Cyfoeth Naturiol Cymru
Natural Resources Wales

Condition Assessment using 2016 River Habitat Survey data and Common Standards Monitoring guidance for the Afon Teifi and Afon Eden – Cors Goch Trawsfynydd SACs

Baxter, E., McKenzie, S., Jones, D., Jones, C and Metcalfe, P.

Ecus Ltd in association with TerrAqua Ecological Services Ltd

NRW Evidence Report No. 192

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Report series:	NRW Evidence Report
Report number:	192
Publication date:	February 2017
Contract number:	ATI-11338a
Contractor:	Ecus Ltd
Contract Manager:	Dr Sue Hearn
Title:	**Condition Assessment using 2016 River Habitat Survey data and Common Standards Monitoring guidance for the Afon Teifi and Afon Eden – Cors Goch Trawsfynydd SACs**
Author(s):	**Baxter, E., McKenzie, S., Jones, C., Jones, D. and Metcalfe, P.**
Technical Editor:	Dr Phil Metcalfe
Peer Reviewer(s)	n/a
Approved By:	Nick Birkinshaw
Restrictions:	None

Distribution List (core)

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National Library of Wales	1
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Recommended citation for this volume:

Baxter, E., McKenzie, S., Jones, C., Jones, D. and Metcalfe, P. 2017. Condition assessment using 2016 River Habitat Survey data and Common Standards Monitoring guidance for the Afon Teifi and Afon Eden – Cors Goch Trawsfynydd SACs. NRW Evidence Report No: 192, 95 pp. NRW, Bangor.

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Mae Cyfoeth Naturiol Cymru (CNC) yn gyfrifol am ddynodi, monitro a rheoli Ardaloedd Cadwraeth Arbennig (ACA) dan Gyfarwyddeb 'Cynefinoedd' 1992 (92/43/EEC). Mae'r adroddiad hwn yn nodi'r casgliadau ar gyfer Arolygon Cynefinoedd Afonydd ac arolygon cynefinoedd Cam 1, sy'n ategu gwaith CNC o safbwynt monitro a rheoli ACA Afon Teifi ac ACA Afon Eden – Cors Goch Trawsfynydd.

Mae ACA Afon Teifi wedi'i dynodi oherwydd ei chynefin glan afon *Ranunculion*, a restrir yn y Gyfarwyddeb Cynefinoedd fel Cynefin Atodiad 1: "Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation". Mae'n ofynnol i CNC werthuso statws cadwraethol nodwedd y cynefin glan afon *Ranunculion* trwy ddefnyddio canllawiau Monitro Safonau Cyffredin (JNCC, 2016). Caiff y nodwedd hon ei hasesu ar sail wyth o briodoleddau: llif, ansawdd y dŵr, strwythur y cynefin, gwaddodion mân, dangosyddion negyddol, casgliadau biolegol, dangosyddion nodweddion unigryw lleol ac aflonyddu uniongyrchol gan bobl. Gall pob priodoledd gael mwy nag un isbriodoledd, sy'n cyfrannu at asesiad cyffredinol o'r nodwedd fel bod mewn cyflwr Ffafriol neu gyflwr Anffafriol.

Mae ACA Afon Eden – Cors Goch Trawsfynydd wedi'i dynodi oherwydd anifeiliaid yr afon. Mae'r afon yn cynnal yr unig boblogaeth hyfyw o'r Fisglen Berlog Dŵr Croyw (*Margaritifera margaritifera*) yng Nghymru. Mae sicrhau strwythur cynefin naturiol o ansawdd uchel yn bwysig o ran cynnal poblogaeth iach o'r fisglen berlog dŵr croyw yn yr afon.

Mae'r adroddiad hwn yn asesu'r priodoleddau hollbwysig ar gyfer targedau Strwythur y Cynefin yn Afon Teifi ac Afon Eden, gan ddefnyddio data a gasglwyd yn ystod yr Arolygon Cynefinoedd Afonydd, gan gynnwys:

- Ffurf y sianel;
- Sgôr Addasu Cynefin;
- Naturioldeb llystyfiant y glannau;
- Naturioldeb llystyfiant parth glannau'r afon;
- Gweddillion coediog mawr;
- Strwythurau oddi mewn i'r sianel.

Yn ychwanegol, caiff y priodoleddau canlynol eu hasesu:

- Gwaddodion mân – siltio;
- Dangosyddion negyddol – rhywogaethau estron/sy'n absennol yn lleol.

Mae Afon Teifi yn enghraifft o afon sydd, gan mwyaf, heb ei haddasu o safbwynt addasiadau i'r sianel a strwythurau artiffisial. Mae'r pwysau o du siltio'n isel. Nid yw'r defnydd a wneir o'r glannau, yn arbennig llystyfiant glannau'r afon, mor naturiol ag y gallai fod oherwydd y pori dwys eang oddi mewn i'r dalgylch, a'r rhywogaethau goresgynnol sydd wedi ymledu'n eang, yn arbennig jac y neidiwr. Ar y cyfan, ystyrir bod y cynefin ar gyfer y nodwedd *Ranunculion* yn ffafriol.

Mae nifer o welliannau wedi'u gwneud i Afon Eden er mwyn gwella strwythur y cynefin ar gyfer y fisglen berlog dŵr croyw, a asesir ac a gofnodir fel addasiadau artiffisial a strwythurau oddi mewn i'r sianel. Mae cynefin yr afon yn hynod naturiol ac ni cheir llawer o siltio, sy'n cynrychioli ansawdd ffafriol ar gyfer y cynefin.

2. Executive Summary

Natural Resources Wales (NRW) is responsible for the designation, monitoring and management of Special Areas of Conservation (SACs) under the 1992 'Habitats' Directive (92/43/EEC). This report outlines the findings from River Habitat Surveys (RHS) and simplified Phase 1 habitat surveys, that support NRW's monitoring and management of the Afon Teifi SAC and Afon Eden - Cors Goch Trawsfynydd SAC.

The Afon Teifi SAC is designated for *Ranunculion* river habitat, listed in the Habitats Directive as the Annex 1 Habitat: "Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation". NRW is required to evaluate the conservation status of the *Ranunculion* river habitat feature using Common Standards Monitoring (CSM) guidance (JNCC, 2016). This feature is assessed against eight attributes; flow, water quality, habitat structure, fine sediment, negative indicators, biological assemblages, indicators of local distinctiveness and direct human disturbance. Each attribute may have more than one sub-attribute, which contribute to the overall assessment of the feature as being in Favourable condition or Unfavourable condition.

The Afon Eden – Cors Goch Trawsfynydd SAC is designated for river fauna. The river supports the only viable population of Freshwater Pearl Mussel (*Margaritifera margaritifera*) in Wales. Ensuring a natural high quality river habitat structure is important for sustaining a healthy freshwater pearl mussel population in the river.

This report assesses the key attributes for the Habitat Structure targets for the Afon Teifi and Afon Eden, using data collected during the RHS including:

- Channel planform;
- Habitat Modification Score (HMS);
- Bank vegetation naturalness;
- Riparian zone vegetation naturalness;
- Large woody debris;
- In-channel structures.

In addition the following attributes are assessed:

- Fine sediment- siltation;
- Negative indicators- alien/locally absent species.

The Afon Teifi is an example of a predominantly unmodified river with respect to channel modifications and artificial structures. Pressures from siltation are low. Riparian land use and particularly bankside vegetation is not as natural as it could be due to the widespread high intensity grazing within the catchment, and widespread coverage of invasive species, particularly Himalayan balsam. Overall the habitat for the *Ranunculion* feature is considered to be favourable.

The Afon Eden has a number of recent channel enhancements to improve the habitat structure for freshwater pearl mussel, technically assessed and reported as artificial modifications and in-channel structures. The riparian habitat is highly natural and siltation is very low, which represents favourable habitat quality.

3. Introduction

3.1. Background

Natural Resources Wales (NRW) commissioned Ecus Ltd, in association with TerrAqua Ecological Services Ltd, to undertake River Habitat Survey (RHS) and simplified Phase 1 habitat survey of the Afon Teifi SAC and Afon Eden - Cors Goch Trawsfynydd SAC. The surveys of each will inform a Condition Assessment of the habitat features of the rivers in accordandance with the Common Standards Monitoring (CSM) Guidance (JNCC, 2016).

CSM is a 6-year rolling programme of assessment of designated sites, set against quality standards, of the state of all notified features of interest on all protected areas. Special Areas of Conservation (SAC) are designated on the basis of 'notified features of interest', as they may be of a particular habitat or vegetation type/species, or type of geological or geomorphological feature.

3.2. Project Scope

The primary aim of this project was to collect, analyse and interpret data on the river habitat, to inform whether Favourable Condition targets for the Afon Teifi SAC and Afon Eden - Cors Goch Trawsfynydd SAC are met and support conservation management objectives.

The project scope was led by the following core requirements:

- River Habitat Survey including an additional simplified Phase 1 survey of the bank plant community at 28 agreed sites on the Afon Teifi, including tributaries, and 6 sites on the Afon Eden using the standard methodologies;
- Data entered into excel spreadsheets, quality assured and formatted, presented by SAC management units and WFD waterbody units;
- Data analysis for habitat sub-attributes contained within the CSM Guidance for Rivers (JNCC, 2016);
- Interpretation and summary provided in a short technical report;
- Invasive species records presented in a format for inclusion within the National Biodiversity Network; and
- Confidential report containing site details, including landowner details, comments on access (e.g. parking), and any site specific Health and Safety considerations.

3.3. Afon Teifi SAC and Afon Eden - Cors Goch Trawsfynydd SAC Overview

The Afon Teifi and Afon Eden (including their tributaries) represent linear ecosystems. They act as important wildlife corridors and essential migration routes, providing key breeding areas for many nationally and internationally important species. The Teifi and Eden are of special interest for their associated plant and animal communities. The rivers' overall diversity are a product of their underlying geology, soil type, adjacent land use and near natural fluvio-geomorphological regime.

The results of the survey undertaken in 2016 will contribute to the assessment of condition status of the Natura 2000 features in the Afon Teifi and Afon Eden. The results will provide information to support the management and restoration of

protected sites and the delivery of River Basin Management Plans in accordance with the Water Framework Directive (WFD).

3.3.1. Afon Teifi SAC: Site Description

The Afon Teifi, located in west Wales, is one of the longest rivers in Wales (122 km), stretching from it's source at the Teifi Pools in the Cambrian Mountains to the estuary that flows into Cardigan Bay. It is regarded as one of the most unmodified water courses in the UK.

The Afon Teifi flows over mudstone, siltstones and sandstones with deposits, which includes silt, peat and alluvial sediment. Gorges characterise the lower sections. This geology influences the water chemistry, with low to moderate nutrient conditions, and contributes to the hydrological characteristics of the river. The catchment is predominantly pastoral, with areas of woodland and commercial coniferous forestry mainly in the headwaters. Small pockets of arable and small urban areas are present further downstream in the catchment (CCW, 2012).

The spatey flow regime has led to an in-stream vegetation community dominated by stream water-crowfoot *Ranunculus penicillatus* ssp. *penicillatus*, water-starworts *Callitriche hamulata* and *C. obtusangula* and the aquatic moss *Fontinalis squamosa* in a diverse characteristic macrophyte community (JNCC, n.d.a).

