



# Waterways and Wildlife

Environmental asset condition assessment



Canal &  
River Trust



Glandŵr  
Cymru

The Canal & River Trust in Wales



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# Preface

This survey methodology for the condition of our environmental assets has been developed by Glandŵr Cymru (the Canal & River Trust in Wales) in collaboration with ECUS. We are grateful to the Welsh Government for funding this work, through the Green Infrastructure Capital Investment fund.

It is the habitats - the fabric of the natural environment – which are most essential for our waterways' wildlife and the management of these habitats affects the species we can expect to find on our waterways. While we can set broad generic frameworks for what is good and what can be achieved on our waterways given the pressures of other uses and the constraints of space and place, the exact management actions for any given waterway must be heavily influenced by the regional context and local priorities.

Our aim therefore is to optimise the state of the waterway environment, taking into account the local pressures, opportunities and interests.

Our Waterways and Wildlife prospectus establishes the framework for this approach to be embedded in the way waterways are managed, delivering a vision for the role that the natural environment of the canals of Wales can and does play within the wider landscape.

The Handbook part of this series gives an insight into the wide range of habitats and wildlife that we care for and highlights some of the many ways in which we manage our natural environment to make a difference.

This methodology builds on the Handbook to present a way of assessing the condition of these key habitats and developing an action plan for improvement, and presents a pilot example work from the Monmouthshire & Brecon Canal in South-east Wales.

The pilot is a first step in delivering this approach. For Glandŵr Cymru, there is more work to do, especially engaging staff and contractors working on our waterways, and local communities and partners working alongside us, to deliver a transformation in the way canal habitats are managed and improved.

# 1. Introduction to the methodology and action plan production

The broad aim of this methodology is to develop the application of Wales' unique approach to the sustainable management of natural resources – as set out in the Wellbeing of Future Generations (Wales) Act and the Environment (Wales) Act – for our inland waterways.

Inland waterways are particularly suitable for developing such an approach because the nature of the canals, comprising natural, built and social heritage and their reliance for their survival on their relevance and importance to local people, means Glandŵr Cymru's work, to be successful, has to align with the principles of sustainable development.

To do this within the principles of sustainable management of natural resources we need to:

- 1) Understand what benefits and intrinsic value the environmental assets of our waterway network can provide; while recognising what limits are placed on delivering natural environmental value by the physical constraints and social / economic uses of the waterways; and so identify what improvements might be practicable.
- 2) Gather evidence to identify the current condition of specific waterway environmental assets and the landscape-scale context in which they sit; to identify what improvements will make the optimum contribution to ecosystem values and resilience.
- 3) Encourage further stakeholder involvement on our waterways to engage interested parties including local people and other potential collaborators in the development of proposals and plans for delivery.
- 4) Embed the targeted improvements into the work of Glandŵr Cymru, its partners and others working on canals by assigning new local standards for routine maintenance, repair and refurbishment works; and as a list of aspirations where resources and partners may be sought to take forward locally.

This methodology outlines how we propose to implement those steps by:

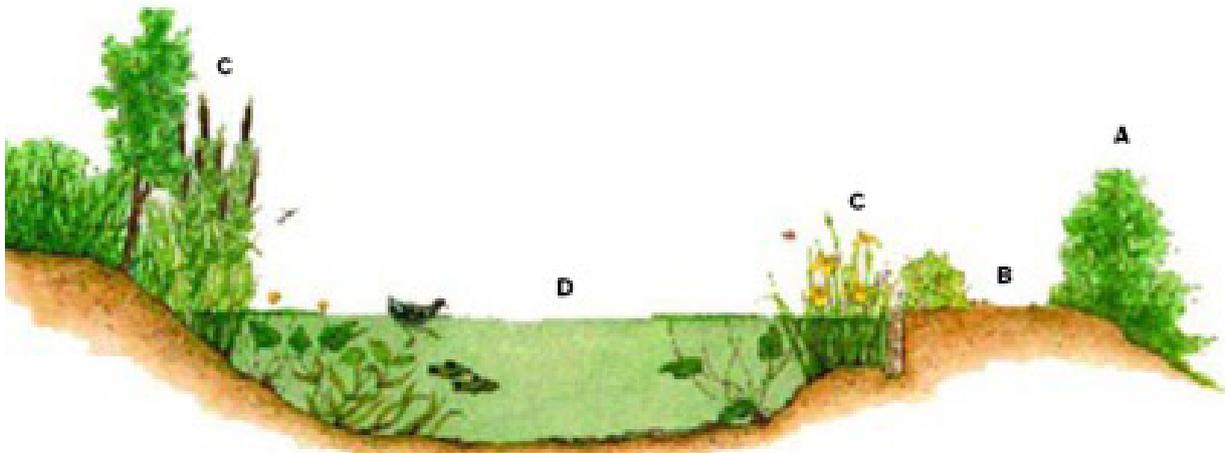
- identifying which habitats are of particular importance on our inland waterways and what contributes to their condition (Chapters 2 & 4);
- introducing a practical methodology for surveying and assessing the natural assets of an inland waterway to identify opportunities for improvement, considering local context (Chapters 3 & 4);
- defining what typically can be done to enhance their value within the physical constraints and requirements of other uses; plus how to modify this menu of improvement options by taking into account the landscape-scale context and specific constraints & opportunities of a given waterway (Chapter 5); and
- presenting a worked example of survey and initial planning of actions for the Monmouthshire & Brecon Canal (Chapter 6).

## 2. Waterway Environmental assets - habitats

Waterways deliver multiple benefits – economic, social and environmental. They are, by definition, artificial or heavily modified landscapes and their environmental values reflect this. It may not be possible to have large scale pristine environments because of constraints imposed by other uses and the narrow width of a waterway, but the very nature of these waterways is also their strength in two ways:

**Waterway corridors present the opportunity for a wide variety of habitat types in a short cross-section** – woodland and scrub; open and flowing water; marginal fringes; grassland and hedgerows all within the space of a few metres:

- A** Towpath hedgerow
- B** Towpath; mown grass and hay meadow
- C** Marginal vegetation; variable on offside, often hedge or woodland fringe
- D** Aquatic; open water



Example canal cross-section



Aerial view of a canal corridor, showing diversity of habitats and connectivity

**Waterways are connecting corridors** – linking the urban with the rural and allowing wildlife to link to islands of habitat either in urban fringes or heavily managed countryside.

## 2.1 Identification of environmental habitats

The identification of habitats that would comprise the target asset types was undertaken by Glandŵr Cymru following a programme of stakeholder consultation. The environmental asset types to be used within the protocol were defined as follows.

### Open water

The open water asset type is defined as the area of water typically located between marginal habitats or canal wash walls, comprising open water and submerged and floating aquatic plants. This asset includes canals, navigable rivers, reservoirs, docks & side pond but does not include feeders, isolated ponds & ephemeral waterbodies.

### Marginal fringe

The marginal fringe asset type comprises transitional areas between land and water including any emergent vegetation in front of, behind, or forming the bank protection. This asset includes emergent vegetation and areas of substrate with potential to support emergent vegetation.

### Hedgerows

For the purposes of this survey the hedgerow asset type was defined as a boundary line of trees or shrubs over 20 m long and less than 5 m wide at the base, provided that the trees or shrubs were, or had previously been, more or less continuous. This asset type would encompass the following:

- earth banks or walls where these occur in association with a line of trees or shrubs,
- 'classic' shrubby hedgerows,
- shrubby hedgerows with trees and
- very gappy hedgerows (where each shrubby section may be less than 20 m long, but the gaps are less than 20 m).

### Woodlands

For the purpose of this survey the woodland asset type is defined as continuous areas of vegetation dominated by trees and/or shrubs more than 5m in width. This asset types also includes areas without woody vegetation with woodland indicator ground flora.

### Grassland

The grassland asset type is defined as areas of herbaceous vegetation dominated by grasses, forbs or ruderal non-woody species. This habitat includes towpath verges, lock-sides, embankments, reservoir head-banks and amenity areas.

### Canal-side trees

The canal-side trees asset type refers to large mature trees with amenity, historical or aesthetic value, typically mature, native species in excess of 75 cm diameter at breast height that would not be included in the woodland or hedgerow asset type. Trees within this category will always be considered to achieve good environmental condition and therefore recording is limited to presence/absence.

### Structures

Aqueducts, bridges, tunnels, and locks, as well as cottages, warehouses and other buildings, have become integral parts of the landscape of our waterways, and can contribute much to their biodiversity. In general, it is the older structures, built of stone and with lime mortar, that have the greatest value. A wealth of life unfurls from the nooks and crannies, making the most of the damp conditions and shaded areas under bridges and in tunnels. Because of their proximity to water, our structures often support unusually diverse communities.

