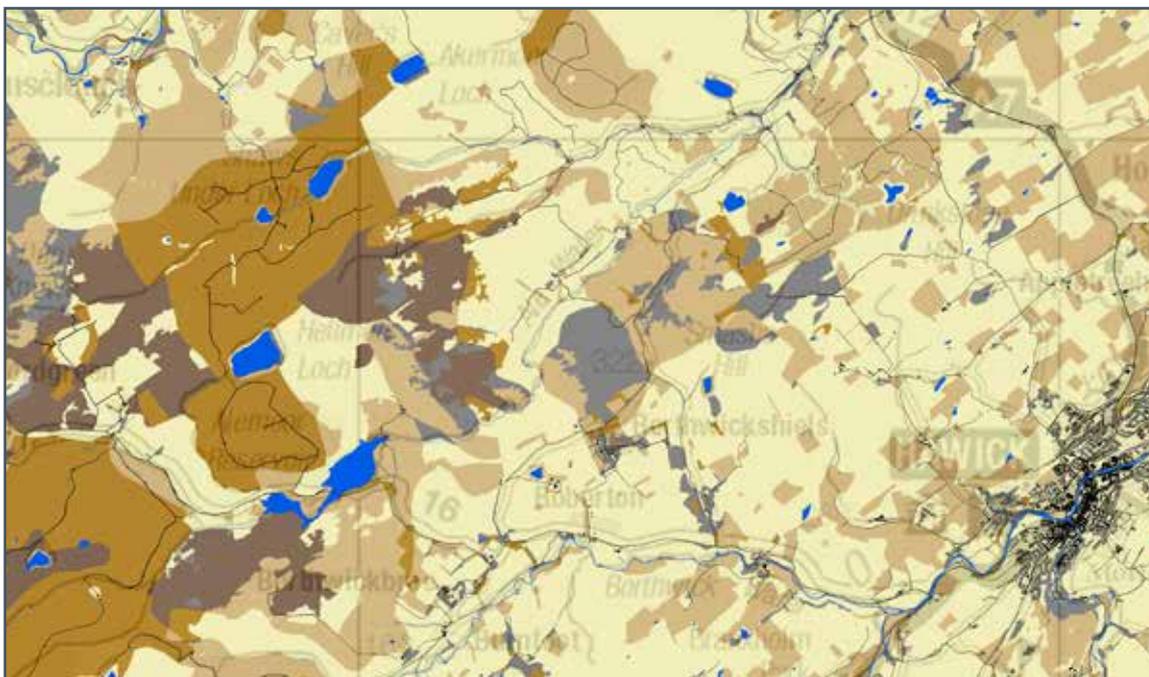
- Areas providing multi-benefits were identified by looking at the areas identified as opportunity areas for soil carbon; where opportunities for soil carbon exist in the same areas as opportunities for enhanced biodiversity, improved natural flood control, and/or enhanced water quality multi-benefits exist.

Opportunities map

This map shows areas where management can enhance the capacity of the soil to store carbon.

In this map:

- Darker shades of brown show areas with more opportunity to store carbon
- Grey areas are of very high value for carbon storage – these require continued sensitive management to maintain the carbon pool



How the opportunities are evaluated:

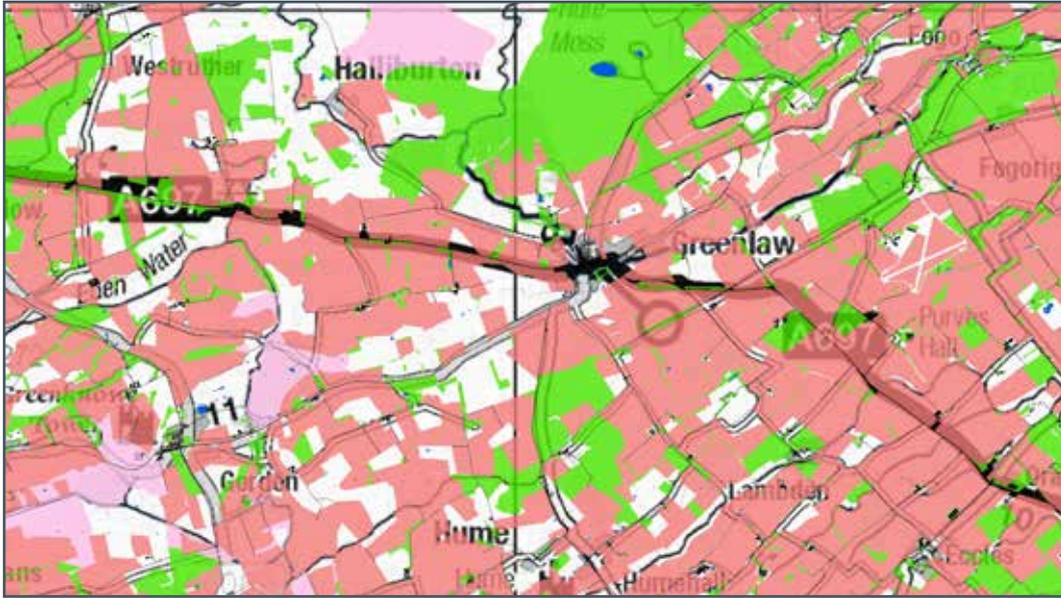
- Areas with organic soils present are opportunity areas, as organic soils have a higher potential for storing carbon than mineral soils
- Degraded habitats are opportunity areas, as restoring them to fully functioning systems will enhance the amount of carbon entering the soil
- Land under arable cultivation can provide opportunity for enhanced carbon storage, through suitable agricultural carbon management

Interaction map

This map shows potential constraints to improving carbon storage in the soil. Interactions between agriculture and carbon storage are important, as the harvesting of vegetation prevents dead organic plant matter from entering, and being stored in, the soil

In this map:

- Dark pink areas show opportunities on current arable land, where conversion to a permanent sward would give most benefit
- Light pink areas show opportunities through soil carbon sensitive agricultural management on deep peat
- Green areas show other opportunities for enhanced carbon storage through soil carbon sensitive agricultural management, e.g. by using organic, rather than inorganic, fertilisers



How the interactions are evaluated:

- Arable farming is a constraint on soil carbon storage, as agricultural practices remove organic matter from the soil system. Sensitive soil and carbon management (e.g. permanent cropping systems or organic fertilisers) is needed to maintain or increase soil carbon storage. (Dark Pink)
- Agriculture taking place on peat soils prevents the restoration of functioning peat systems; this is a constraint on soil carbon storage, as healthy peat systems are very good carbon stores (light pink)
- Changing from permanent pasture to arable rotation will result in the release of a lot of soil carbon; areas where this action is possible are a potential future source of carbon to the atmosphere (green)

Stock (Natural Capital) map

This map shows areas, where particularly large quantities of carbon are stored in the soil.

In this map:

- Soil in areas with darker grey colouring stores more carbon



How the provision of this service is evaluated:

- Organic soils, as opposed to mineral soils, store the largest quantities of carbon
- Gentle slopes benefit this service, as the soil profile is more stable. On steep slopes, the soil can be carried away by water flowing over the surface, which causes the carbon to be released back into the atmosphere.
- Habitats following a natural cycle benefit this service, as the natural die-back of parts of the vegetative cover will cause carbon to enter into the soil. Land use that removes vegetation before natural die-back occurs contribute least to this service.

Biodiversity

Biodiversity is a way to describe the variety of different forms of life on Earth; it covers the number and rarity of different plants, animals and habitats present, as well as how healthy a habitat / species is and how likely it is to stay healthy when faced with outside changes. Biodiversity is not only important because humans enjoy natural landscapes through many recreational activities, it is also the foundation for the provision of ecosystem services through the functioning of ecosystems. The benefits humans derive from nature ultimately depend on the presence of a variety of animal and plant species and habitat types. The more there are and the more resilient the system is to outside changes, the better it will contribute to the provision of ecosystem services and the more stable the provision of these services will be over time.