The Afon Teifi is designated as a Special Area of Conservation, selected for the Annex 1 habitat *Ranunculion fluitans* and *Callitricho-Batrachion* vegetation and Annex 2 species floating water plantain (*Luronium natans*),brook lamprey (*Lampetra planeri*), river lamprey (*Lampetra fluviatilis*), Atlantic salmon (*Salmo salar*), bullhead (*Cottus gobio*) and otter (*Lutra lutra*). The river is also considered noteworthy for an unusually low-gradient section flowing through Cors Caron; a large area of active raised bog that is considered an SAC in its own right (JNCC, n.d.a).

The condition of all SACs in Wales, including the Afon Teifi, are assessed by Natural Resources Wales against site-specific Conservation Objectives as required by the 1992 'Habitats' Directive (92/43/EEC). Previous River Habitat Surveys have been undertaken between 1994 and 2003.

3.3.2. Afon Eden – Cors Goch Trawsfynydd SAC: Site Description

The Afon Eden is located in west Wales and is a tributary of the Afon Mawddach. The river begins south of Llyn Trawsfynyyd and flows for approximately 12 km to the confluence, upstream of the village of Ganllwyd. The Afon Eden has a predominantly upland character and is regarded as relatively unmodified. High rainfall has led to the formation of raised bogs in the catchment (CCW, 2008).

The SAC habitat is dominated by bogs, marshes, water fringed vegetation and fens, which comprises approximately 83% of the designated area, with inland water bodies (10%), dry grassland/steppes (1.3%), improved grassland (0.7%) and broad-leaved deciduous woodland comprising the rest (JNCC, n.d.b). Cattle and sheep grazing as well as forestry are the main activities undertaken in the catchment (CCW, 2008).

The Afon Eden SAC is selected for the Annex 2 species freshwater pearl mussel (*Margaritifera margaritifera*), which is the only population regarded as viable in Wales

(JNCC, n.d.b). The population was discovered in 1997 and numbers have declined from approximately 1400 in 1997 to 684 in 2011 (Garrett and Thomas, 2012). Freshwater pearl mussel rely on salmonids for completion of their lifecycle. During the summer months freshwater pearl mussels release their larvae (glochidia) en-masse, which attach themselves to the gill filaments of juvenile salmonids and grow. The following spring, the larvae detach from the salmonid and require clean gravel on which to land and begin maturing- aiding mussel dispersal in the catchment (Skinner et al., 2003). The SAC has also been selected for floating water-plantain (*Luronium natans*), which can be found growing in approximately 100 m of naturally slow-flowing meander pools upstream from Pont y Grible (JNCC, n.d.b). The river itself has not been selected as a SAC for its habitat features or vegetation communities.

There have been no previous RHS and associated reporting undertaken on the Afon Eden.

4. Methodology

4.1. Assessment Units

The Condition Assessment method splits the river to be assessed into Evaluated Corridor Sections (ECS). This allows for sites along similar stretches of river to be grouped for the assessment of attributes.

Two different approaches to classifying the Evaluated Corridor Sections for the Afon Teifi and Afon Eden were taken:

1. SAC management unit (including the tributaries within the unit); and
2. WFD waterbody ID.

Results of the Condition Assessment are presented for both of these groupings of assessment units. Where possible, at least one survey site per SAC Management Unit was selected. It should be noted that SAC Management units on the Afon Eden were small and therefore sites spanned across the SAC unit boundaries.

The WFD waterbody units in the Teifi catchment represented smaller sections of river and therefore contained between two and four survey sites on the main Afon Teifi with only one survey site on a tributary.

4.2. Site Selection

NRW provided a confirmation of 34 sites that required surveys at project inception. Prior to each survey, existing data from previous surveys was made available by NRW for review. Map based outputs with aerial imagery were produced to act as an aid for each river survey. Maps of the survey site locations within the catchments with the assessment unit outlined can be found in Appendix A.

A total of 28 survey sites were located on the Afon Teifi and six survey sites were located on the Afon Eden. Survey site locations on the Afon Teifi are presented in Table 4.1 and for the Afon Eden in Table 4.2. Each table provides a record of the Site ID and Survey ID number, central grid reference and the date of the survey as well as the groupings into corresponding SAC and WFD assessment units.

The sites selected were viewed as being representative of the range of habitats within each management unit or waterbody and where possible, avoided areas where morphology or hydrology could be considered as being uncharacteristically affected by anthropogenic influence, for example bridges and weirs.

Prior to survey, NRW contacted relevant landowners for access permission, however surveyors carried bilingual letters (supplied by NRW) that outlined the purpose of the survey and overall objectives of the project. These could be presented to landowners should they be met on site during the survey.

Table 4.1: Survey site locations, Afon Teifi

Survey ID	Site ID	Survey Date	River	Central Grid Reference	SAC Unit	WFD Waterbody ID
16498	10534	07/11/16	Piliau	SN 18200 44500	1	GB110062039070
3878	3296	27/10/16	Teifi	SN 21200 43400		GB110062043563
38409	25334	27/10/16	Teifi	SN 21776 43602		
16500	10536	07/11/16	Teifi	SN 25700 41600	2	
16502	10538	07/11/16	Teifi	SN 28400 41300		
16548	10584	-	Cych/ Dulas	SN 24500 38200		GB110062039010
16546	10582	30/10/16	Gwyddil	SN 42100 38500		GB110062039020
35035	21967	11/11/16	Cych	SN 26800 37882		GB110062039041
879	879	11/11/16	Ceri	SN 32100 45500		GB110062039110
16547	10583	01/12/16	Cerdin	SN 41900 41800		GB110062039140
35447	22380	07/11/16	Teifi	SN 33210 41085		GB110062043564
16504	10540	28/10/16	Teifi	SN 30900 40600		
16509	10545	31/10/16	Teifi	SN 42200 41600	3	
16537	10573	01/12/16	Clettwr	SN 45100 42400		GB110062039220
16513	10549	31/10/16	Teifi	SN 50100 42500		GB110062043565
881	881	08/11/16	Teifi	SN 55600 46300	4	
16516	10552	08/11/16	Teifi	SN 52700 45600		
16517	10553	05/12/16	Grannell	SN 52500 48400		GB110062039230
16519	10555	02/11/16	Dulas	SN 59800 51700		GB110062039240
31907	18496	24/11/16	Groes	SN 69596 60110		GB110062043490
16520	10556	02/11/16	Teifi	SN 60000 48900		GB110062043566
16525	10561	02/11/16	Teifi	SN 65600 57000		
838	838	03/11/16	Teifi	SN 64000 55500		
34833	21766	03/11/16	Teifi	SN 62110 51350		
3796	3214	28/11/16	Teifi	SN 69500 64400	5	GB110062043501
16530	10566	18/11/16	Teifi	SN 68500 63000		
797	797	24/11/16	Teifi	SN 75400 66000	6.1	GB110062043540
35407	22340	24/11/16	Teifi	SN 72885 66640		

Table 4.2: Survey site locations, Afon Eden

Survey ID	Site ID	Survey Date	River	Central Grid Reference	SAC Unit	WFD Waterbody ID
BrynRe	-	05/11/16	Crawcwellt North	SH 69945 32852	8	GB110064054630
Aber	-	05/11/16	Bronaber	SH 70659 32285	11	
Pont-y-Grible	-	04/11/16	Eden	SH 70852 30477	12	
Byrdir	-	04/11/16	Eden	SH 71075 30109	36	
Ty'n-llwyn	-	04/11/16	Eden	SH 71140 29632		
Bryn Eden	-	04/11/16	Eden	SH 71095 29202	15	

4.3. Field Survey

4.3.1. River Habitat Survey

River Habitat Survey (RHS) were undertaken by an accredited surveyor (Carmen Jones - LB043) according to the methodology given in the "River Habitat Survey Guidance Manual: 2003 Version" (Environment Agency, 2003). Grid references for the start, midpoint and end of each survey reach were recorded using a GPS. Photographs were taken using a digital camera, according to the standard RHS methodology, which included the general character and notable features for each survey site.

RHS is carried out along a standard 500m length of river channel. Observations are made at ten equally spaced spot-checks along the channel, whilst information on valley form and land-use in the river corridor recorded during the sweep-up provides additional context (Environment Agency, 2003).

The River Habitat Survey is predominantly undertaken from the bank. Particular care was taken not to disturb the substrate in reaches known to contain freshwater pearl mussel, for example a visual assessment of river substrate was made from the bank rather than using the ranging pole to assess the sediment composition. This was to avoid liberating fine sediment into the watercourse, that would be detrimental to freshwater pearl mussel.

RHS forms were subject to standard quality assurance procedures and a copy of all forms submitted to NRW for inclusion in the national RHS database.

4.3.2. Simplified Phase 1 Habitat Survey

In addition to the RHS, an assessment of the naturalness of the bank vegetation at each transect was completed using a simplified Phase 1 habitat survey and assessment. At each spot check within the RHS, the bank face vegetation on both banks was recorded using the habitat categories listed within the CSM Guidance for Rivers (JNCC, 2016), with reference to Box 2.1 Table 1. This generated 20 records for each survey site.

4.3.3. Negative Indicators (Invasive non-native species)

Non-native and locally absent species were recorded within the 500 m RHS survey reach, using the invasive species field sheets provided by NRW. Grid references, photos, extent and comments were made for each high impact Water Framework Directive species (UKTAG, 2015). These records will be submitted by NRW to the National Biodiversity Network or details inputted into the Plant Tracker app.

4.4. Data Analysis and Interpretation

The attributes assessed in this project are summarised in Table 4.3. Each attribute has a target, against which compliance is assessed. The Condition Assessment tables present the recommended outcomes of "Pass" (green) or "Fail" (red) for each target. Boxes are coloured when additional considerations are made relating to the target compliance based on site observations or professional judgement.

Note that all assessment units must be in favourable condition to report the whole site as favourable for an attribute/sub-attribute. However, expert judgment should be

used to decide whether the failure of one unit in a larger designated site is sufficient to warrant the whole site being classed as unfavourable (JNCC, 2014).

Assessment of the Habitat Structure attributes requires the analysis of historical maps, aerial imagery and data derived from the RHS and a simplified version of the JNCC Phase 1 habitat survey (JNCC, 2016). In addition, the fine sediment attribute is assessed using data collected during the RHS and the Negative Indicators attribute assessed using observations made during the RHS.

Table 4.3. List of attributes monitored and assessed.

Attribute	Data Source
Habitat structure	
Channel planform	Map data, aerial survey data and historical records.
Habitat Modification Score	River Habitat Survey (RHS) data from numerous sections are used to derive the Habitat Modification Score
Bank vegetation naturalness	Simplified Phase 1 habitat survey, which will inform the SERCON scores.
Riparian zone vegetation naturalness	RHS (Section F) used to derive SERCON scores.
Large woody debris	RHS (Section J).
In-channel structures	RHS (Section D) and other data sources.
Fine sediment	
Siltation	RHS (Section P and spot check channel substrate)
Negative indicators	
Alien/locally absent species	High risk WFD invasive non-native species observations within the RHS reach.