### Reserves

Specific designated sites such as SSSIs and SACs or particular areas of waterways the Trust has identified to manage for special wildlife benefits. These may comprise multiple habitats or require management for a single or several species. Management will therefore be tailored to each of these sites.

## 2.2 Identification of key attributes

Each asset type can be broadly characterised by reference to several key attributes, which can be used to assign a condition grade to each asset type (see Chapter 4).

The attributes assigned to each asset type and the proforma responses available within the checklist are included in Table 1 below.

Asset	Attribute	Observation
Open water	Clarity <i>Clear = visible to bed, cloudy = visible to bed at margins, turbid = bed not visible</i>	Clear
		Cloudy
		Turbid
	Species Diversity	Multiple aquatic species
		Few aquatic species
		No aquatic species
	Water quality <i>Measured through % cover of section by filamentous algae and duckweed</i>	None or minimal <5%
		Occasional 5-25%
		Frequent 25-50%
		Abundant 50-75%
		Dominant >75%
	Negative indicators <i>High risk invasive aquatic plant species (Crassula, Azolla, Pennywort, Parrot's feather)</i>	No high risk invasive species
		High risk invasive species present
		High risk invasive species present at >25% cover
	Shading <i>% of channel length (both sides) with overhanging tree branches that extend at least 1m over the channel)</i>	None or minimal <5% of channel length shaded
		Frequent – up to 50% of channel length shaded
		Abundant – more than 50% of channel length shaded
		Dominant > 75% of channel length shaded
Management opportunities	Noted in free text box where applicable	
Marginal fringe	Continuity	Continuous – present along >75% of suitable bank length
		Semi continuous – present along 50-75% of suitable bank length
		Discontinuous – present along <50% suitable bank length
		Marginal fringe absent but potentially suitable conditions
	Diversity	Multiple marginal emergent species present
		At least one fringe forming marginal species present
		No fringe forming marginal species

<b>Marginal fringe</b>	Negative indicators	No high risk invasive species	
	<i>High risk woodland invasive species (Himalayan balsam, Japanese knotweed, giant hogweed, rhododendron)</i>	High risk invasive species present	
		High risk invasive species present at >25% cover	
		Management opportunities	Noted in free text box where applicable
<b>Grassland</b>	Continuity	Largely continuous – no or few bare patches	
		Semi-continuous – small but frequent patches of bare ground	
		Discontinuous – large patches of grass dominated by bare ground	
		Remnant – small patches of grass dominated by bare earth	
	Diversity	Diverse – many different grasses and grassland plants	
		Some different grasses and plants	
		One species dominant – few other plants	
	Negative indicators	No high risk invasive species present	
		<i>High risk grassland invasive species (Himalayan balsam, Japanese knotweed, giant hogweed)</i>	High risk invasive species present
			High risk invasive species present at >25% cover
	Grassland quality	Occasional – A few ruderal plants or species present	
		<i>Presence and abundance of ruderal species (nettle, thistle, dock, willowherb, bramble)</i>	Up to 50% cover of ruderal species
			More than 50% cover of ruderal species
	Management opportunities	Noted in free text box where applicable	
<b>Woodland</b>	Diversity	Mix of native tree, understory and ground flora species	
		One or more tree species with some understory and ground flora	
		Single species dominant, understory and ground flora lacking	
	Negative indicators	No high risk invasive species. Non-native species (sycamore) absent	
		No high risk invasive species. Non-native species (sycamore) rare	
		Invasive species absent, non-native species frequent	
		High risk invasive species present at low abundance	
		High risk invasive species frequent or abundant	
	Woodland amenity value	High – significant/prominent landscape feature and/or publically accessible	
		Moderate – some landscape value	
Low - not publically accessible and no notable landscape value			

<b>Woodland</b>	Width	Multiple depth trees or continuous scrub >5m
		Single line of trees
		Broken line of trees
	Continuity	Continuous – present throughout section
		Broken woodland belt with noticeable gaps
		Less than 75% of suitable habitat wooded
		Impoverished – less than 25% of suitable habitat wooded
	Woodland structure	Good-mixed ages, mature trees and young recruitment
		Poor – single age/size trees e.g. plantation
		Woodland connectivity
		Good connectivity to other woody habitats
		Not connected to other woody habitats but connected to semi-natural habitats
		Isolated, for example in urban environments
Management opportunities	Noted in free text box where applicable	
<b>Hedgerows</b>	Continuity	Continuous hedgerow where appropriate
		Semi continuous – occasional gaps, less than 1.5m
		Gappy – less than 75% cover in suitable habitat
		Defunct – less than 25% cover in suitable habitat
		Poor – thin gappy at base, not stockproof
	Diversity	Diverse – mix of native woody, understory and ground flora species
		Moderate – more than one woody species
		Low diversity – single species dominant, understorey and ground flora lacking.
	Negative indicators	No high risk invasive species present
		<i>High risk hedgerow invasive species (Himalayan balsam, Japanese knotweed, giant hogweed)</i> High risk invasive species present over less than <25% of hedgerow length
		High risk invasive species present over less than >25% of hedgerow length
	Connectivity	Good – multiple connections to adjacent green infrastructure
		Moderate – at least one connection to adjacent green infrastructure
		Poor – no connections to adjacent green infrastructure
	Management opportunities	Noted in free text box where applicable

<b>Canalside trees</b>	Species	
	DBH	"Diameter at breast height" gives indication of maturity
	Amenity value	Subjective assessment of landscape importance (e.g. single mature tree / line of trees).
	Structure and health	Basic condition assessment
<b>Structures</b>	Vegetation	Potentially harmful woody vegetation (e.g. self-set saplings) would indicate poor condition; ivy may require management for structural repairs but creates good habitat (especially for nesting birds) while in place and general non-woody vegetation both indicate some management may be required; important non-woody vegetation such as ferns, mosses etc. should be retained where possible.
	Habitat suitability (bats)	Presence of crevices and potential access to voids that could be of use as bat roosts – initial "potential" assessment only (does not confirm or deny presence of bats).

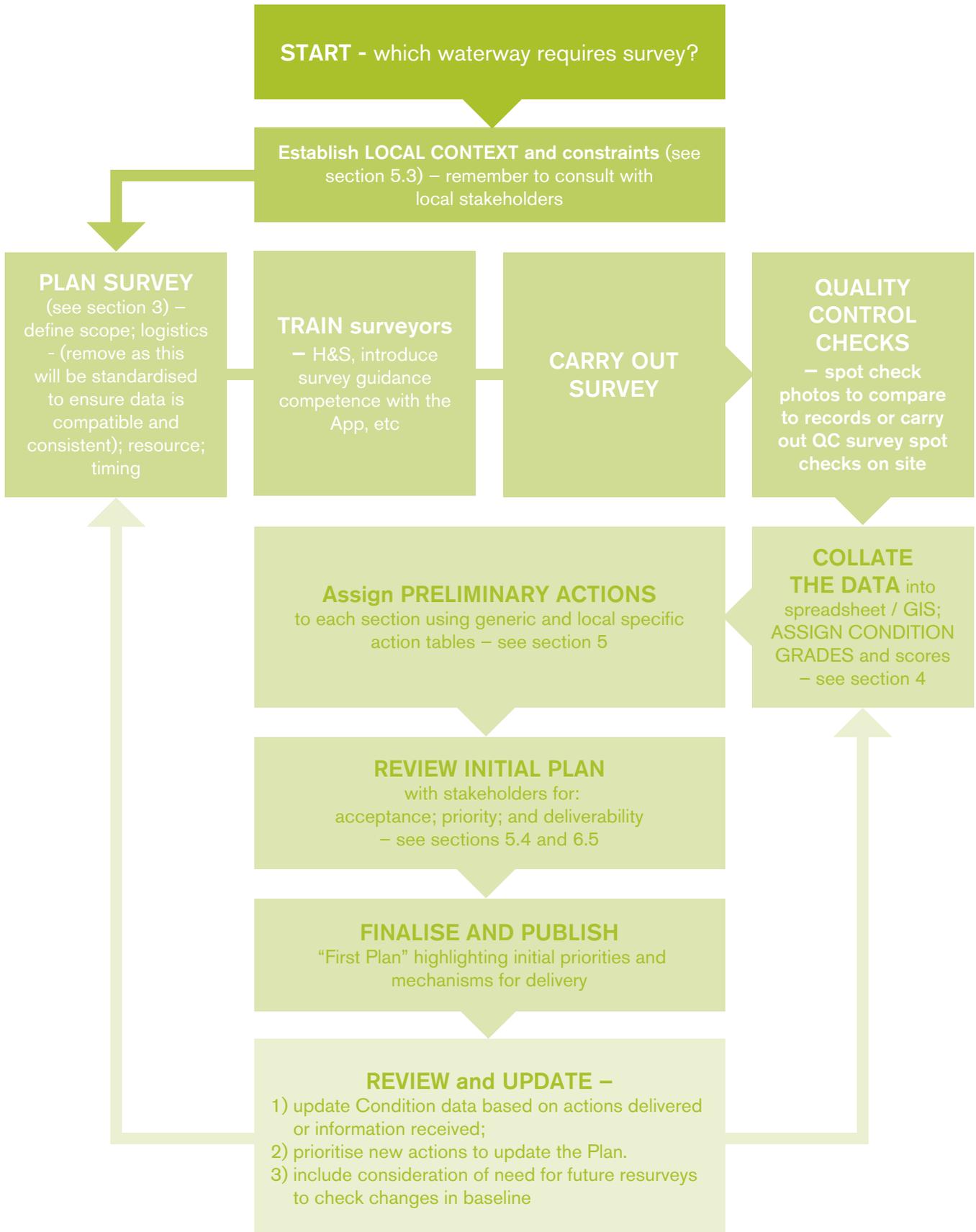
1 "Reserves" - Attributes for reserves will be site-specific