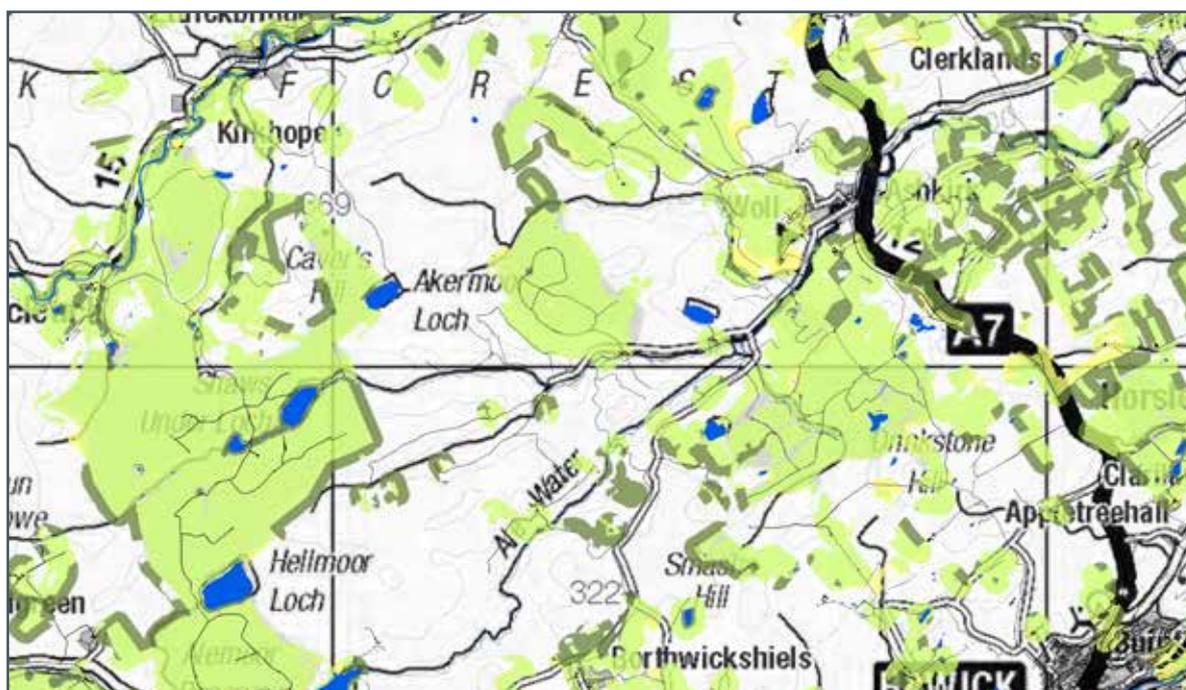
The main mapping output for this service is the multi-benefit map, which is of high value for land management decisions. This map is based on stock (Natural Capital) and opportunities maps. Detailed information regarding interaction between this service and agriculture can be obtained from the interactions map.

Multi-benefits map

This map shows areas where measures to enhance biodiversity will additionally benefit other important ecosystem services.

This map shows:

- Areas, where management for carbon storage could yield benefits for one (light green), two (dark green), three (light brown), or four (dark brown) other ecosystem services
- Areas, where management for carbon storage would not yield additional benefits (yellow)



How multi-benefits were evaluated:

- Areas providing multi-benefits were identified by looking at the areas identified as opportunity areas for biodiversity; where opportunities for biodiversity exist in the same areas as opportunities for enhanced soil carbon, improved natural flood control, enhanced water quality, and/or opportunities for planting of broadleaved woodland multi-benefits exist.

Opportunities map

This map shows areas where the diversity of plant and animal life, as well as habitats, can be enhanced on a large scale.

In this map:

- Darker shades of green indicate more opportunity for enhancement of biodiversity
- Brown areas are of very high biodiversity value – these require continued sensitive management to maintain current levels of biodiversity



How the opportunities are evaluated:

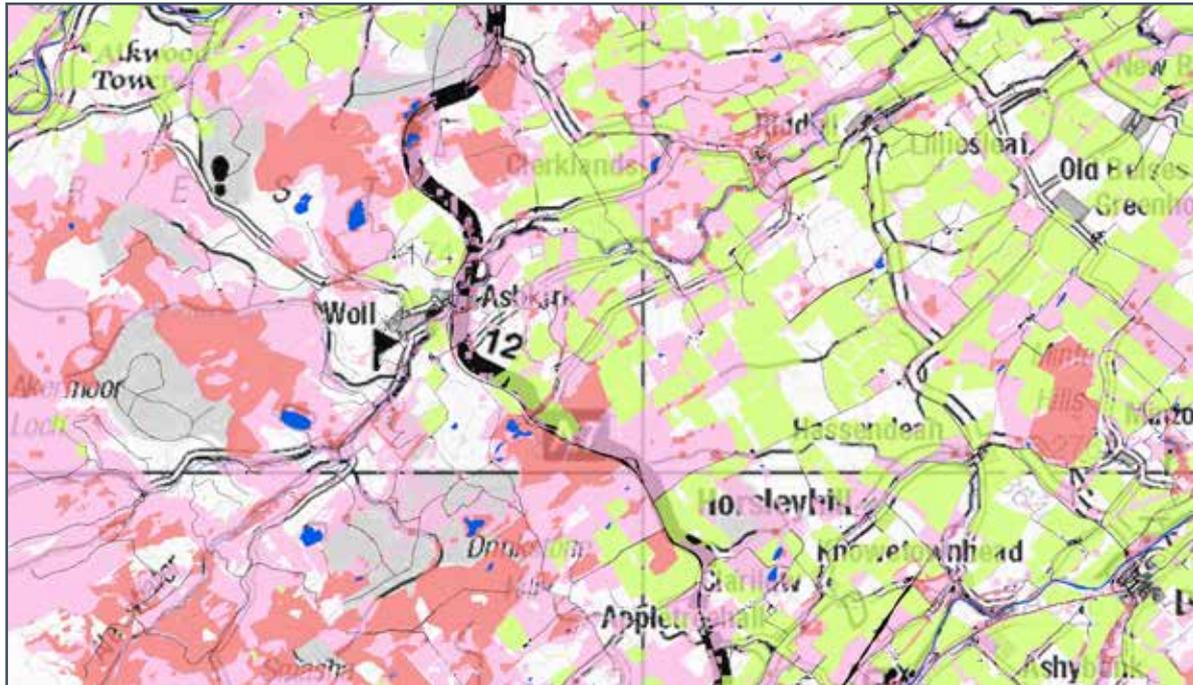
- Current land cover is one of the main factors in assessing opportunity for enhanced biodiversity
 - o Degraded semi-natural habitats offer most opportunity, as they can be restored into a natural state
 - o Areas that are currently of low biodiversity value, but could be restored into more natural systems, offer some opportunity
 - o Land that is under high-value, agricultural or forestry management, is considered to offer little opportunity, as habitat change in these areas is unlikely
- Opportunity areas that would enhance ecological networks and, thereby, the ability of species to move between habitat patches, are considered particularly high value opportunity areas

Interaction map

This map shows how opportunities to enhance biodiversity interact with the presence of land used for agriculture. Here, it is important to consider that some management actions benefiting biodiversity will have only minor impacts on the current land use.

In this map:

- Dark pink areas show opportunities on current arable land
- Light pink areas show opportunities on land currently in improved pasture
- Green areas show other opportunities to enhance biodiversity



How the interactions are evaluated:

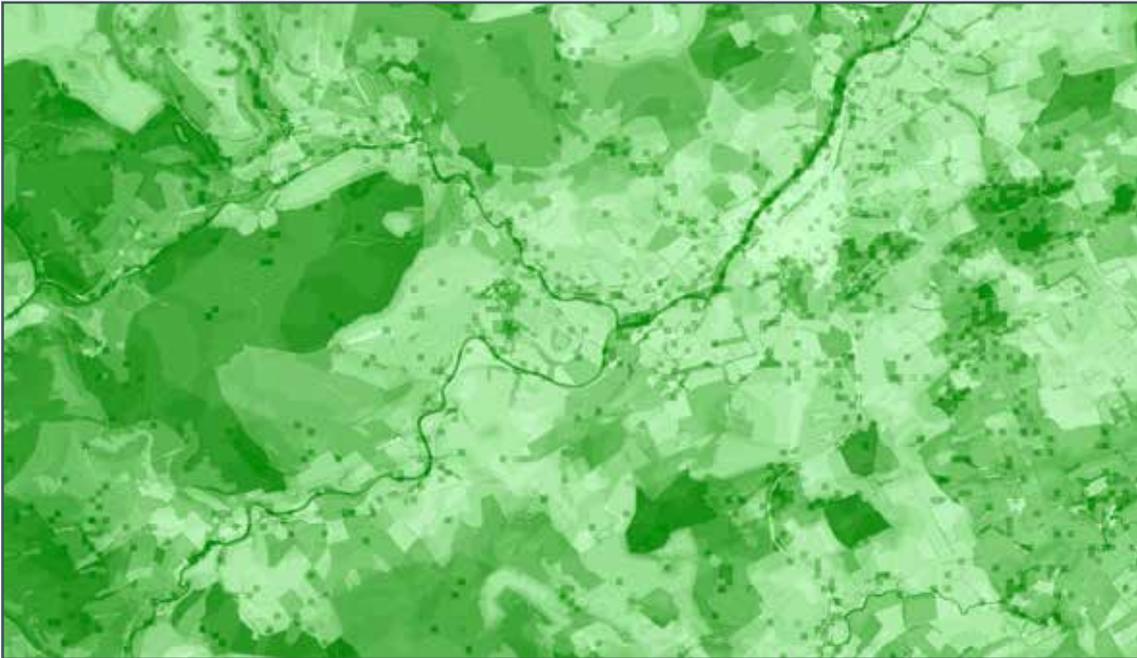
- Areas that have previously been identified as high opportunity areas for enhanced biodiversity and are currently used as arable land offer some opportunity, as some measures benefiting biodiversity, e.g. grass margins, will have only minor impacts on agricultural productivity
- Areas that have previously been identified as high opportunity areas for enhanced biodiversity and are currently used as (improved) pasture land, offer opportunity, as several measures benefiting biodiversity will have only limited impact upon current land use
- Areas that have previously been identified as high opportunity areas for enhanced biodiversity and are currently in land uses such as rough grazing or forested land are opportunity areas, as measures benefitting biodiversity can be incorporated into the current land use

Stock (Natural Capital) map

This map shows areas, where biodiversity is particularly high, with biodiversity being a measure of the variety of different forms of life, it also covers the number and rarity of different plants, animals and habitats present, as well as how healthy a habitat / species is and how likely it is to stay healthy when faced with outside changes

In this map:

- Darker green colouring shows areas where biodiversity is higher.