4.4.1. Habitat Structure Assessment

Channel Planform

Channel form should be generally characteristic of the river type with a predominantly unmodified planform. An assessment of the naturalness of the channel planform for each SAC unit and WFD waterbody was undertaken using aerial survey data and satellite imagery, alongside local knowledge and map data (it should be noted there were no historic maps available, reducing confidence in these assessments). Features that affect the river flood zone, the river course and alterations to the channel were considered in the assessment, and the zone of the impact of each feature considered.

Habitat Modification Score

Habitat Modification Score (HMS) is a metric derived from a number of sections within the RHS data that record the nature of modifications to a river and their estimated persistence. The modifications are cumulated and used to indicate the overall extent of habitat modification within the survey site within a total HMS. The HMS translates into habitat modification classes from 1 (representing “Pristine/ Near-natural” conditions) to 5 (“Severely modified”), which describe the level of modification within a site.

The SAC conservation objectives relating to habitat modification are that the rivers should be predominantly unmodified. To provide a quantitative assessment, the target from the CSM Guidance (JNCC, 2016) is used.

Bank Vegetation Naturalness

Data from the simplified Phase I Habitat Survey, carried out at each of the 10 RHS transect locations for each survey site, were used to assess bank vegetation naturalness. Vegetation types are assigned points relating their naturalness and summed for each site. A SERCON score is assigned in relation to the cumulative total as per the method detailed in Box 2.1 Table 1 in the JNCC guidance (JNCC, 2016).

Riparian Zone Vegetation Naturalness

Data from the standard RHS survey (Sections F and H) were used to calculate scores for riparian zone vegetation naturalness as per the method in Box 2.2 Table 1 in the JNCC guidance (JNCC, 2016).

Woody Debris

Data on large woody debris (LWD) were available from the 'sweep-up' section of the RHS form (Section J) and is recorded as absent, present or extensive (>33%).

For this indicator, the guidance requires at least five RHS sites to be considered in the assessment; where five RHS sites are not available within an assessment unit (SAC Unit/waterbody), then units should be amalgamated (JNCC, 2016). To enable future targeted action and comparison, the assessment has been undertaken at a SAC unit or WFD waterbody level regardless of the number of sites, with individual sites drawn out for detail.

Two targets are available for the woody debris indicator, reflecting the tendency of woody debris to be moved during floods and occasionally to form debris dams. These targets should be viewed as interchangeable. If targets are not met, the reasons should be identified. An assessment unit should not fail if there are no (or very few) naturally occurring trees to provide a source of woody debris (e.g. upland or fenland rivers), or where this is removed for overriding reasons of public safety (for example to prevent flooding or bridge collapse).

In-channel Structures

Data from the standard RHS survey (Section D) were used to assess in-channel structures. Assessments included the upstream 'ponding' effects that artificial structures have on flow patterns and habitat structure. A quick sweep-up assessment using aerial photography was made to determine if there were any additional structures outside of the RHS sites that could have a major impact on the unit.

4.4.2. Fine Sediment- Siltation

Data from the RHS survey (Sections E and P) were used to assess siltation.

4.4.3. Negative Indicators- Alien/Locally Absent Species

Data from macrophyte surveys and RHS (Section O) were used to assess alien species. The assessment is based on the species listed as high impact by the UK-TAG Water Framework Directive (2015), presented in Table 4.4. The assessment

applies to species on the banks and in the riparian zone as well as species in the channel and margins.

Invasive fauna species, for example North American signal crayfish (*Pacifastacus leniusculus*), were not specifically surveyed for but were noted if observed during the survey.

Table 4.4. High-impact alien river plant species for assessment

Common name	Scientific name
Floating pennywort	*Hydrocotyle ranunculoides*
Water fern	*Azolla filiculoides*
Canadian pondweed	*Elodea canadensis*
Nuttall's pondweed	*Elodea nuttallii*
Japanese knotweed	*Fallopia japonica*
Giant knotweed	*Fallopia sachalinensis*
Japanese knotweed/ Giant knotweed hybrid	*Fallopia* x *bohemica*
Himalayan balsam	*Impatiens glandulifera*
Giant hogweed	*Heracleum mantegazzianum*
Rhododendron	*Rhododendron ponticum* + hybrids

4.5. RHS Considerations and Limitations

High river flows during the autumn season could have posed a restriction on undertaking the surveys and data quality. Local gauging stations were monitored and surveys were only undertaken when river flows were within an approved threshold as advised by NRW, avoiding any periods of high flows. All surveys were undertaken during optimal flow levels.

Access was not granted by the landowner for the Afon Teifi survey site located on the Afon Cych/Dulas (Site ID 10584) and therefore the RHS survey at this site was not undertaken.

There is a risk of under-recording invasive species during autumn and winter surveys, particularly Himalayan balsam, which is an annual. Dead stems were generally visible during the surveys, although they could have been missed on the banks opposite the surveyor, especially if amongst other vegetation or if they had died back. Japanese knotweed stems persist during the winter and form large stands, so are more likely to have been recorded, where present.

The Habitat Modification Scores are typically returned from the statutory authority following inclusion of the RHS data into the database. These database derived scores were not available at the time of report production and therefore have been calculated manually following the rules supplied by NRW. These scores should be treated as indicative only for the purposes of undertaking the condition assessment.

5. Field Survey Results

The completed RHS forms were supplied to the Natural Resources Wales for inclusion on the RHS database. A copy of all the RHS field forms are provided in the data appendix to this report. The Phase 1 Habitat data is also included in the data appendix.

Invasive species records are provided within Appendix C of this report in a format that enabled submission for inclusion in national databases.

Survey data has been entered into spreadsheets including the habitat modification scores, bank naturalness and riparian zone naturalness calculations. These are provided in electronic format alongside the report.

A confidential report accompanies this report containing details of site access.

6. Condition Assessment: Afon Teifi

6.1. Overview

A photograph of each survey site along with key features of interest/impact are included within Appendix B. The Condition Assessment for the Afon Teifi is composed of three broad attributes from the CSM guidance for rivers (JNCC, 2016), which will be assessed in detail within this section of the report:

- Habitat structure;
- Fine sediment;
- Negative indicators.

The Condition Assessment results will include the recommendation for whether the targets pass or fail; a summary description of the results of the assessment; and implications for the river in terms of ecological impact.

6.2. Habitat Structure

The results from the morphological and habitat structure analysis for the Afon Teifi are presented below. The attributes assessed include channel planform, habitat modification, bank vegetation naturalness, riparian zone naturalness, woody debris and in-channel structures.

6.2.1. Channel Planform

Target: Channel Planform
Channel form should be generally characteristic of river type, with predominantly unmodified planform. <5% of the assessment unit should be artificial, re-aligned or constrained.

The river planform (i.e. the shape of the river when viewed from above) of the Afon Teifi should be natural, not artificially straightened or moved. Factors that have contributed to the assessment of this target include the cumulative presence of channel modifications, including channel alterations and floodplain developments. Where banks have been reinforced or resectioned within the RHS sites, these are mentioned within the assessment table as it will impact upon the future potential naturalness of the river planform.

Table 6.1. Channel Planform by SAC Management Unit.

Site ID	River	Central Grid Reference	SAC Unit	Comment	Pass/ Fail
10534	Piliau	SN 18200 44500	1	Localised reprofiling and reinforcement to protect pasture, but channel and planform otherwise natural. A484 and A478 follow sections of river.	**Pass**
3296	Teifi	SN 21200 43400			
25334	Teifi	SN 21776 43602			
10536	Teifi	SN 25700 41600	2	Localised bank reinforcement, and resectioning to protect pasture on the main Afon Teifi and tributaries. A484 constrains right bank along short sections of the main river and river narrows through small urban areas (e.g. Cenarth and Newcastle Emlyn). Upstream of Newcastle Emlyn, the Afon Teifi flows between the A484 and A475, which mark the extent of the meanders. Tributaries all have a near natural planform.	**Pass**
10538	Teifi	SN 28400 41300			
10584	Cych/ Dulas	SN 24500 38200			
10582	Gwyddil	SN 42100 38500			
21967	Cych	SN 26800 37882			
879	Ceri	SN 32100 45500			
10583	Cerdin	SN 41900 41800			
22380	Teifi	SN 33210 41085			
10540	Teifi	SN 30900 40600			
10545	Teifi	SN 42200 41600	3	Localised bank reinforcement to protect pasture. Clettwr has more extensive sections of reinforcement and bank realignment was noted.	**Pass**
10573	Clettwr	SN 45100 42400			
10549	Teifi	SN 50100 42500			
881	Teifi	SN 55600 46300	4	Small amount/localised bank reinforcement and bank resectioning. There appears to be natural oxbow lakes (for example at grid references SN 55372 46315 and SN 56596 46769) downstream of Lampeter, indicating this section is hydrodynamically active. The Afon Dulas was over-deepened at the survey site and had been recently dredged and straightened; from the OS map and aerials it appears to have also been straightened outside of the survey reach.	**Pass**
10552	Teifi	SN 52700 45600			
10553	Grannell	SN 52500 48400			
10555	Dulas	SN 59800 51700			
18496	Groes	SN 69596 60110			
10556	Teifi	SN 60000 48900			
10561	Teifi	SN 65600 57000			
838	Teifi	SN 64000 55500			
21766	Teifi	SN 62110 51350			
3214	Teifi	SN 69500 64400	5	Channel through Cors Caron SAC has historically been straightened and deepened. There is evidence of the old channel. Small amount/localised bank reinforcement, embankment and resectioning.	**Fail**
10566	Teifi	SN 68500 63000			
797	Teifi	SN 75400 66000	6.1	Small amount/localised bank reinforcement, bank resectioning and poaching, otherwise planform appears natural.	**Pass**
22340	Teifi	SN 72885 66640			

Overall, the Afon Teifi has a relatively characteristic and natural planform, with tight meanders, especially in the middle reaches (SAC Units 2-4). However, floodplain development of roads and urban areas, whilst typically mirroring the river planform, are likely to constrain the natural movement of the channel. The river banks have been locally reinforced to protect farmland, predominantly where the banks are not

wooded. Interventions of this type will influence the future channel planform by changing flows and the erosional processes. The channel frequently narrows artificially at bridge crossings, for example at Cenarth and Newcastle Emlyn (Unit 2) but this does not appear to cause upstream ponding.

The section of the Afon Teifi that flows through Cors Caron SAC (Appendix B1: Afon Teifi SAC Unit 5, Images 1 – 4). A section of river, 1.5 km in length, was straightened and deepened at the end of the 19th Century, reducing both the naturalness of the river and connectivity with an area of adjacentraised bog (CCW, 2012). The evidence of the historic channel, with relic meanders adjacent to the current channel can be seen on aerial imagery. This stretch of river represents 12.5% of SAC Unit 5, which has led to the unit being classified as failing the target. This section also represents approximately 12.5% of the WFD waterbody GB110062043501, which has also led to the unit being classified as failing the target. Upstream, within SAC Unit 6.1, there was a small amount of bank reinforcement, bank resectioning and poaching, but as this is localised this unit passes the assessment.

Table 6.2. Channel Planform by WFD waterbody.