2 See 3.3.1 below for status of Canalside Trees in survey

3 See 3.3.2 below – this category was added during survey period so is missing from the pilot in chapter 6

4 Reserves (see previous page). "Attributes for reserves will be site specific.

The flowchart below illustrates how the survey on the Monmouthshire and Brecon canal has been planned and delivered:

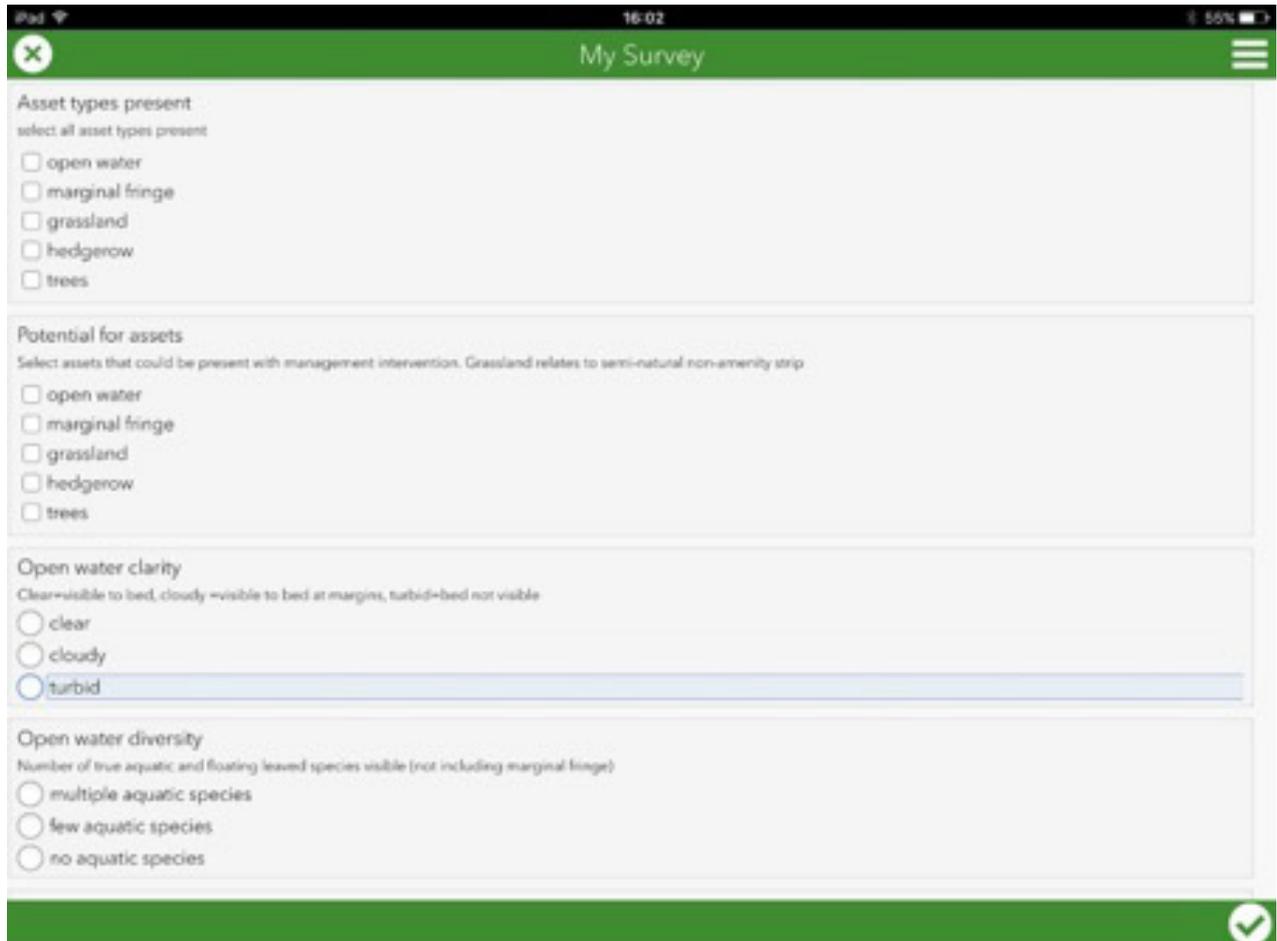


### 3. Survey method

3.1 The key attributes for each asset type were divided in accordance with the general condition grades (see the Condition Assessment tables in Chapter 4) and so a proforma checklist of condition options was compiled that could be completed in the field by a non-technical specialist to grade the condition of each asset from A to E.

This checklist can be utilised in a range of formats, but in the pilot example Arc GIS Survey123 was used (this has the advantage of being useable with handheld devices such as smart phones or tablets and using the devices' own GPS to provide accurate location of data).

The on-screen form features limited free-text and simple tick-box option selection:



The screenshot shows a mobile application interface for a survey. The title bar is green with a white 'X' icon on the left and a white checkmark icon on the right. The main content area is white and contains four sections of questions:

- Asset types present**: select all asset types present. Options:  open water,  marginal fringe,  grassland,  hedgerow,  trees.
- Potential for assets**: Select assets that could be present with management intervention. Grassland relates to semi-natural non-amenity strip. Options:  open water,  marginal fringe,  grassland,  hedgerow,  trees.
- Open water clarity**: Clear=visible to bed, cloudy=visible to bed at margins, turbid=bed not visible. Options:  clear,  cloudy,  turbid.
- Open water diversity**: Number of true aquatic and floating leaved species visible (not including marginal fringe). Options:  multiple aquatic species,  few aquatic species,  no aquatic species.

Attributes and grade divisions were designed with stakeholder consultation and the protocol was ground-truthed and refined during testing on the Monmouthshire and Brecon Canal (see Chapter 6).

**3.2** In the pilot on the Monmouthshire and Brecon Canal the survey was undertaken by dividing the canal corridor into survey sections that were defined by bridge or lock locations at approximately 1 km intervals. At each location the surveyor walked the entire length to obtain an overview of the section before completing the survey form in Arc 123Survey using a hand held device.

At each location the following information was collected prior to completion of the environmental asset assessment:

- Date of survey
- Section start and finish points (bridge numbers/locks)
- Offside bank type (dominant bank type)
- Towpath bank type (dominant bank type)
- Presence/ absence of moorings
- Adjacent land use offside
- Adjacent land use towpath side
- Protected species present (Name confirmed records of species)
- Protected species potential (name species for which suitable habitats are present)
- Management opportunities (note any opportunities for management obvious on site)
- Other observations (anything else relevant/ interesting)
- Asset types present
- Potential for assets within stretch if not present

Each record was geo-referenced through the survey form and uploaded to ESRI's cloud based server on completion.

**3.3** Following completion of the survey, surveyor feedback was collated and used to provide recommendations to further refine the survey form.

**3.3.1** This included the removal of "Canalside trees" from the condition assessment due to the time taken to assess; lack of a clear connection between data being collected and management actions to benefit biodiversity; and concerns that their ecological assessment overlapped with safety assessment (canalside trees are already assessed for public safety management purposes every 2-4 years).

**3.3.2** "Structures" were added to the assessment during the survey period (and so do not feature in the Monmouthshire & Brecon pilot results).

**3.3.3** "Timing of the survey - Generally it is best to carry out the survey during spring and summer (end of May until the beginning of October). It is possible to undertake the survey at other times, but the results may be affected due to changes in vegetation cover, signs of species present, water clarity, etc.

**3.4** Desk Study of context – alongside the walkover survey, discussions with stakeholders should identify the character of the waterway and the landscape scale context of priorities and opportunities (see section 6.1 for the Monmouthshire & Brecon example of this).