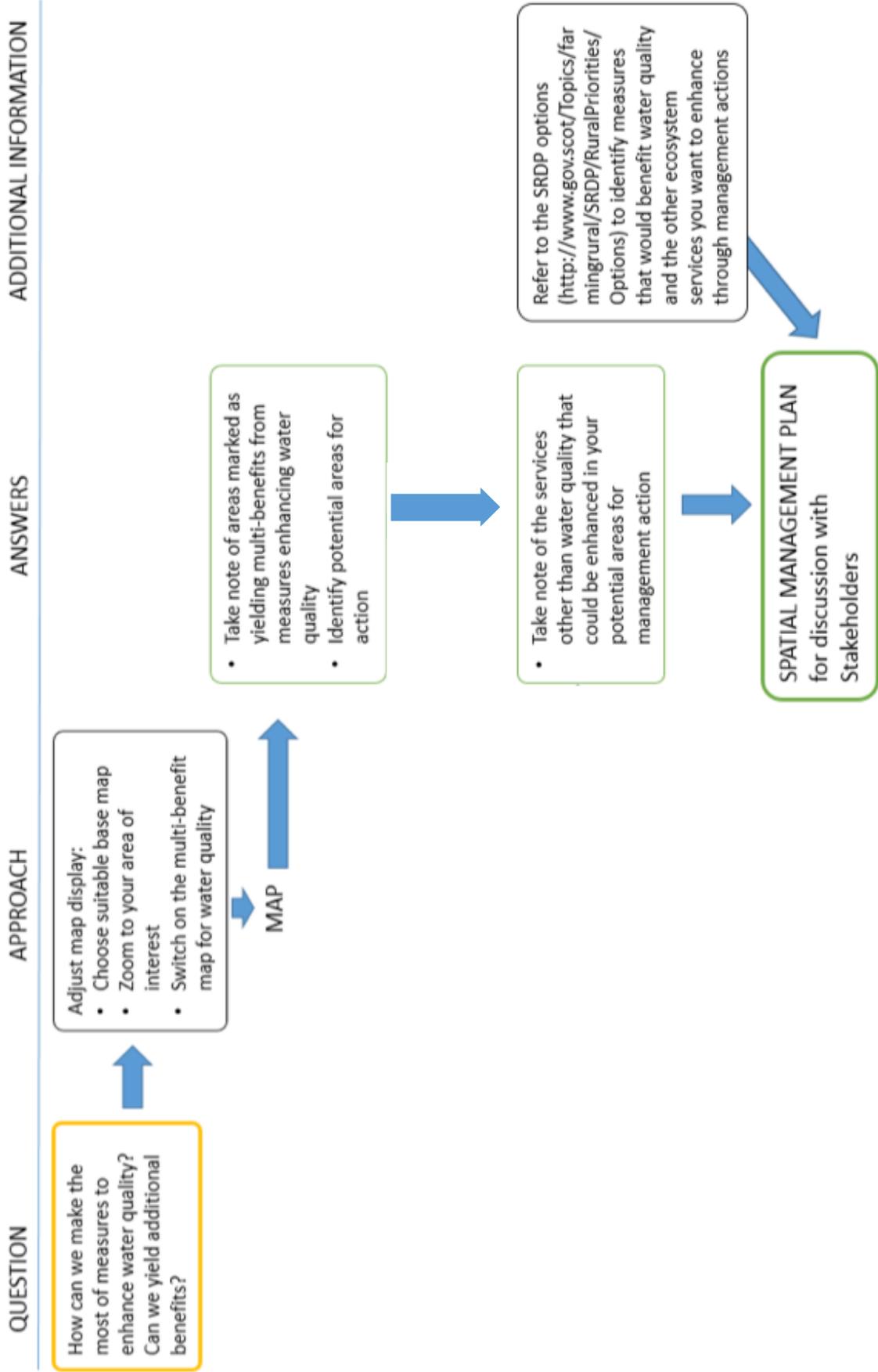
How the provision of this service is evaluated:

- In semi-natural habitats, biodiversity is higher than in areas managed intensively for a few agricultural species
- Protected sites benefit biodiversity, as human interference in these areas is managed to reduce negative impact upon wildlife
- Areas in which the presence of internationally important species has been recorded are of particularly high biodiversity value
- Habitat patches that are connected, e.g. by corridors of a similar habitat, or adjacent to patches of the same or a similar habitat are of higher biodiversity value, as this type of ecological connectivity allows for species to move freely and interact