Site ID	River	Central Grid Reference	WFD Waterbody ID	Comment	Pass/ Fail
10534	Piliau	SN 18200 44500	GB110062039070	Near natural- A478 follows river channel closely for approx. 0.6 km.	**Pass**
3296	Teifi	SN 21200 43400	GB110062043563	Localised bank resectioning and reprofiling through pasture. A484 constrains right bank along short sections. Planform otherwise natural.	**Pass**
25334	Teifi	SN 21776 43602			
10536	Teifi	SN 25700 41600			
10538	Teifi	SN 28400 41300			
10584	Cych/ Dulas	SN 24500 38200	GB110062039010	Near natural.	**Pass**
10582	Gwyddil	SN 42100 38500	GB110062039020	Near natural.	**Pass**
21967	Cych	SN 26800 37882	GB110062039041	Localised bank reinforcement. Minor road tracks the river up the valley.	**Pass**
879	Ceri	SN 32100 45500	GB110062039110	Localised bank reinforcement and resectioning but otherwise almost natural.	**Pass**
10583	Cerdin	SN 41900 41800	GB110062039140	Localised bank reinforcement but otherwise natural planform with tight meanders in the mid-lower reaches.	**Pass**
22380	Teifi	SN 33210 41085	GB110062043564	Localised bank reinforcement and resectioning. Downstream end of waterbody unit, Afon Teifi is constrained between A484 and A475, to	**Pass**
10540	Teifi	SN 30900 40600			
10545	Teifi	SN 42200 41600			

				Newcastle Emlyn, which mark the extent of the meanders.	
10573	Clettwr	SN 45100 42400	GB1100620 39220	Bank reinforcement and resectioning. The tributary has received more artificial modification than others, but the planform remains predominantly natural.	**Pass**
10549	Teifi	SN 50100 42500	GB1100620 43565	Localised bank reinforcement. There appears to be natural oxbow lakes downstream of Lampeter, indicating this section is hydrodynamically active.	**Pass**
881	Teifi	SN 55600 46300			
10552	Teifi	SN 52700 45600			
10553	Grannell	SN 52500 48400	GB1100620 39230	Localised bank reinforcement.	**Pass**
10555	Dulas	SN 59800 51700	GB1100620 39240	Localised bank reinforcement and resectioning. The Afon Dulas was over-deepened at the survey site and had been recently dredged and straightened; from the OS map and aerials it appears to have also been straightened outside of the survey reach.	**Fail**
18496	Groes	SN 69596 60110	GB1100620 43490	Localised bank reinforcement and resectioning, otherwise planform appears natural.	**Pass**
10556	Teifi	SN 60000 48900	GB1100620 43566	Localised bank reinforcement, otherwise planform appears natural.	**Pass**
10561	Teifi	SN 65600 57000			
838	Teifi	SN 64000 55500			
21766	Teifi	SN 62110 51350			
3214	Teifi	SN 69500 64400	GB1100620 43501	Channel through Cors Caron SAC has historically been straightened and deepened. There is evidence of the old channel. Small amount/localised bank reinforcement, embankment and resectioning.	**Fail**
10566	Teifi	SN 68500 63000			
797	Teifi	SN 75400 66000	GB1100620 43540	Small amount/localised bank reinforcement, bank resectioning and poaching, otherwise planform appears natural.	**Pass**
22340	Teifi	SN 72885 66640			

The Afon Dulas has been recently dredged and straightened in a small section of the survey reach. This represents a small section of the overall SAC unit and waterbody

so it is recommended that this does not cause this tributary to fail the channel planform target.

The Afon Teifi SAC **fails** to meet the **Channel Planform** targets due to Unit 5 failing the assessment target.

6.2.2. Habitat Modification

Target: Habitat Modification
>65% or more of condition monitoring sites should fall within the semi-natural HMS Class 1, with the remainder predominantly unmodified (Class 2). No (or minimal) deterioration from the last monitoring cycle.*

*Insufficient data to assess this target

The habitat modification scores (HMS) have been calculated manually, to provide an indicative classification of the RHS sites according to the degree of artificial channel and bank modification. The assessment tables include details from the RHS forms on the predominant bank and channel modifications within the survey stretches, for example whether there is evidence of reinforcement, resectioning, embankment or poaching within the RHS sites, especially where these have been recorded as extensive. This provides explanation of the key artificial influences within the catchment and the drivers behind the scores.

Table 6.3. Habitat Modification by SAC Management Unit.

Site ID	River	Central Grid Reference	HMS Score	HMS Class	SAC Unit	Comment	Pass / Fail
10534	Piliau	SN 18200 44500	20	2	1	Poaching, localised reprofiling and reinforcement to protect pasture present. Extensive left bank reprofiling in Site 25334, combined with a major bridge classifies the site as significantly modified.	**Fail**
3296	Teifi	SN 21200 43400	105	2			
25334	Teifi	SN 21776 43602	565	4			
10536	Teifi	SN 25700 41600	0	1	2	Bank reinforcement, bank resectioning, embankment and poaching present on the main Afon Teifi and the tributaries. Bridge on Afon Ceri (Site 879 and Site 22380 on Teifi).	**Fail**
10538	Teifi	SN 28400 41300	40	2			
10584	Cych/ Dulas	SN 24500 38200	-	-			
10582	Gwyddil	SN 42100 38500	30	2			
21967	Cych	SN 26800 37882	40	2			
879	Ceri	SN 32100 45500	285	3			
10583	Cerdin	SN 41900 41800	65	2			
22380	Teifi	SN 33210 41085	385	3			
10540	Teifi	SN 30900 40600	60	2			
10545	Teifi	SN 42200 41600	40	2	3	Bank reinforcement, embankment and poaching present on the Teifi. Clettwr has extensive bank	**Fail**
10573	Clettwr	SN 45100 42400	795	4			
10549	Teifi	SN 50100 42500	0	1			

						reinforcement.	
881	Teifi	SN 55600 46300	30	2	4	Bank reinforcement, bank resectioning, embankment and poaching present. Site 21766 had extensive bank resectioning and reinforcement. Site 838 fenced. Afon Dulas channel resectioned and intermediate bridge.	**Fail**
10552	Teifi	SN 52700 45600	0	1			
10553	Grannell	SN 52500 48400	60	2			
10555	Dulas	SN 59800 51700	1290	4			
18496	Groes	SN 69596 60110	300	3			
10556	Teifi	SN 60000 48900	60	2			
10561	Teifi	SN 65600 57000	20	2			
838	Teifi	SN 64000 55500	0	1			
21766	Teifi	SN 62110 51350	630	4			
3214	Teifi	SN 69500 64400	800	4	5	Small amount/localised bank reinforcement, embankment and resectioning present at Site 10566.	**Fail**
10566	Teifi	SN 68500 63000	2104	5			
797	Teifi	SN 75400 66000	70	2	6.1	Bank reinforcement, reprofiling and poaching present.	**Fail**
22340	Teifi	SN 72885 66640	365	3			

Overall, RHS sites in all SAC management units recorded localised artificial bank modifications including bank reinforcement (Appendix B1: Afon Teifi SAC Unit 4, Image 19, bank reprofiling and bank resectioning (Appendix B1: Afon Teifi SAC Unit 4, Image 26), which have been undertaken to protect farmland and prevent erosional cliff formation. This was recorded as extensive in some sites, which contributes to higher HMS.

In addition, bridges (e.g. Appendix B1: Afon Teifi SAC Unit 4, Image 29) and inflows/outflows (e.g. Appendix B1: Afon Teifi SAC Unit 5, Image 12) were recorded within a low number of survey sites, which contributed to higher modification scores, particularly when considered to have a major influence due to in-channel supports.

There were short stretches of river with artificial embankments present, for example Site 10582 on Gwyddil (SAC Unit 2), Site 10561 (Appendix B1: Afon Teifi SAC Unit 4, Image 28) and 10566 on Teifi (SAC Unit 5), although these were not considered as extensive within the survey sites and do not appear to be a common modification in the catchment.

The banks of the main river and tributaries were often recorded as poached (Appendix B1: Afon Teifi SAC Unit 5, Image 11). This reflects the predominant catchment land use of grazing pasture, which was not always fenced to prevent cattle access to the river channel.

Overall, survey sites had low HMS, reflecting the predominantly unmodified nature of the Afon Teifi and its tributaries. Despite this, only four sites were described as pristine (HMS Class 1) and thirteen sites were described as predominantly unmodified (HMS Class 2). Most units comprised at least one survey site scoring a higher habitat modification class, therefore failing to comply with the target for habitat modification overall. The site location chosen for the RHS, may not have been representative of the overall management unit, for example it may be located in an area of particularly extensive reinforcement or with a major bridge resulting in failing

the target. Where this is considered to be applicable it has been highlighted in the assessment.

SAC Unit 1 was classified overall as failing to meet the habitat modification target due to Site 25334 on the Afon Teifi, which contained a major bridge with multiple in-channel piers and extensive bank reinforcement (Appendix B1: Afon Teifi SAC Unit 1, Image 10). However, this is not typical of the condition of a large proportion of the SAC unit.

Most survey sites within SAC Unit 2 were classified as either Pristine (Class 1) or Predominantly Unmodified (Class 2). The Afon Ceri scored a higher HMS, due to the presence of a minor bridge and some bank reinforcement and resectioning, and Site 22380 on the Afon Teifi contained a major bridge with some bank modifications, which tipped the sites into being classified as Obviously Modified (Class 3), failing to comply with the target.

The survey sites on the Afon Teifi main river were relatively natural within Unit 3. The survey site on the Afon Clettwr, however, was located close to a woollen mill, with associated bank resectioning, artificial bank materials and bank reinforcement. A mill leat ran adjacent to the river containing a waterwheel. Two bridges within the survey site contributed to an overall classification of the waterbody as Signficantly Modified (Class 4). It is not thought that this is reflective of the wider waterbody, which appears to be more natural.

Within SAC Unit 4, 66% of the survey sites were classified as either Class 1 or Class 2, reflecting relatively natural conditions. Two tributaries contributed to SAC Unit 4 failing to meet the habitat modification target. The channel of the Afon Dulas within the survey site had been resectioned and contained an intermediate bridge. The Afon Groes also had the channel and bank resectioned through a small part of the survey site. These are not thought to be representative of characters of the wider tributary. Site 21766 on the Afon Teifi was also Significantly Modified (Class 4) due to extensive bank resectioning and reinforcement with gabion baskets (Appendix B1: Afon Teifi SAC Unit 4, Image 30).

SAC Unit 5 and Unit 6.1 was consistently the most modified stretch of river. Channel resectioning of the survey sites in Cors Caron SAC lead to the downstream sites within the assessment unit (Site 3214 and 10566) being recorded as Significantly Modified and Severely Modified respectively. Upstream, the survey sites had a more natural character. Site 797 on the Afon Teifi had localised bank reinforcement and poaching (Class 2). Site 22340 contained an intermediate bridge as well as localised bank modifications (Class 3).

Table 6.4. Habitat Modification by WFD Waterbody.