This stage should identify particular features of the waterway that might influence what can or should / should not be done in terms of habitat improvements (some measures to improve one habitat may have an adverse impact on another, or on an economic or social feature of the waterway).

It should also identify what habitat issues are of importance in the surrounding waterway corridor – what habitats and species can the waterway help to protect, connect, expand? What are local people and potential partners interested in helping to improve?

This information will be essential for deciding what actions to take forward and what to prioritise (see section 5.3 below)

## 4. Condition assessment

- 4.1** Condition assessment aimed to define each survey reach in relation to each asset type. Based on the outcomes of the stakeholder workshop the following condition categories were adopted.
- A.** Very good, no threats or improvements
  - B.** Good, some opportunity for improvement
  - C.** Satisfactory, opportunities for improvement
  - D.** Poor, management required
  - E.** Degraded, significant management required

- 4.2** On completion of the canal survey all records are collated and interrogated to determine the condition of each environmental asset based on how the section met a variety of criteria as detailed in Table 2 below.

The initial proposal was for assigning a numeric score to the condition of each attribute (5 for "A" down to 1 for "E") and then the compilation of an algorithm based on total score and control rules to assign overall Condition Grade for each asset type.

However, in development it became clear that initial assessment would always align with the lowest attribute value - for example, where a single attribute was present at Condition Grade D (e.g. invasive species present at low abundance in open water habitats) the section was deemed to require management regardless of the presence of other higher scoring attributes.

Scores on Attributes can be retained to help with finer differences within condition grades and for consideration of local prioritisation and criticality assessment (see section 5.3 below).

- 4.3** Overall condition grades for each attribute are based on the lowest value attribute.

So a section of Open Water graded "E" for clarity, "C/D" for diversity; "A" for algae and duckweed; "A/B/C" for invasive species and "C" for shading would be graded "E" overall due to the turbidity score.

- 4.4** A numeric score can be calculated to give more detail to the overall condition grade. For example highlighting the difference between a single attribute at grade E and all the attributes at grade E.

To do this add together the stated numeric values of attribute grades. Where a condition spans several grades, use the highest available score:

So for the same example as above the numeric score is 1 (for "E"); plus 3 (for "C/D"); plus 5 (for "A"); plus 5 (for "A/B/C"); plus 3 (for "C"); and would score 17 overall.

Table 2 – Condition grades and scores for attributes

Asset	Attribute	Condition				
		A (5)	B (4)	C (3)	D (2)	E (1)
<b>Open water</b>	Clarity	Clear: Bed visible across channel		Cloudy: Bed visible at margins		Turbid: Bed not visible
	Diversity	Multiple aquatic plant species present		Some aquatic plants present		No aquatic plants visible
	Filamentous algae and duckweed	None or minimal (<5%)	Occasional (less than 25%)	Frequent (up to 50%)	Abundant (up to 75%)	Dominant (over 75%)
	Invasive species	Absent			Present	Abundant (>25% cover)
	Shading Overhanging trees (at least 1 m into channel)	None or minimal (<5%)		Frequent (up to 50% of channel length shaded)	More than 50% of channel length (eg more than 100% on 1 side)	More than 75% of channel length
<b>Marginal fringe</b>	Continuity	>75%		50-75%	<50%	0%
	Average Width	>1 m	0.5-1 m		<0.5m	0%
	Diversity	Multiple marginal and emergent species present		at least 1 emergent fringe forming species present		
	Invasive species	Absent			Present	Abundant (>25% cover)
<b>Grassland</b>	Continuity	Largely continuous		Discontinuous - small but frequent areas of bare, compacted earth	Discontinuous - large areas of bare, compacted earth	Remnant - small patches of grass dominated by bare earth
	Diversity	Lots of different grass and plant species (diverse)		Some mixed grasses and plants	Single species dominant	
	Invasive species	Absent			Present	Abundant (>25%)
	Ruderal Species (nettle, dock thistle)	A few present		Up to half	More than half	
<b>Woodland</b>	Diversity of trees	Mix of native tree, understorey and ground flora species		One or more tree species with some understorey and ground flora	Single species dominant, understorey and ground flora lacking	
	Invasive species	Invasive species absent. Non-native species e.g. sycamore absent	Invasive species absent. Non-native species e.g. sycamore rare	Invasive species absent. Non-native species frequent	Invasive species present at low abundance	Invasive species frequent or abundant

<b>Woodland</b>	Amenity value	High (significant / prominent landscape feature, and / or publicly accessible)	High (significant / prominent landscape feature, and / or publicly accessible)	Moderate (some landscape value)	Low	
	Width	Multiple depth trees or continuous scrub > 5m			Single line of trees	Broken line of trees
	Continuity	Continuous		Occasional, gaps < 1.5m	< 75%	< 25% / absent
	Structure	Mixed ages, mixed structures			Single age	
	Connectivity	connectivity to other woody habitats		not connected to other woody habitats, connected to other semi-natural habitats		isolated in urban environment
<b>Hedgerow</b>	Continuity	Continuous		Occasional, gaps < 1.5m	< 75%	< 25% / absent
	Functionality	Dense, stockproof			Thin, not stockproof	
	Diversity	Mix of native tree, understorey and ground flora species		One or more tree species with some understorey and ground flora	Single species dominant, understorey and ground flora lacking	
	Invasive species	Absent	Absent	Absent	< 25%	> 25%
	Connectivity	Multiple connections to adjacent green infrastructure		At least one connection to adjacent green infra-structure	No connections	
<b>Trees</b>	Species	Not assessed * see section 3.3.1 above*				
	DBH					
	Amenity value					
	Structure and health					
<b>Structures</b>	Vegetation	High value soft vegetation – ferns, mosses etc.	Ivy cover providing nesting habitat	No vegetation or low value soft vegetation		Woody vegetation potentially damaging structure
	Habitat suitability (bats)	Many cavities / vegetation cover / evidence of bats	Bat-suitable cavities		No habitat present (may be due to nature of building)	Structure should be suitable but no habitat present (actions required)

**4.5** Following surveyor feedback and further consultation, it was agreed that the condition of high value trees would not be assessed as all valuable trees were likely to be considered in “good environmental condition” and were already recorded through existing mechanisms (see section 3.3.1 above).

**4.6** On completion of the condition assessment process each environmental asset and its associated condition is plotted on GIS to provide an overview of each stretch and asset type (see Chapter 6 for an example).

This baseline condition data can then be used to build up a management plan of improvement actions (see Chapter 5).

## 5. Developing actions

To convert the survey information into a draft Action Plan requires reference to a menu of improvements. Because of the site-specific and collaborative nature of sustainable management of natural resources and particularly decisions about changes to waterways given their multiple uses and values, this requires a series of iterations.

**5.1 Generic Improvements** - Through several workshops including stakeholders, the project team identified change criteria for the various asset categories that integrated the principles of the Bigger; Better; More; Connected concept from the Lawton Report whilst recognising the duties, responsibilities and existing commitments of Glandŵr Cymru.

Standard management objectives and prescriptions for different asset types and condition grades were determined. These generic improvement options are also informed by the case studies in the Waterways' Wildlife handbook – identifying the sort of actions that can be embedded in maintenance or delivered as stand-alone initiatives without significant adverse impact on other uses and values of the waterways, subject to local consultation and assessment against other management objectives for the specific section of waterway. They are designed to be deliverable by Glandŵr Cymru programmes of work or through collaborative action with other stakeholders.