Case studies

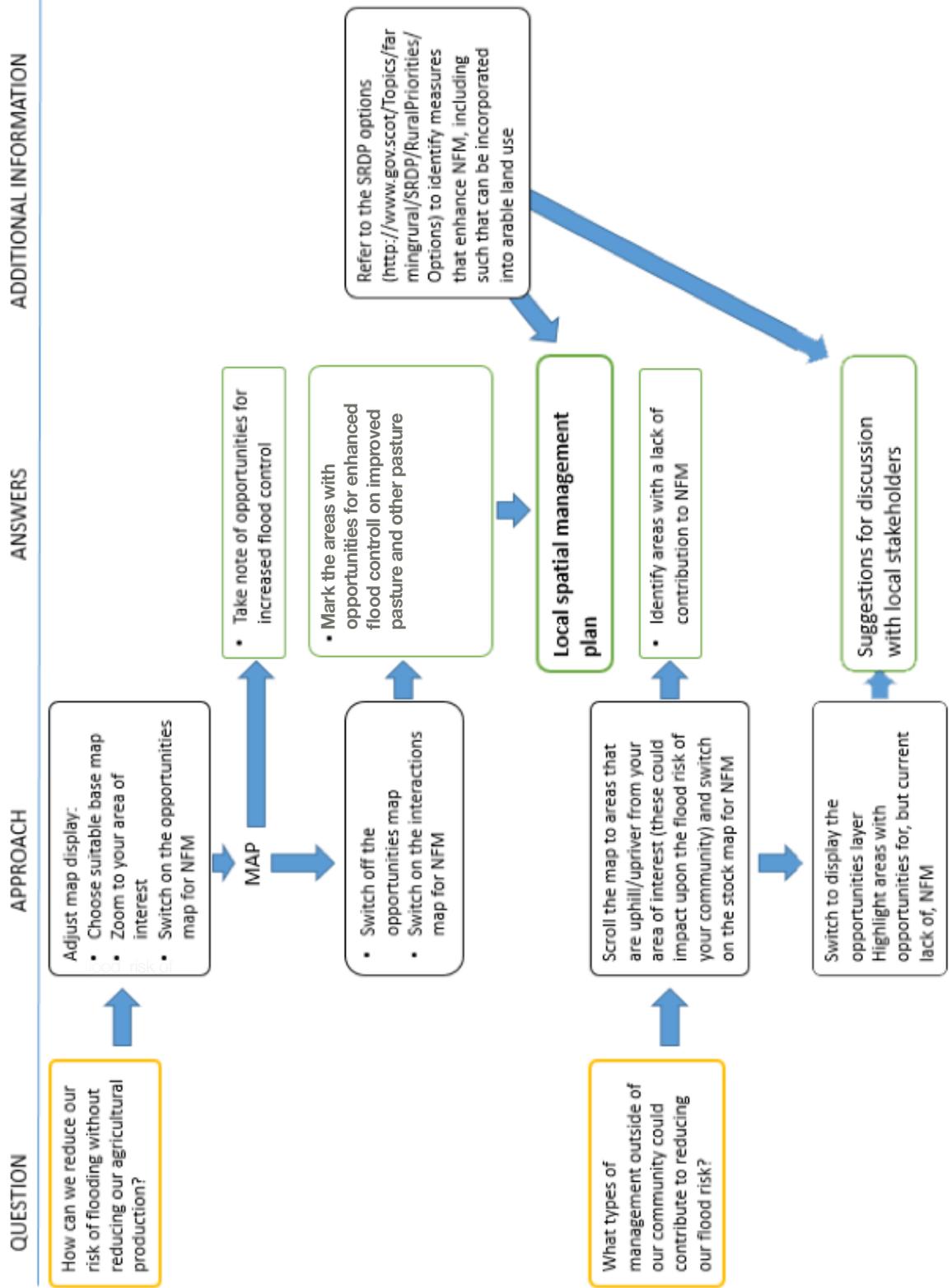
Scottish Rural Development Programme (SRDP) level

During the planning stage of an agri-environment scheme, enhancing water quality is identified as one priority, as this will reduce the costs associated with clean drinking water. Understanding where local management measures can be targeted to achieve this whilst enhancing additional ecosystem services is very desirable. The SBC online tool can be used to identify which measures are best applied where within the region to maximise benefits for other ecosystem services in addition to meeting the targets for enhanced water quality.