Site ID	River	Central Grid Reference	HMS Score	HMS Class	WFD Waterbody ID	Comment	Pass/ Fail
10534	Piliau	SN 18200 44500	20	2	GB1100620 39070	Relatively natural, poaching present.	**Pass**
3296	Teifi	SN 21200 43400	105	2	GB1100620 43563	Bank reprofiling and reinforcement present. Extensive left bank reprofiling at Site 25334.	**Fail**
25334	Teifi	SN 21776 43602	565	4			
10536	Teifi	SN 25700 41600	0	1			
10538	Teifi	SN 28400 41300	40	2			
10584	Cych/ Dulas	SN 24500 38200	-	-	GB1100620 39010	-	-
10582	Gwyddil	SN 42100 38500	30	2	GB1100620 39020	Localised embankment and poaching.	**Pass**
21967	Cych	SN 26800 37882	40	2	GB1100620 39041	Bank reinforcement present on right bank.	**Pass**
879	Ceri	SN 32100 45500	285	3	GB1100620 39110	Bank reinforcement and resectioning present on both banks.	**Fail**
10583	Cerdin	SN 41900 41800	65	2	GB1100620 39140	Bank reinforcement present on right bank.	**Pass**
22380	Teifi	SN 33210 41085	385	3	GB1100620 43564	Bank reinforcement, resectioning and poaching present.	**Fail**
10540	Teifi	SN 30900 40600	60	2			
10545	Teifi	SN 42200 41600	40	2			
10573	Clettwr	SN 45100 42400	795	4	GB1100620 39220	Extensive bank reinforcement and bank reprofiling present.	**Fail**
10549	Teifi	SN 50100 42500	0	1	GB1100620 43565	Bank reinforcement and poaching present at Site 881 only.	**Pass**
881	Teifi	SN 55600 46300	30	2			
10552	Teifi	SN 52700 45600	0	1			
10553	Grannell	SN 52500 48400	60	2	GB1100620 39230	Bank reinforcement and poaching present.	**Pass**
10555	Dulas	SN 59800 51700	1290	4	GB1100620 39240	Bank reprofiling and poaching present.	**Fail**
18496	Groes	SN 69596 60110	300	3	GB1100620 43490	Bank reinforcement	**Fail**

						and resectioning present.	
10556	Teifi	SN 60000 48900	60	2	GB1100620 43566	Bank reinforcement, embankment and poaching present. Site 21766 had extensive bank resectioning and reinforcement.	**Fail**
10561	Teifi	SN 65600 57000	20	2			
838	Teifi	SN 64000 55500	0	1			
21766	Teifi	SN 62110 51350	630	4			
3214	Teifi	SN 69500 64400	800	4	GB1100620 43501	Small amount/localised bank reinforcement, embankment and resectioning present at Site 10566.	**Fail**
10566	Teifi	SN 68500 63000	2104	5			
797	Teifi	SN 75400 66000	70	2	GB1100620 43540	Bank reinforcement, reprofiling and poaching present.	**Fail**
22340	Teifi	SN 72885 66640	365	3			

Where single sites comprise the WFD assessment unit and there is only a small amount of modification recorded as present and therefore the site is classed as semi-natural (Class 2), it is recommended these assessment units should pass the habitat modification target.

The tributaries of the Afon Teifi were more likely to be recorded as natural compared with the main river, particularly in the lower sections of the catchment. As described above, the Afon Ceri, Afon Clettwr, Afon Dulas and Afon Groes all failed to comply with the target. The tributaries were represented by a single survey site and therefore there should be low confidence in this assessment as the survey site may not be representative of the whole waterbody. Additional survey sites would increase confidence of this interpretation.

The Afon Teifi was often represented by a small number of survey sites (between two and four). The sites at the downstream end of the catchment were relatively natural in character, with waterbodies often failing due to one survey site recording artificial features or modifications. One waterbody (GB110062043565) in the middle of the catchment passed the target, with two sites recorded as Pristine and the third as Predominantly Unmodified. The two most upstream waterbodies, including through Cors Caron SAC were more modified overall.

The Afon Teifi SAC **fails** to meet the **Habitat Modification** targets.

6.2.3. Bank Vegetation Naturalness

Target: Bank Vegetation Naturalness
Mean SERCON score for the assessment unit of 4 or 5

SERCON scores were averaged over the SAC Management Unit (Table 6.5) and for the WFD waterbody (Table 6.6).

Table 6.5. Bank vegetation naturalness SERCON scores by SAC Management Unit.

Site ID	River	Central Grid Reference	SERCON Score	SAC Unit	SAC Mean	Pass/ Fail
10534	Piliau	SN 18200 44500	3	1	3	**Fail**
3296	Teifi	SN 21200 43400	5			
25334	Teifi	SN 21776 43602	1			
10536	Teifi	SN 25700 41600	1	2	2.7	**Fail**
10538	Teifi	SN 28400 41300	1			
10584	Cych/ Dulas	SN 24500 38200	-			
10582	Gwyddil	SN 42100 38500	4			
21967	Cych	SN 26800 37882	5			
879	Ceri	SN 32100 45500	4			
10583	Cerdin	SN 41900 41800	5			
22380	Teifi	SN 33210 41085	1			
10540	Teifi	SN 30900 40600	3			
10545	Teifi	SN 42200 41600	0	3	1.3	**Fail**
10573	Clettwr	SN 45100 42400	4			
10549	Teifi	SN 50100 42500	0			
881	Teifi	SN 55600 46300	0	4	2	**Fail**
10552	Teifi	SN 52700 45600	0			
10553	Grannell	SN 52500 48400	5			
10555	Dulas	SN 59800 51700	3			
18496	Groes	SN 69596 60110	3			
10556	Teifi	SN 60000 48900	0			
10561	Teifi	SN 65600 57000	5			
838	Teifi	SN 64000 55500	0			
21766	Teifi	SN 62110 51350	2			
3214	Teifi	SN 69500 64400	5	5	5	**Pass**
10566	Teifi	SN 68500 63000	5			
797	Teifi	SN 75400 66000	5	6.1	4	**Pass**
22340	Teifi	SN 72885 66640	3			

The bank vegetation along the Afon Teifi and its tributaries was predominantly characterised by improved grassland (39% of spot checks), unimproved grassland (24% of spot checks) and semi-natural deciduous woodland (20% of spot checks).

The survey sites on the Afon Teifi main river were more likely to score low SERCON scores, indicating the bank vegetation was less natural than that recorded for the tributaries. Many of the Afon Teifi sites were assigned SERCON scores of between

0-2, compared to the tributaries which scored 4 or 5. Exceptions to this include Piliau, Dulas and Groes, which scored SERCON scores of 3.

When assessing the Afon Teifi SAC management units, Units 1-4 failed to meet the target for bank vegetation naturalness. This was primarily due to the lower scoring improved grassland dominating sites on the Afon Teifi. The upstream SAC units, SAC Unit 5 and Unit 6.1, included the Cors Caron SAC and the banks of the Afon Teifi through this section were colonised by marshy grassland and fen species. This led to higher bank naturalness scores and therefore higher SERCON scores and the Unit passing the target.

Table 6.6. Bank vegetation naturalness SERCON scores by WFD Waterbody.

Site ID	River	Central Grid Reference	SERCON Score	WFD Waterbody ID	Mean	Pass/ Fail
10534	Piliau	SN 18200 44500	3	GB110062039070	3	**Fail**
3296	Teifi	SN 21200 43400	5	GB110062043563	2	**Fail**
25334	Teifi	SN 21776 43602	1			
10536	Teifi	SN 25700 41600	1			
10538	Teifi	SN 28400 41300	1			
10584	Cych/ Dulas	SN 24500 38200	-	GB110062039010	-	
10582	Gwyddil	SN 42100 38500	4	GB110062039020	4	**Pass**
21967	Cych	SN 26800 37882	5	GB110062039041	5	**Pass**
879	Ceri	SN 32100 45500	4	GB110062039110	4	**Pass**
10583	Cerdin	SN 41900 41800	5	GB110062039140	5	**Pass**
22380	Teifi	SN 33210 41085	1	GB110062043564	1.3	**Fail**
10540	Teifi	SN 30900 40600	3			
10545	Teifi	SN 42200 41600	0			
10573	Clettwr	SN 45100 42400	4	GB110062039220	4	**Pass**
10549	Teifi	SN 50100 42500	0	GB110062043565	0	**Fail**
881	Teifi	SN 55600 46300	0			
10552	Teifi	SN 52700 45600	0			
10553	Grannell	SN 52500 48400	5	GB110062039230	5	**Pass**
10555	Dulas	SN 59800 51700	3	GB110062039240	3	**Fail**
18496	Groes	SN 69596 60110	3	GB110062043490	3	**Fail**
10556	Teifi	SN 60000 48900	0	GB110062043566	1.7	**Fail**
10561	Teifi	SN 65600 57000	5			
838	Teifi	SN 64000 55500	0			
21766	Teifi	SN 62110 51350	2			
3214	Teifi	SN 69500 64400	5	GB1100620435	5	**Pass**

10566	Teifi	SN 68500 63000	5	01		
797	Teifi	SN 75400 66000	5	GB1100620435	4	**Pass**
22340	Teifi	SN 72885 66640	3	40		

When assessing survey sites contributing to the Afon Teifi WFD waterbodies, the tributaries that formed individual waterbodies typically passed the bank naturalness target whereas the Afon Teifi, particularly in the downstream reaches predominantly failed the target.

The Afon Teifi SAC **fails** to meet the **Bank Vegetation Naturalness** targets.

6.2.4. Riparian Zone Naturalness

Target: Riparian Zone Naturalness
Mean SERCON score for the assessment unit of 4 or 5

SERCON scores were averaged over the SAC Management Unit (Table 6.7) and for the WFD waterbody (Table 6.8).

Table 6.7. Riparian zone naturalness SERCON scores by SAC Management Unit.

Survey ID	Site ID	River	Central Grid Reference	SERCON Score	SAC Unit	SAC Mean	Pass/ Fail
16498	10534	Piliau	SN 18200 44500	5	1	4.3	**Pass**
3878	3296	Teifi	SN 21200 43400	5			
38409	25334	Teifi	SN 21776 43602	3			
16500	10536	Teifi	SN 25700 41600	4	2	4.1	**Pass**
16502	10538	Teifi	SN 28400 41300	4			
16548	10584	Cych/ Dulas	SN 24500 38200	-			
16546	10582	Gwyddil	SN 42100 38500	2			
35035	21967	Cych	SN 26800 37882	5			
879	879	Ceri	SN 32100 45500	5			
16547	10583	Cerdin	SN 41900 41800	5			
35447	22380	Teifi	SN 33210 41085	4			
16504	10540	Teifi	SN 30900 40600	4			
16509	10545	Teifi	SN 42200 41600	3	3	2.7	**Fail**
16537	10573	Clettwr	SN 45100 42400	4			
16513	10549	Teifi	SN 50100 42500	1			
881	881	Teifi	SN 55600 46300	2	4	2.7	**Fail**
16516	10552	Teifi	SN 52700 45600	1			
16517	10553	Grannell	SN 52500 48400	1			
16519	10555	Dulas	SN 59800 51700	5			
31907	18496	Groes	SN 69596 60110	5			
16520	10556	Teifi	SN 60000 48900	1			
16525	10561	Teifi	SN 65600 57000	5			
838	838	Teifi	SN 64000 55500	1			
34833	21766	Teifi	SN 62110 51350	3			
3796	3214	Teifi	SN 69500 64400	5	5	5	**Pass**
16530	10566	Teifi	SN 68500 63000	5			

797	797	Teifi	SN 75400 66000	5	6.1	4	**Pass**
35407	22340	Teifi	SN 72885 66640	3			

The riparian zone within 5 m of the Afon Teifi SAC was predominantly characterised by improved grassland, rough pasture and broadleaved woodland. The riparian zone further away from the watercourse, within 50 m, typically included broadleaved woodland, scrub and shrubs, rough pasture, improved grassland and tall herb. Overall, most survey sites recorded SERCON scores of 4 or 5 except for sites situated in the middle reaches of the Afon Teifi main river.