Table 3- Generic improvement actions

Key Habitat / site	Generic Improvements	Possible synergies with other measures
<b>Open Water</b>	Water Framework Directive Good Ecological Potential mitigation measures; including control of invasive non-native aquatic plant species	Marginal vegetation
	Management of some invasive non-native animal species	
	Chemical water quality improvements (WFD parameters)	
	"In channel" aquatic plant reserves or planting	
	Improvement of marginal reed fringes, creation of reed beds, installation of reed islands, etc. to improve water quality	
	Measures to reduce blue green and other algal blooms	
	Discharge mitigation measures to improve WQ	WFD parameter improvements
	Dredging to reduce sediment resuspension	
<b>Marginal Vegetation</b>	Fringe planting to extend / connect / gap-up habitat	
	"Soft/green bank" improvements or introduction of reed fringe and/or restoration of the adjoining soft bank	Dredging (disposal)
	Control of invasive non-native plant species	
	Diversity planting within existing fringe with native local species	

<b>Hedgerows</b>	Laying	Dead-hedging
	Coppicing (species specific or on over-mature or over-flailed hedgerows)	Dead-hedging
	Gap-planting	
	Planting to extend or connect habitat	
	Diversity planting in hedge-base; hedgerow plants and associated ground flora	Link to grassland measures for pollinators
	Planting and maintenance of hedgerow trees within hedgerows	
	Control of invasive non-native plant species	
	"Dead hedging" and construction of wood stacks for bugs and other wildlife	Link to grassland measures for pollinators
<b>Canalside trees</b>	Conservation of veteran and valuable mature trees	
	New pollarding and re-pollarding of mature pollards	
	Creation and maintenance of standing dead-wood and monoliths, where safety allows	
<b>Woodlands</b>	Coppice (for certain species)	Bug-piling
	Planting to increase species diversity	
	Planting or other management to increase ground cover / understorey / canopy diversity	
	Leave in situ fallen / felled dead wood	
	Management of dominant non-native plant species	
	construction of brash / wood stacks for bugs and other wildlife	
<b>Grassland</b>	Reduce intensity of cutting	
	Selection of slower-growing native seed mixtures over non-native mixtures. This will also reduce cutting frequency	
	Localised cut and rake of species rich grassland by volunteers	
	Control of invasive non-native plant species	
	Planting or seeding for species diversity	
	Change regime for specific environmental benefit such requirement for protected species	
<b>SSSI</b>	Deliver agreed positive management actions (Site Specific)	
<b>non-statutory, Glandŵr Cymru-declared nature reserve</b>	Deliver agreed positive management actions (Site Specific)	
<b>Structures</b>	Retain and create opportunities for bat roosting	
	Retain and create opportunities for nesting birds, reptiles, amphibians, etc.	
	Retain valuable non-woody wall flora, lower plants, ferns, fresh water sponges, etc unless removal is required for repointing, required for operational reasons or to protect heritage structure. Removal of damaging woody plant species and other vegetation should continue	

**5.2 Using all the data – what actions to pursue:** the baseline survey results table indicates which sections have attributes that will generally require action (grades “D” and “E”) or could be improved further (grades “B” and “C”).

Generic actions from table 3 can be assigned to overcome problems which the condition grades indicate, for instance creation of marginal fringes where these are absent.

Consider opportunities to address more than one attribute by a single action – for instance dredging can improve water clarity and remove nutrients, but also the dredged material can be used for creation of marginal fringes.

Also take into account the practicality of delivering actions. Where actions would interfere with other uses or values of the waterway (see 5.3 below) should be avoided. On the other hand, those actions which can be added to existing maintenance tasks (routine vegetation management, dredging) can more easily be delivered and will create the step-change in Glandŵr Cymru routine actions that we are seeking. Some actions are also easier to empower volunteer and partner groups to undertake (especially those not requiring any large equipment or expensive materials).

However, before generic actions are pursued, we need to check the local context.

**5.3 Local context & criticality-** Before committing to generic actions from Table 3 an integral part of the Methodology is a desk-review of the local context for the survey – the overall character of the waterway and landscape scale priorities (as noted in section 3.4 above).

This context setting must include consultation with local stakeholders, including waterway managers and user representatives and external interest groups such as relevant regulators.

This will help to indicate any actions that might be prioritised locally, or should not be pursued – either to protect a particular characteristic or in line with economic or social benefits being provided by the waterway (for instance, on the Monmouthshire & Brecon Canal the wooded character means that actions to remove shading trees and so improve that water quality attribute will not generally be appropriate, and so where the open water asset is a poor grade (“D” or “E”) for only this attribute, no action should be

taken. Also there is significant pressure for moorings on the Canal and in areas of high demand this will make some improvements impractical.

This might result in sections graded “D” or “E” ending with no appropriate actions.

This could also result in certain actions being prioritised as being particularly important because of the character of the site, designations or presence of protected or important species.

The data can also be used to create an updated “Local menu of Improvements” table to replace table 3 - considering the local context, priorities and opportunities (see section 6.1 for a worked example of this on the Monmouthshire & Brecon Canal).

These local priorities will also indicate which actions and attributes we should focus our attention on – for instance the Monmouthshire & Brecon Canal is valued as corridor for bats, so closing any extensive gaps in the hedge / wood / tree line should take precedence over other actions in those areas.

Finally the overall numeric score can help assign a “criticality” to action on any given section – remember that the lower the score, the more attributes are in poor condition grades and so the “worse” overall the section is. A high numeric score indicates there are fewer problems to solve (so it will be easier to “upgrade” the section) while alternatively a very low score indicates multiple problems and perhaps maximum benefits from improvements.

**5.4 Review of draft actions** – Completion of a table of actions from the baseline survey, taking local context into account, is only one step in the Action Plan.

The production of the Action Plan needs to be an iterative process and the first draft of “localised” actions should then be subject to rounds of discussion with Glandŵr Cymru colleagues and other stakeholders involved in the management of the waterway; local stakeholders (especially waterway users) and potential partner organisations for connections to adjoining sites and opportunities for joint delivery.

In this way conflict with other benefits and uses of the waterway will be avoided; stakeholders will develop ownership of the actions; and more opportunities for effective and efficient delivery will be identified. There is no need to press for the whole Plan to be delivered in a short period. At each iteration, what is achievable in the short term will be identified and actioned, and possibly new actions added to the Plan for review at the next opportunity.

## 6. Monmouthshire & Brecon Canal pilot

As part of the project to develop this Methodology, the principles were applied in practice on the Monmouthshire & Brecon Canal in South-east Wales.

**6.1** Local assessment – As identified in Chapter 5 above, local implementation of the Methodology starts with consideration of the local context – the existing character of the waterway; landscape scale opportunities and priorities; any existing plans for changes in management that might affect choices or opportunities for environmental change.

For the Monmouthshire & Brecon Canal (M&B), this exercise involved discussion with local Glandŵr Cymru environmental team members; Welsh Government officers; and review of available information. This identified the following key factors:

The character of the waterway:

- The M&B is largely rural, running through or alongside the Brecon Beacons National Park for much of its length; generally cut on a contour along the hillside;
- Adjoining woodland / hedgerows / lines of mature trees, both on towpath embankments and upslope of the Canal, is common and shading of the water surface (limiting emergent fringe) occurs in many areas;
- The canal is narrow (generally less than 10m wide) and is a shallow dish construction – silt disturbance by boat movement or runoff from upslope ground is common and there are few options for “in channel” measures;
- There is significant mooring pressure. As the canal is not connected to the national inland waterway network there is a higher than average number of hire boats for visitors. This creates high demand for mooring spaces on the towpath or offside for overnight and short stay and this limits opportunities for marginal fringe establishment;
- The canal construction features many embankments which are vulnerable to movement. Relining of historic clay sections of canal bed is common and limits opportunities for more natural habitats.

Landscape scale context and opportunities:

- The canal is intimately linked to the River Usk SAC, running along the southern flank of the Usk valley and cutting across numerous tributaries as well as the main river itself;
- The landscape association with the National Park (the canal is the most popular visitor attraction in the Park) means that opening up and maintaining views into and of the canal is important;
- The canal is a major corridor for bats, especially Lesser Horseshoe bats which have an SAC-designated roost in the valley near to the canal itself. It is of primary importance that the “tree-lined corridor” nature of the waterway is maintained;
- As in many other areas, action for pollinators is a local (and Welsh national) priority for the area;
- The Canal also has the potential to be an expansion corridor for the Dormouse – with extensive hazel stands that would benefit from re-introduction of rotational coppice management.

This affects the menu of improvements for the Canal as follows:

Table 4 - Localised menu of improvements – revision of Generic Improvements table to include specific modification for the Monmouthshire & Brecon Canal

Key Habitat / site	Generic Improvements	Possible synergies with other measures	Mon & Brec specifics	Works we would insert this measure into as scope / specification
<b>Open water</b>	Water Framework Directive Good Ecological Potential mitigation measures; including control of invasive non-native aquatic plant species	Marginal vegetation		Channel relining
	Management of some invasive non-native animal species			
	Chemical water quality improvements (WFD parameters)		WFD compliant, but note concerns over nutrient / silt loading from catchment affecting River Usk	Water Control
	"In channel" aquatic plant reserves or planting		Limited opportunities - narrow, shallow canal.	
	Improvement of marginal reed fringes, creation of reed beds, installation of reed islands, etc. to improve water quality			
	Measures to reduce blue green and other algal blooms			
	Discharge mitigation measures to improve WQ	WFD parameter improvements	Discharges are not a significant issue on M&B	
	Dredging to reduce sediment resuspension			
<b>Marginal vegetation</b>	Fringe planting to extend / connect / gap-up habitat		Yes, but limited by extent of woodland / tree cover in corridor	Channel relining
	"Soft/green bank" improvements or introduction of reed fringe and/or restoration of the adjoining soft bank	Dredging (disposal)	Yes, as part of relining standard	Channel relining
	Control of invasive non-native plant species			
	Diversity planting within existing fringe with native local species			Dredging