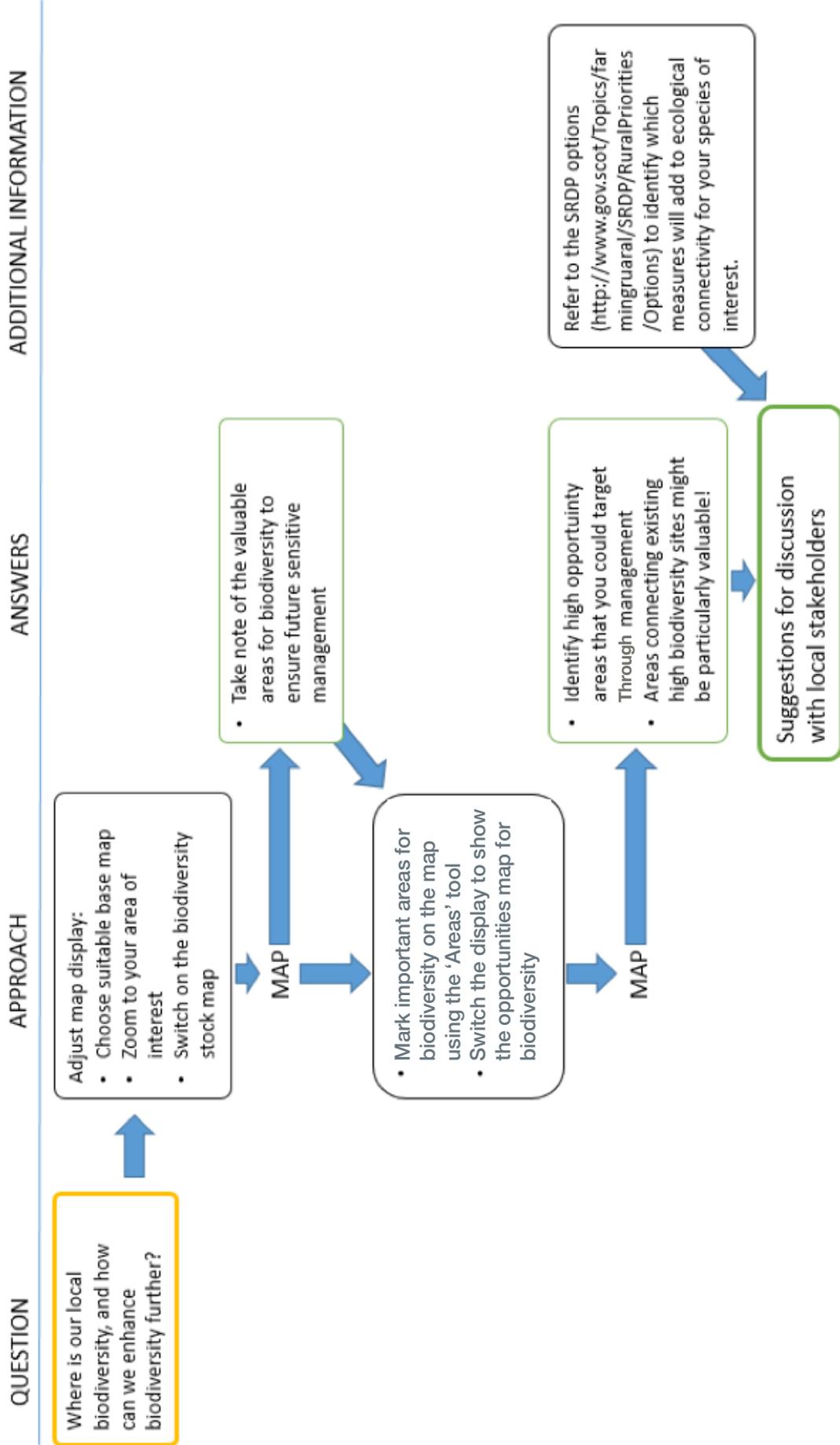
Community level

An example of how the tool can be used by a local community considers an area struggling with the personal and economic consequences of frequent flooding events who want to enhance natural flood management (NFM) to mitigate the risk of further flooding. However, agricultural production is very important for the community, and NFM measures should not cause financial losses in this sector. The SBC online tool, in conjunction with the SRDP report, may help them to identify suitable measures and where to apply them, as well as provide a basis for discussion with adjacent communities.



Non-Government Organisation (NGO) level

An NGO or Environmental Charitable Trust concerned with local biodiversity wants to identify local biodiversity hotspots and apply its limited financial means in the most efficient manner possible to further enhance local biodiversity. With the SBC online tool, they can easily identify present hotspots, and target their action to areas with the potential for high biodiversity value; they can even decide to specifically target areas enhancing the overall ecological connectivity in the region, enabling wildlife to move freely between sites.



Feedback

The Land Use Strategy pilot maps are one of the few publicly available tools for the evaluation of ecosystem services.

We welcome your views and comments on how you make use of the mapping tool and any suggestions you have for improvements in the tool.

Please send your comments to lus@scotborders.gov.uk



You can get this document on tape, in large print, and various other formats by contacting us at the address below. In addition, contact the address below for information on language translations, additional copies, or to arrange for an officer to meet with you to explain any areas of the publication that you would like clarified.

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