When assessing the Afon Teifi SAC management units, Unit 1 passed the target for riparian zone naturalness. The downstream Afon Teifi survey sites within this Unit were characterised by broadleaved woodland, adjacent to the river. The exception to this is Site 25334 (Afon Teifi at Llechryd), which instead had improved grassland within the riparian zone.

Unit 2 also passed the target. Most sites within Unit 2 recorded improved grassland within 5 m of the river and therefore did not score high initially, however, scrub, broadleaved woodland and rough pasture characterised the riparian zone within 50 m, which increased the naturalness score. The exception to this was Site 10582 on Gwyddil, which included sub-urban and conifer plantation within the riparian zone.

Units 3 and 4 in the mid-reaches of the Afon Teifi failed to meet the target for riparian naturalness. Improved grassland characterised the riparian zone close to the mainstem Afon Teifi in particular. The tributaries were typically more natural with broadleaved woodland, scrub and rough pasture. A number of sites recorded parkland or garden landuses within 50 m of the watercourse, which lowered the naturalness score.

The Unit 5 survey sites within Cors Caron SAC recorded high riparian naturalness scores of 7 or 8, prior to being rounded down to the final SERCON score of 5. This was due to wetland and rough pasture dominating the riparian zone on the raised bog. Upstream on the Afon Teifi, in SAC Unit 6.1, Site 22340 (Teifi at Pontrhydfendigaid) was less natural; sub-urban and parkland landuses recorded in the wider riparian zone counteracted the higher scoring rough pasture habitat close to the river. Unit 6.1 passed the target relating to Riparian Zone Naturalness.

Table 6.8. Riparian zone naturalness SERCON scores by WFD Waterbody.

Survey ID	Site ID	River	Central Grid Reference	SERCON Score	WFD Waterbody ID	Mean	Pass/ Fail
16498	10534	Piliau	SN 18200 44500	5	GB110062 039070	5	**Pass**
3878	3296	Teifi	SN 21200 43400	5	GB110062 043563	4	**Pass**
38409	25334	Teifi	SN 21776 43602	3			
16500	10536	Teifi	SN 25700 41600	4			
16502	10538	Teifi	SN 28400 41300	4			
16548	10584	Cych/ Dulas	SN 24500 38200	-	GB110062 039010	-	
16546	10582	Gwyddil	SN 42100 38500	2	GB110062 039020	2	**Fail**
35035	21967	Cych	SN 26800 37882	5	GB110062 039041	5	**Pass**
879	879	Ceri	SN 32100 45500	5	GB110062 039110	5	**Pass**
16547	10583	Cerdin	SN 41900 41800	5	GB110062 039140	5	**Pass**
35447	22380	Teifi	SN 33210 41085	4	GB110062 043564	3.7	**Fail**
16504	10540	Teifi	SN 30900 40600	4			
16509	10545	Teifi	SN 42200 41600	3			
16537	10573	Clettwr	SN 45100 42400	4	GB110062 039220	4	**Pass**
16513	10549	Teifi	SN 50100 42500	1	GB110062 043565	1.3	**Fail**
881	881	Teifi	SN 55600 46300	2			
16516	10552	Teifi	SN 52700 45600	1			
16517	10553	Grannell	SN 52500 48400	1	GB110062 039230	1	**Fail**
16519	10555	Dulas	SN 59800 51700	5	GB110062 039240	5	**Pass**
31907	18496	Groes	SN 69596 60110	5	GB110062 043490	5	**Pass**
16520	10556	Teifi	SN 60000 48900	1	GB110062 043566	3.5	**Fail**
16525	10561	Teifi	SN 65600 57000	5			
838	838	Teifi	SN 64000 55500	1			
34833	21766	Teifi	SN 62110 51350	3			
3796	3214	Teifi	SN 69500 64400	5	GB110062 043501	5	**Pass**
16530	10566	Teifi	SN 68500 63000	5			
797	797	Teifi	SN 75400 66000	5	GB110062 043540	4	**Pass**
35407	22340	Teifi	SN 72885 66640	3			

When assessing the Afon Teifi WFD waterbodies, the tributaries that formed individual waterbodies typically passed the riparian naturalness target, as did the Afon Teifi at the upstream and downstream ends of the SAC. The middle reaches of the Afon Teifi, the Gwyddil and the Grannell failed the target.

The Afon Teifi SAC **fails** to meet the **Riparian Zone Naturalness** targets.

6.2.5. Woody Debris

Target: Woody Debris
Either 75% or more RHS sites have large woody debris 'present' **or** 10% or more of RHS sites have large woody debris as extensive.

Woody debris has increasingly been recognised as having an important in the healthy functioning of the river system. Some of the benefit of woody debris include river bank and bed stabilisation; increased floodwater storage; provision of fish habitat; increased habitat complexity and creation of niche habitats; provides cover for foraging and resting; improves water quality; and supports invertebrate life cycles (Mott, 2006).

Table 6.9. Woody debris by SAC Management Unit.

Site ID	River	Central Grid Reference	Present or Absent	SAC Unit	Pass/ Fail
10534	Piliau	SN 18200 44500	Present	1	**Pass** 100% sites have LWD present
3296	Teifi	SN 21200 43400	Present		
25334	Teifi	SN 21776 43602	Present		
10536	Teifi	SN 25700 41600	Present	2	**Pass** 87.5% sites have LWD present
10538	Teifi	SN 28400 41300	Absent* (large woody debris absent but woody debris noted)		
10584	Cych/ Dulas	SN 24500 38200	-		
10582	Gwyddil	SN 42100 38500	Present		
21967	Cych	SN 26800 37882	Present		
879	Ceri	SN 32100 45500	Present		
10583	Cerdin	SN 41900 41800	Present		
22380	Teifi	SN 33210 41085	Present		
10540	Teifi	SN 30900 40600	Present		
10545	Teifi	SN 42200 41600	Absent	3	**Fail** 66.7% sites have LWD present
10573	Clettwr	SN 45100 42400	Present		
10549	Teifi	SN 50100 42500	Present		
881	Teifi	SN 55600 46300	Present	4	**Fail** 66.7% sites have LWD present
10552	Teifi	SN 52700 45600	Absent		
10553	Grannell	SN 52500 48400	Present		
10555	Dulas	SN 59800 51700	Absent		
18496	Groes	SN 69596 60110	Present		
10556	Teifi	SN 60000 48900	Absent		
10561	Teifi	SN 65600 57000	Present		
838	Teifi	SN 64000 55500	Present		
21766	Teifi	SN 62110 51350	Present		
3214	Teifi	SN 69500 64400	Absent	5	**Fail** 50% sites have LWD present
10566	Teifi	SN 68500 63000	Present		
797	Teifi	SN 75400 66000	Absent	6.1	**Fail** 0% sites have LWD present
22340	Teifi	SN 72885 66640	Absent		

The majority of the survey sites within the Afon Teifi catchment had woody debris recorded as present: 19 sites had woody debris present compared to the 8 sites where it was not recorded. No sites recorded large woody debris as extensive.

There was a difference in woody debris occurrence between the downstream and upstream sites. The lower reaches of the Afon Teifi recorded more woody debris and when survey sites were combined, these assessment units passed the woody debris target. In SAC Units 1 and 2, much of the banks of the downstream sections of the Afon Teifi had a continuous line of mature riparian trees, which provides a source of woody debris (Appendix B1: Afon Teifi SAC Unit 1, Images 11 & 12).

Conversely, further upstream, particularly in the middle to upper reaches of the Afon Teifi and on the Afon Dulas, large woody debris was less prevalent. Combined, these survey sites led to the assessment units narrowly failing the target for woody debris. In Units 3 and 4, many of the survey sites on the Afon Teifi were located in cattle grazed pasture and mature bankside trees were less widespread, although still present. The riparian habitat in these areas would have historically had trees occurring naturally and therefore the expected state of the river would have been to have large woody debris in the channel. Large woody debris in the tributaries boosted the averages for these management units. These assessment units only narrowly failed the woody debris target with 66.7% of sites recording large woody debris as present.

SAC Unit 5 failed the target for woody debris. The sites located within Cors Caron SAC had a raised bog habitat, therefore bankside trees and large woody debris would not be expected through this section. The upstream two survey sites in Unit 6.1 had bankside trees but no woody debris within the river channel and also failed the target relating to woody debris.

Table 6.10. Woody debris by WFD Waterbody.

Site ID	River	Central Grid Reference	Present or Absent	WFD Waterbody ID	Pass/ Fail
10534	Piliau	SN 18200 44500	Present	GB110062039070	**Pass** 100% sites have LWD present
3296	Teifi	SN 21200 43400	Present	GB110062043563	**Pass** 75% sites have LWD present
25334	Teifi	SN 21776 43602	Present		
10536	Teifi	SN 25700 41600	Present		
10538	Teifi	SN 28400 41300	Absent* (large woody debris absent but woody debris noted)		
10584	Cych/ Dulas	SN 24500 38200	-	GB110062039010	-
10582	Gwyddil	SN 42100 38500	Present	GB110062039020	**Pass** 100% sites have LWD present
21967	Cych	SN 26800 37882	Present	GB1100620	**Pass**

				39041	100% sites have LWD present
879	Ceri	SN 32100 45500	Present	GB1100620 39110	**Pass** 100% sites have LWD present
10583	Cerdin	SN 41900 41800	Present	GB1100620 39140	**Pass** 100% sites have LWD present
22380	Teifi	SN 33210 41085	Present	GB1100620 43564	**Fail** 66.7% sites have LWD present
10540	Teifi	SN 30900 40600	Present		
10545	Teifi	SN 42200 41600	Absent		
10573	Clettwr	SN 45100 42400	Present	GB1100620 39220	**Pass** 100% sites have LWD present
10549	Teifi	SN 50100 42500	Present	GB1100620 43565	**Fail** 66.7% sites have LWD present
881	Teifi	SN 55600 46300	Present		
10552	Teifi	SN 52700 45600	Absent		
10553	Grannell	SN 52500 48400	Present	GB1100620 39230	**Pass** 100% sites have LWD present
10555	Dulas	SN 59800 51700	Absent	GB1100620 39240	**Fail** 0% sites have LWD present
18496	Groes	SN 69596 60110	Present	GB1100620 43490	**Pass** 100% sites have LWD present
10556	Teifi	SN 60000 48900	Absent	GB1100620 43566	**Pass** 75% sites have LWD present
10561	Teifi	SN 65600 57000	Present		
838	Teifi	SN 64000 55500	Present		
21766	Teifi	SN 62110 51350	Present		
3214	Teifi	SN 69500 64400	Absent	GB1100620 43501	**Fail** 50% sites have LWD present
10566	Teifi	SN 68500 63000	Present		
797	Teifi	SN 75400 66000	Absent	GB1100620 43540	**Fail** 0% sites have LWD present
22340	Teifi	SN 72885 66640	Absent		

The Afon Dulas was the only tributary to not have woody debris recorded in the survey section. This was due to the surrounding landuse dominated by pasture. The wider catchment has wooded sections and trees naturally occurring on the bankside, therefore it is likely that large woody debris would be found in the channel within the assessment unit.