<b>Hedgerows</b>	Laying	Dead-hedging	Yes, especially to recreate "vistas"	
	Coppicing (species specific or on over-mature or over-flailed hedgerows)	Dead-hedging	Yes, especially for reintroducing cyclical management of hazel for dormouse	
	Gap-planting		Yes to ensure continual corridor line for bats	
	Planting to extend or connect habitat		Yes to ensure continual corridor line for bats	Any works affecting the back of towpath (including resurfacing / embankment works)
	Diversity planting in hedge-base; hedgerow plants and associated ground flora	Link to grassland measures for pollinators		Any works affecting the back of towpath (including resurfacing / embankment works)
	Planting and maintenance of hedgerow trees within hedgerows			
	Control of invasive non-native plant species			
	"Dead hedging" and construction of wood stacks for bugs and other wildlife	Link to grassland measures for pollinators	Yes, for arisings from other works and linked to pollinators	Any works involving cutting trees or brash
<b>Canalside trees</b>	Conservation of veteran and valuable mature trees		Generally retain as significant landscape feature of the canal and to maintain bat corridor line	
	New pollarding and re-pollarding of mature pollards			
	Creation and maintenance of standing dead-wood and monoliths, where safety allows			
<b>Woodlands</b>	Coppice (for certain species)	Bug-piling	Yes for hazel - reintroduce 10-15 year cycle of management	
	Planting to increase species diversity		Yes, especially around hazel coppicing	Any works disturbing woodland (i.e. for access)
	Planting or other management to increase ground cover / understorey / canopy diversity			Any works disturbing woodland (i.e. for access)
	Leave in situ fallen / felled dead wood			
	Management of dominant non-native plant species			
	construction of brash / wood stacks for bugs and other wildlife			Tree works

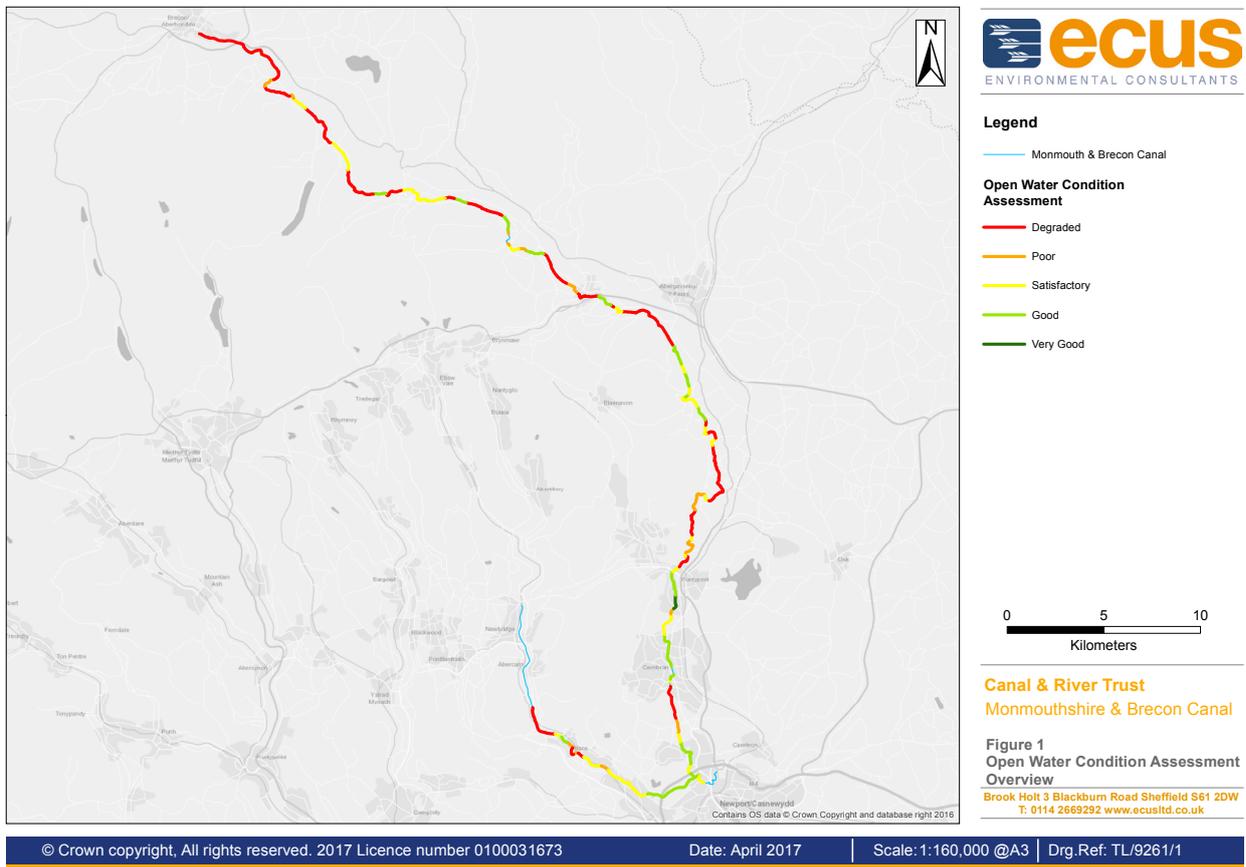
<b>Grassland</b>	Reduce intensity of cutting		Yes, target improvements at pollinators	Grass cutting
	Selection of slower-growing native seed mixtures over non-native mixtures. This will also reduce cutting frequency			Any works disturbing grass surfaces and needing to reinstate - DO NOT USE AMENITY MIXES
	Localised cut and rake of species rich grassland by volunteers			
	Control of invasive non-native plant species			
	Planting or seeding for species diversity		Yes, target improvements at pollinators	
	Change regime for specific environmental benefit such requirement for protected species		Yes, target improvements at pollinators	Grass cutting
	<b>SSSI</b>	Deliver agreed positive management actions (Site Specific)		Water control (River Usk SAC); maintain corridor for Lesser Horseshoe Bats
<b>Non-statutory, Glandŵr Cymru-declared nature reserve</b>	Deliver agreed positive management actions (Site Specific)		Yes, some specific sites	
<b>Structures</b>	Retain and create opportunities for bat roosting		Yes, some specific sites	Repointing; PPM works
	Retain and create opportunities for nesting birds, reptiles, amphibians, etc.			
	Retain valuable non-woody wall flora, lower plants, ferns, fresh water sponges, etc unless removal is required for repointing, required for operational reasons or to protect heritage structure. Removal of damaging woody plant species and other vegetation should continue		Yes, some specific sites	PPM vegetation clearance

**6.2 Survey results** – the baseline survey on the Monmouthshire & Brecon Canal returned results for five Asset types – Open Water; Marginal Fringe; Grassland; Woodland; and Hedgerow.

Each of these was assessed as per the Methodology in Chapters 3 & 4 and the results plotted on maps to highlight the areas for potential action and provide a simple overview of condition. Key management actions for each habitat, specific to the Monmouthshire and Brecon Canal context, were also defined, as follows:

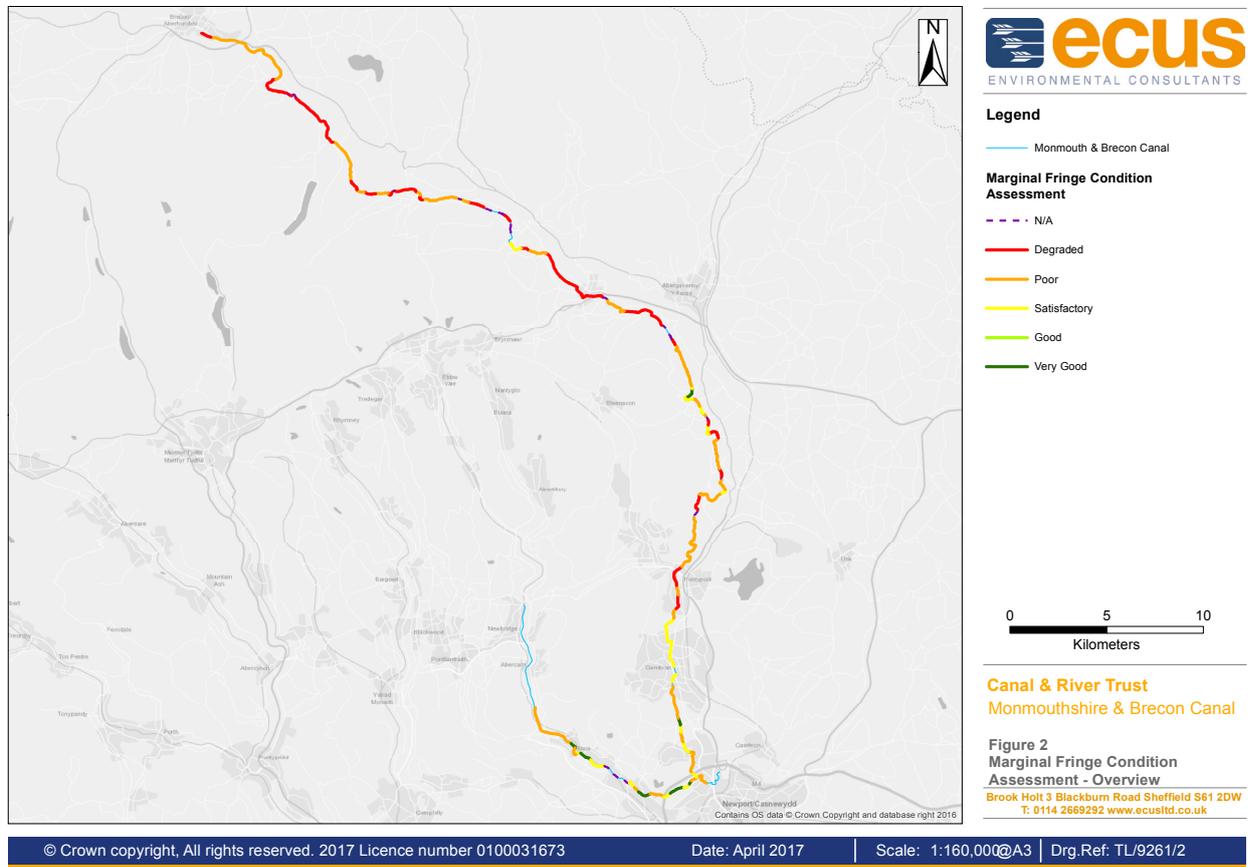
**The key management actions for the habitat type Open water on the M&B are:**

- deal with non-natives;
- dredging (continue existing programme – across whole canal);
- although many sections affected by shading, removal of shading contraindicated by local wooded character;
- limited opportunities to improve aquatic species diversity (where not limited by shading etc.), should be taken where possible.



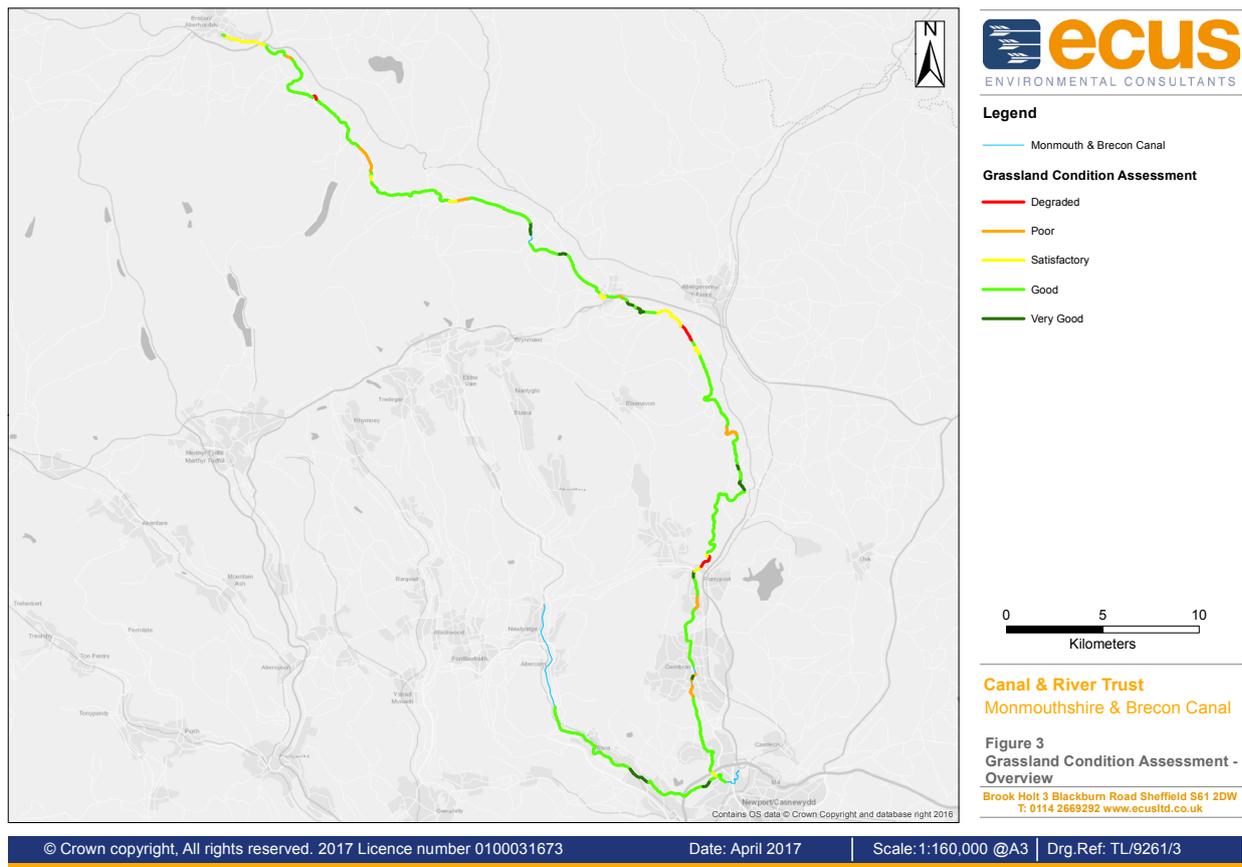
The key management actions for the habitat type Marginal fringe on the M&B are:

- Opportunities for increasing range of marginal fringe away from mooring sites should be taken when opportunities arise e.g. through relining works or dredging disposal;
- Improve continuity of discontinuous fringe;
- Remove invasive species



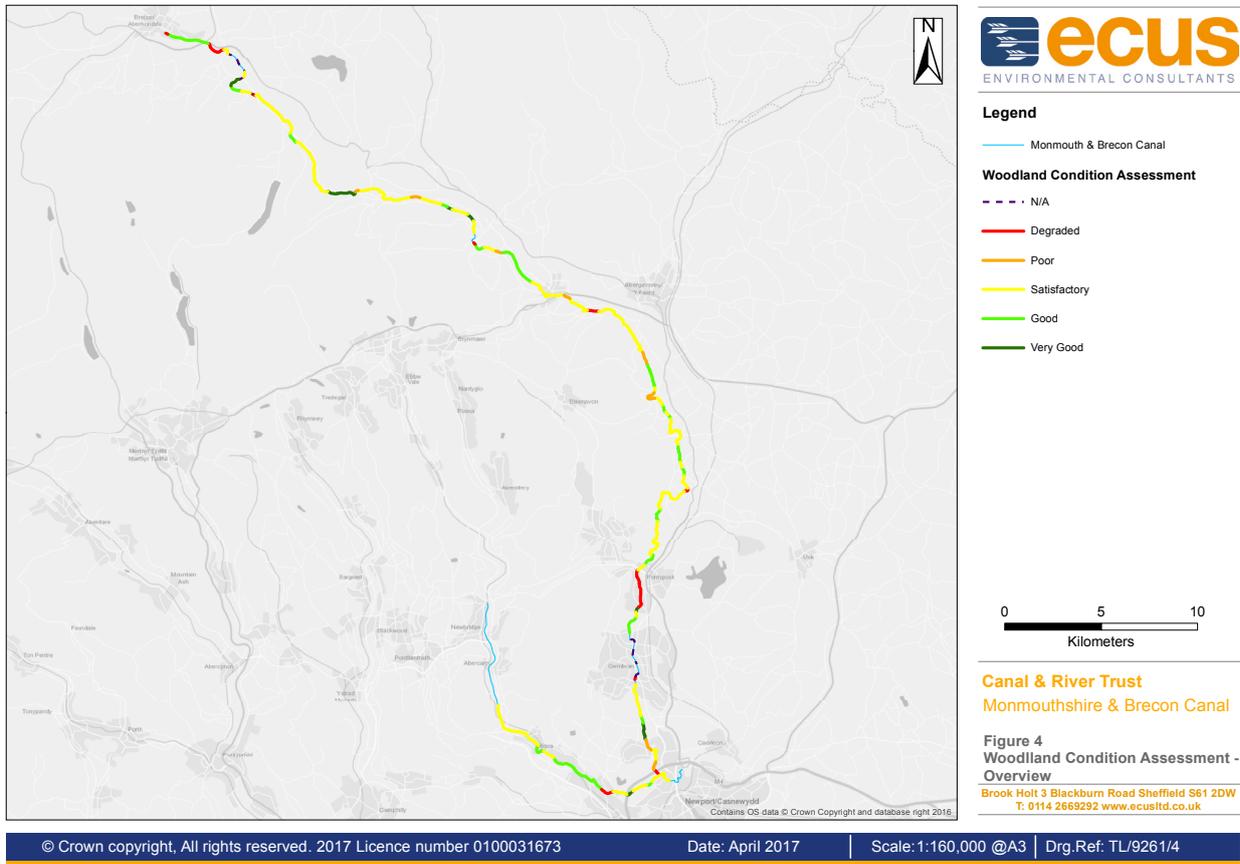
The key management actions for the habitat type Grassland on the M&B are:

- Alter grass cutting regimes or carry out planting – where space & use allows – to favour plants for pollinators



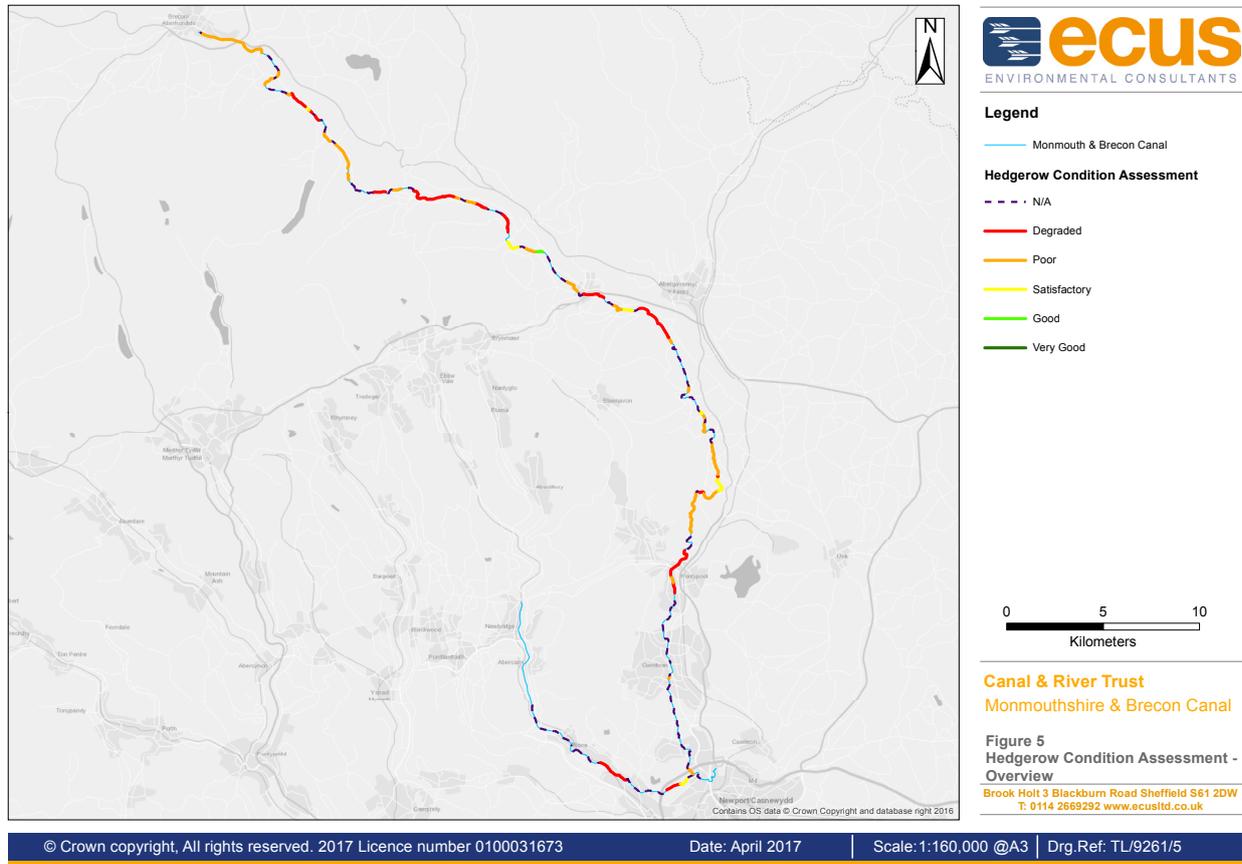
The key management actions for the habitat type Woodland on the M&B are:

- Hazel coppicing for dormice
- Positive woodland management – diversity of structure and planting up gaps
- Remove invasives



The key management actions for the habitat type Hedgerow on the M&B are:

- Laying (reinstating traditional management, improving views)
- Improve continuity – gapping up and new planting
- Improve diversity – planting range of species



### 6.3 The M&B action plan

The following table gives an example of how we would present the condition grades for habitats on the Monmouthshire and Brecon Canal, listed by survey section, and identifies the initial action that could be undertaken along with some indication of how this might be delivered. This is an example of a first stage action plan. Next steps will be to discuss with stakeholders and partners about prioritisation and delivery to identify which actions should be taken forward and which to address first. 166 Sections were surveyed in total, but we are presenting the first 13 here to illustrate the format.

Section	Open Water Condition Grade	Open Water Management opportunities	Delivery	Marginal Fringe Condition Grade	Marginal Fringe Opportunities	Delivery	Grassland Condition Grade	Grassland Management opportunities	Delivery	Woodland Condition Grade	Woodland Management opportunities	Delivery	Hedgerow Condition Grade	Hedgerow Management opportunities	Delivery
1	Degraded	Na		N/A	Na		Good	Na		Satisfactory	Tree replanting between gaps		Poor	Plant gaps and to improve diversity	Project / Volunteers
2	Poor	Na		Degraded	Improve continuity	Volunteers / Project	Good	Na		Satisfactory	Gap planting	Project / Volunteers	Poor	Plant gaps and to improve diversity	Project / Volunteers
3	Satisfactory	Na		Poor	Improve continuity	Volunteers / Project	Degraded	Na		Good	Na		Degraded	Planting of hedgerows	Project / Volunteers
4	Degraded	Na		Poor	Improve continuity	Volunteers / Project	Satisfactory	Na		Satisfactory	Clearing of laurel species, replanting of native species	Project / Volunteers	Degraded	Replanting of gaps	Project / Volunteers
5	Satisfactory	Na		Poor	Improve continuity	Volunteers / Project	Good	Na		Satisfactory	Planting gaps	Project / Volunteers	Poor	Plant gaps and to improve diversity	Project / Volunteers
6	Poor	Na		Poor	Improve continuity	Volunteers / Project	Good	Na		Poor	Plant in gaps	Project / Volunteers	Degraded	Some recent hedgerow laying could be exerted along length of section	
7	Degraded	Na		Degraded	Creation of marginal fringe	Relining / Dredging / Volunteers / Project	Good	Na		Satisfactory	Na		Degraded	No hedgerows present	
8	Poor	Na		Degraded	Creation of marginal fringe	Relining / Dredging / Volunteers / Project	Good	Improved diversity planting	Project / Volunteers	Satisfactory	Na		N/A	Na - no hedgerows	
9	Poor	Na		N/A	Improve continuity	Volunteers / Project	Very Good	Na		Satisfactory	Na		Degraded	Planting of hedgerows	Project / Volunteers
10	Poor	Na		Degraded	Na		Good	Na		Degraded	Plant in gaps	Project / Volunteers	Satisfactory	Plant gaps and to improve diversity	Project / Volunteers
11	Satisfactory	Na		Poor	Improve continuity	Volunteers / Project	Good	Na		Good	Na		Satisfactory	Plant gaps and to improve diversity	Project / Volunteers
12	Poor	Na		Degraded	Na		Good	Na		Satisfactory	Na		N/A	Na	
13	Good	Na		Poor	Improve continuity	Volunteers / Project	Good	Na		Satisfactory	Na		Poor	Planting in gaps	Project / Volunteers

## 6.4 The Next Steps

This Action Plan is only at the first stage.

From here we will carry out consultation with local colleagues to ensure no conflicts exist with other management plans / uses and to discuss delivery mechanisms; with local stakeholders to ensure support for proposals; with potential partners to discuss opportunities for working together to deliver.

Initial actions will be implemented and review of survey data and updating of actions will continue.

Actions delivered and improvements to asset condition grades as a consequence will be reported annually.

This process will help us achieve Glandwr Cymru's long term aims to improve our waterways for wildlife as follows:

- Our waterways will be great habitats for wildlife with at least 90% of statutory designated sites and bodies of water within our control meeting national targets by 2025.
- Our waterways and towpaths will form part of the wider green infrastructure network and will be valued as havens for people and wildlife, with a 10% increase in the extent of habitats of condition grade A to C by 2025.

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