The Afon Teifi SAC **fails** to meet the **Woody Debris** targets.

6.2.6. In-channel Structures

Target: In-channel Structures
Throughout the assessment unit, if present, structures should have no effect (or minor effect) on migration, sediment transport and habitat structure. Assessments should include the upstream ponding effects that artificial structures have on flow patterns and habitat structure.

During the River Habitat Survey, artificial structures are classified as having a minor, intermediate or major impact. For example, when assessing bridges: any bridge will have at least a minor impact; bridges with no in-river supports and with abutments occupying 10-25 m of bank will be recorded as intermediate; and major bridges include road or rail bridges with one or more in-channel supports or wide bridges with abutments extending more than 25 m along the bank. Whilst these will have an impact on the bank naturalness and potentially the in-channel flow dynamics and geomorphology, this is considered unlikely to be a barrier to migratory fish and often localised to the structure.

Table 6.11. In-channel structures by SAC Management Unit.

Site ID	River	Central Grid Reference	RHS Result	SAC Unit	Comment	Pass/ Fail
10534	Piliau	SN 18200 44500	None	1	Minor road bridges within the Piliau catchment. One major bridge at Llechryd on Afon Teifi causes ponding upstream and localised impacts to the flow regime, causing a mid-channel bar downstream. The sediment and habitat is influenced but it will not impede migration.	**Pass**
3296	Teifi	SN 21200 43400	Minor x 1 (Outfall/ intake)			
25334	Teifi	SN 21776 43602	Major x 1 bridge & Minor x 1 outfall/ intake.			
10536	Teifi	SN 25700 41600	None	2	Bridges with at least one pier in a small number of places e.g. Newcastle Emlyn and a major weir at Pont Allt y Cafen causes ponding in sections of the Afon Teifi and is a barrier to migration. The tributaries are relatively free of in-channel structures with the exception of the Ceri. *The Ceri has a small number of weirs.	**Fail**
10538	Teifi	SN 28400 41300	None			
10584	Cych/ Dulas	SN 24500 38200	-			
10582	Gwyddil	SN 42100 38500	None			
21967	Cych	SN 26800 37882	None			
879	Ceri	SN 32100 45500	Minor x 1 (Outfall/ intake)*			
10583	Cerdin	SN 41900 41800	Minor x 1 (Outfall/ intake)			
22380	Teifi	SN 33210 41085	Major x 1 bridge & Minor x 1 outfall/ intake.			

10540	Teifi	SN 30900 40600	None			
10545	Teifi	SN 42200 41600	None	3	Bridge at Llandysul intermediate impact. Bridge at Llanybydder major impact due to in-channel piers. Clettwr tributary has weirs and outfall.	**Fail**
10573	Clettwr	SN 45100 42400	Intermediate x 1 bridges & Minor x 3 (weirs, bridges and outfall/ intake)			
10549	Teifi	SN 50100 42500	None			
881	Teifi	SN 55600 46300	None	4	Lampeter Bridge and Pont Llanfair a major bridge and Tregaron bridge minor. No migration barriers and all bridges have minimal ponding upstream.	**Pass**
10552	Teifi	SN 52700 45600	None			
10553	Grannell	SN 52500 48400	Ford			
10555	Dulas	SN 59800 51700	Minor x 2 bridges			
18496	Groes	SN 69596 60110	Water gates x 2, 1 drinking bay			
10556	Teifi	SN 60000 48900	Informal drinking bay (offline)			
10561	Teifi	SN 65600 57000	None			
838	Teifi	SN 64000 55500	None			
21766	Teifi	SN 62110 51350	Major x 1 bridge			
3214	Teifi	SN 69500 64400	None	5	Pont Einon at downstream end of Cor Caron NNR is a major bridge.	**Pass**
10566	Teifi	SN 68500 63000	None			
797	Teifi	SN 75400 66000	None	6.1	Intermediate bridge at Pontrhdfendig.	**Pass**
22340	Teifi	SN 72885 66640	Intermediate x 1 bridge & Minor x 1 outfall/ intake			

Unit 1 of the Afon Teifi is clear of obstructions along most of the reach. There are minor impacts recorded as outfalls or intakes. However, there is one major road bridge in Llechryd (Site 25334) with a number of in-channel piers, which has caused a ponded section of river upstream and then the river braids downstream (Appendix B1: Afon Teifi SAC Unit 1, Image 10). This bridge is Grade II* listed and dates back to the 17th Century. The only tributary in this unit, the Afon Piliau, has a small number of minor road bridges outside of the survey site but these are not considered to cause an impact to the channel as the bridges span the entire stream with no in-channel structures.

The Cenarth Falls and the Henllan Falls are large natural barriers within Unit 2 of the Afon Teifi SAC. There are also a small number of artificial structures within this unit, although the majority of the Afon Teifi through this unit has a lower number of in-channel structures. The major structures include the road bridge at Newcastle Emlyn; a disused rail bridge, which has partially collapsed, but retains in-channel pillars (Appendix B1: Afon Teifi SAC Unit 2, Image 21); and debris dams in the Afon Teifi at Site 22380. These structures therefore interrupt the channel's natural flow and

sediment dynamics, although do not provide a barrier. The bridge to the caravan park at Henllan also has a single pier in the middle of the relatively narrow Afon Teifi channel although this appears to only have a localised impact.

The most significant in-channel structure in Unit 2 is the large weir immediately downstream of the road bridge at Pont Allt y Cafen (grid reference SN 386 392), which appears to cause ponding upstream, particularly at the meander. The upstream road bridge does not have any in-channel supports and therefore causes minimal impact. The tributary stream Afon Ceri has four small weirs that may prevent access to the upper parts of the river for migratory fish (CCW, 2012) and there are also minor impacts from outfalls/intakes. The other tributaries have a small number of road bridges that do not impact on the flow due to spanning the entire channel.

Unit 3 has a small number of minor bridges (e.g. Appendix B1: Afon Teifi SAC Unit 3, Image 7). The piers for the bridge at Llanysul do protrude into the channel from each bank, causing some flow disruption although not a barrier, meaning it is an intermediate artificial structure (Appendix B1: Afon Teifi SAC Unit 3, Image 8). The Clettwr tributary has a group of weirs fairly low down in the sub-catchment, which may prevent access to the majority of this tributary for migratory fish (CCW, 2012) (Appendix B1: Afon Teifi SAC Unit 3, Image 9). This is the primary contributor to Unit 3 failing to meet the target.

In Unit 4, there were major bridges with at least one pier in the channel, including Lampeter Bridge and Pont Llanfair. The Tregaron bridge was classified as minor. There were no migration barriers and all bridges have minimal ponding upstream, causing slight disruption to the river channel processes. Water gates on the Afon Groes recorded within the survey site could cause localised disruption to water (e.g. Appendix B1: Afon Teifi SAC Unit 4, Image 25), sediment and debris flow. Due to being fixed and relatively coarse, they have potential to create a partial barrier to migration, particularly if they got blocked with debris and not regularly maintained.

There were no in-channel structures noted within Unit 5. Unit 6.1 had an intermediate bridge at Pontrhdfendig on the Afon Teifi (Site 22340) and the Pont Einon at the downstream end of Cors Caron NNR is a major bridge. There were no in-channel barriers to migration observed.

Table 6.12. In-channel structures by WFD Waterbody.

Site ID	River	Central Grid Reference	RHS Result	WFD Waterbody ID	Comment	Pass/ Fail
10534	Piliau	SN 18200 44500	None	GB110062039070	Minor road bridges within the Piliau catchment.	**Pass**
3296	Teifi	SN 21200 43400	Minor x 1 (Outfall/ intake)	GB110062043563	One major bridge at Llechryd on Afon Teifi causes ponding upstream. Influence	**Pass**
25334	Teifi	SN 21776 43602	Major x 1 bridge & Minor x 1 outfall/ intake.			

10536	Teifi	SN 25700 41600	None		sediment and habitat but will not impede migration.	
10538	Teifi	SN 28400 41300	None			
10584	Cych/ Dulas	SN 24500 38200	-	GB110062039010		
10582	Gwyddil	SN 42100 38500	None	GB110062039020		**Pass**
21967	Cych	SN 26800 37882	None	GB110062039041		**Pass**
879	Ceri	SN 32100 45500	Minor x 1 (Outfall/ intake)*	GB110062039110		**Pass**
10583	Cerdin	SN 41900 41800	Minor x 1 (Outfall/ intake)	GB110062039140		**Pass**
22380	Teifi	SN 33210 41085	Major x 1 bridge & Minor x 1 outfall/ intake.	GB110062043564	Bridge at Llandysul intermediate impact. Bridge at Llanybydder major impact due to in-channel piers. Major weir at Pont Allt y Cafen causes ponding in sections of the Afon Teifi and is a barrier to migration.	**Fail**
10540	Teifi	SN 30900 40600	None			
10545	Teifi	SN 42200 41600	None			
10573	Clettwr	SN 45100 42400	Intermediate x 1 bridges & Minor x 3 (weirs, bridges and outfall/ intake)	GB110062039220	Clettwr tributary has weirs and outfall.	**Fail**
10549	Teifi	SN 50100 42500	None	GB110062043565	Lampeter Bridge and Tregaron bridge minor. No migration barriers and all bridges have minimal ponding upstream.	**Pass**
881	Teifi	SN 55600 46300	None			
10552	Teifi	SN 52700 45600	None			
10553	Grannell	SN 52500 48400	None	GB110062039230		**Pass**
10555	Dulas	SN 59800 51700	Minor x 2 bridges	GB110062039240		**Pass**
18496	Groes	SN 69596 60110	Water gates x 2, 1 drinking bay	GB110062043490		**Pass**

10556	Teifi	SN 60000 48900	Informal drinking bay (offline)	GB110062043566	Pont Llanfair a major bridge.	**Pass**
10561	Teifi	SN 65600 57000	None			
838	Teifi	SN 64000 55500	None			
21766	Teifi	SN 62110 51350	Major x 1 bridge			
3214	Teifi	SN 69500 64400	None	GB110062043501	Pont Einon at downstream end of Cor Caron NNR is a major bridge.	**Pass**
10566	Teifi	SN 68500 63000	None			
797	Teifi	SN 75400 66000	None	GB110062043540	Intermediate bridge at Pontrhdfendig.	**Pass**
22340	Teifi	SN 72885 66640	Intermediate x 1 bridge & Minor x 1 outfall/ intake			

The Afon Teifi SAC **fails** to meet the **In-Channel Structures** targets.

6.3. Fine Sediment

Target: Fine Sediment
No unnaturally high levels of siltation as indicated by: (a) 'silting' highlighted in Section P of the RHS form ('Overall characteristics – major impacts') OR (b) One-third or more of the total number of RHS spot-checks in the assessment unit have (SI) as the predominant channel substrate

For river types with extensive *Ranunculion* vegetation beds, there should be a predominance of clean gravels, pebbles and cobbles with a low silt dominance.

Table 6.13 Fine sediment condition assessment by SAC management unit

Site ID	River	Central Grid Reference	Section P	No. spot checks (SI)	SAC Unit	Pass/ Fail
10534	Piliau	SN 18200 44500	No	2/10	1	**Fail** 40%
3296	Teifi	SN 21200 43400	No	6/10		
25334	Teifi	SN 21776 43602	No	1/10		
10536	Teifi	SN 25700 41600	No	0/10	2	**Pass** 5%
10538	Teifi	SN 28400 41300	No	0/10		
10584	Cych/ Dulas	SN 24500 38200				
10582	Gwyddil	SN 42100 38500	No	0/10		
21967	Cych	SN 26800 37882	No	0/10		
879	Ceri	SN 32100 45500	No	1/10		
10583	Cerdin	SN 41900 41800	No	0/10		
22380	Teifi	SN 33210 41085	No	0/10		
10540	Teifi	SN 30900 40600	No	3/10		
10545	Teifi	SN 42200 41600	No	0/10	3	**Pass** 0%
10573	Clettwr	SN 45100 42400	No	0/10		
10549	Teifi	SN 50100 42500	No	0/10		
881	Teifi	SN 55600 46300	No	2/10	4	**Pass**

10552	Teifi	SN 52700 45600	No	1/10		12%
10553	Grannell	SN 52500 48400	No	0/10		
10555	Dulas	SN 59800 51700	No	7/10 recently dredged		
18496	Groes	SN 69596 60110	No	0/10		
10556	Teifi	SN 60000 48900	No	1/10		
10561	Teifi	SN 65600 57000	No	0/10		
838	Teifi	SN 64000 55500	No	0/10		
21766	Teifi	SN 62110 51350	No	0/10		
3214	Teifi	SN 69500 64400	No	0/10	5	**Pass** 0%
10566	Teifi	SN 68500 63000	No	0/10		
797	Teifi	SN 75400 66000	No	0/10	6.1	**Pass** 0%
22340	Teifi	SN 72885 66640	No	0/10		

Silt was rarely recorded as the predominant substrate type in the sample spots within the RHS survey reaches. The substrate in the Afon Teifi and tributaries was predominantly coarser gravel, pebble or cobble. Clay, sand and bedrock was rarely recorded within the spot checks. There were two survey sites where a silt substrate was recorded as more extensive (rather than siltation recorded as an overall site characteristic).

Site 3296 on the Afon Teifi (Appendix B1: Afon Teifi SAC Unit 1, Images 3 & 4) recorded silt as the substrate in 60% of the spot checks; this site was the furthest downstream of the survey sites in the gorge and had very smooth, low energy flow (no riffles or pools were recorded). Due to the small number of survey sites within the SAC assessment unit and a small amount of silt recorded on Afon Piliau, this has led to the unit not meeting the target for siltation. The relevant WFD assessment unit passes the target due to the increased number of spot checks, including silt free sites upstream on the Afon Teifi, which reduces the average.

The Afon Dulas (Appendix B1: Afon Teifi SAC Unit 4, Images 7 & 8) had recently been dredged and straightened through a short section of the survey site indicating that siltation has been a problem in this tributary; the flow habitats were relatively low energy and the catchment is extensively grazed. Poaching of the river banks upstream may be a historic source of sediment. The river banks of the survey site were predominantly stock fenced. This led the Afon Dulas WFD assessment unit failing to meet the target for siltation. The SAC assessment unit passed overall due to the high number of sites without silt recorded as the substrate.

Table 6.14. Fine sediment condition assessment by WFD waterbody.

Site ID	River	Central Grid Reference	Section P	No. spot checks (SI)	WFD Waterbody ID	Pass/ Fail
10534	Piliau	SN 18200 44500	No	2/10	GB110062039070	**Pass** 20%
3296	Teifi	SN 21200 43400	No	6/10	GB110062043563	**Pass** 17.5%
25334	Teifi	SN 21776 43602	No	1/10		
10536	Teifi	SN 25700 41600	No	0/10		
10538	Teifi	SN 28400 41300	No	0/10		
10584	Cych/ Dulas	SN 24500 38200			GB110062039010	
10582	Gwyddil	SN 42100 38500	No	0/10	GB110062039020	**Pass**

						0%
21967	Cych	SN 26800 37882	No	0/10	GB110062039041	**Pass** 0%
879	Ceri	SN 32100 45500	No	1/10	GB110062039110	**Pass** 10%
10583	Cerdin	SN 41900 41800	No	0/10	GB110062039140	**Pass** 0%
22380	Teifi	SN 33210 41085	No	0/10	GB110062043564	**Pass** 10%
10540	Teifi	SN 30900 40600	No	3/10		
10545	Teifi	SN 42200 41600	No	0/10		
10573	Clettwr	SN 45100 42400	No	0/10	GB110062039220	**Pass** 0%
10549	Teifi	SN 50100 42500	No	0/10	GB110062043565	**Pass** 10%
881	Teifi	SN 55600 46300	No	2/10		
10552	Teifi	SN 52700 45600	No	1/10		
10553	Grannell	SN 52500 48400	No	0/10	GB110062039230	**Pass** 0%
10555	Dulas	SN 59800 51700	No	7/10 recently dredged	GB110062039240	**Fail** 70%
18496	Groes	SN 69596 60110	No	0/10	GB110062043490	**Pass** 0%
10556	Teifi	SN 60000 48900	No	1/10	GB110062043566	**Pass** 2.5%
10561	Teifi	SN 65600 57000	No	0/10		
838	Teifi	SN 64000 55500	No	0/10		
21766	Teifi	SN 62110 51350	No	0/10		
3214	Teifi	SN 69500 64400	No	0/10	GB110062043501	**Pass** 0%
10566	Teifi	SN 68500 63000	No	0/10		
797	Teifi	SN 75400 66000	No	0/10	GB110062043540	**Pass** 0%
22340	Teifi	SN 72885 66640	No	0/10		

The Afon Teifi SAC **fails** to meet the **Siltation** targets.

6.4. Negative Indicators

Target: Negative indicators
No high-impact alien species established (i.e. self-sustaining populations). Standard checklists of species are based on those used for WFD assessments. A site will be assessed as unfavourable when there is good evidence that any non-native species or locally absent species is causing an impact on site integrity.

Invasive non-native species were recorded along the Afon Teifi in all SAC management units, although were much less frequently encountered upstream of Llanybydder.

Japanese knotweed (*Fallopia japonica*) and Himalayan balsam (*Impatiens glandulifera*) were recorded in all of the Afon Teifi main river survey sites in SAC Units 1-3.

In SAC Unit 1, on the Afon Piliau, Himalayan balsam was locally abundant, with only one small patch recorded within the survey site. The patches were described as between 5 m^2 to more than 50 m^2 in size. On the Afon Teifi, Himalayan balsam was more widespread with an occasional distribution along both banks throughout the survey sites. There was no evidence of any treatment of the patches seen. There was a large patch of Japanese knotweed located on a mid-channel island at the mid-point of Site 25334 (Teifi at Llechryd).

In SAC Unit 2, the distribution of the two invasive species was similar to the pattern described in Unit 1. The main Afon Teifi recorded widespread and dense patches of Himalayan balsam. Japanese knotweed was typically more localised. The patches of Himalayan balsam remained widespread in SAC Unit 3, although less dense, with stands between 1-5 m^2. Himalayan balsam was recorded on a number of the survey sites on the tributaries including Cych, Ceri and Clettwr. There was some limited evidence of treatment of the stand of Japanese knotweed in Site 21967 on the Afon Cych.

Himalayan balsam and Japanese knotweed were recorded in one or two sites in Units 4 and 6.1, although the distribution was much more localised. There were no non-native species recorded in Unit 5.

A summary of the species present are included in Tables 6.15 and 6.16, with full details on the locations and description of the stands presented in Appendix C.

Table 6.15. Negative Indicators by SAC management unit

Site ID	River	Central Grid Reference	INNS	SAC Unit	Pass/ Fail
10534	Piliau	SN 18200 44500	- *Impatiens glandulifera*	1	**Fail**
3296	Teifi	SN 21200 43400	- *Impatiens glandulifera* - *Fallopia japonica* - *Rhododendron ponticum*		
25334	Teifi	SN 21776 43602	- *Impatiens glandulifera* - *Fallopia japonica*		
10536	Teifi	SN 25700 41600	- *Impatiens glandulifera* - *Fallopia japonica*	2	**Fail**
10538	Teifi	SN 28400 41300	- *Impatiens glandulifera* - *Fallopia japonica*		
10584	Cych/ Dulas	SN 24500 38200	-		
10582	Gwyddil	SN 42100 38500	- *Impatiens glandulifera*		
21967	Cych	SN 26800 37882	- *Impatiens glandulifera* - *Fallopia japonica*		
879	Ceri	SN 32100 45500	- *Impatiens glandulifera*		
10583	Cerdin	SN 41900 41800			
22380	Teifi	SN 33210 41085	- *Impatiens glandulifera* - *Fallopia japonica*		
10540	Teifi	SN 30900 40600	- *Fallopia japonica*		
10545	Teifi	SN 42200 41600	- *Impatiens glandulifera* - *Fallopia japonica*	3	**Fail**
10573	Clettwr	SN 45100 42400	- *Impatiens glandulifera*		
10549	Teifi	SN 50100 42500	- *Impatiens glandulifera*		
881	Teifi	SN 55600 46300		4	**Fail**
10552	Teifi	SN 52700 45600	- *Impatiens glandulifera*		
10553	Grannell	SN 52500 48400			
10555	Dulas	SN 59800 51700			
18496	Groes	SN 69596 60110			
10556	Teifi	SN 60000 48900			
10561	Teifi	SN 65600 57000			
838	Teifi	SN 64000 55500			
21766	Teifi	SN 62110 51350	- *Fallopia japonica*		
3214	Teifi	SN 69500 64400		5	**Pass**
10566	Teifi	SN 68500 63000			
797	Teifi	SN 75400 66000		6.1	**Fail**
22340	Teifi	SN 72885 66640	- *Fallopia japonica*		

Table 6.16. Negative Indicators by WFD waterbody.

Site ID	River	Central Grid Reference	INNS	WFD Waterbody ID	Pass/ Fail
10534	Piliau	SN 18200 44500	- *Impatiens glandulifera*	GB110062 039070	**Fail**
3296	Teifi	SN 21200 43400	- *Impatiens glandulifera* - *Fallopia japonica* - *Rhododendron ponticum*	GB110062 043563	**Fail**
25334	Teifi	SN 21776 43602	- *Impatiens glandulifera* - *Fallopia japonica*		
10536	Teifi	SN 25700 41600	- *Impatiens glandulifera* - *Fallopia japonica*		
10538	Teifi	SN 28400 41300	- *Impatiens glandulifera* - *Fallopia japonica*		
10584	Cych/ Dulas	SN 24500 38200	-	GB110062 039010	
10582	Gwyddil	SN 42100 38500	- *Impatiens glandulifera*	GB110062 039020	**Fail**
21967	Cych	SN 26800 37882	- *Impatiens glandulifera* - *Fallopia japonica*	GB110062 039041	**Fail**
879	Ceri	SN 32100 45500	- *Impatiens glandulifera*	GB110062 039110	**Fail**
10583	Cerdin	SN 41900 41800		GB110062 039140	**Pass**
22380	Teifi	SN 33210 41085	- *Impatiens glandulifera* - *Fallopia japonica*	GB110062 043564	**Fail**
10540	Teifi	SN 30900 40600	- *Fallopia japonica*		
10545	Teifi	SN 42200 41600	- *Impatiens glandulifera* - *Fallopia japonica*		
10573	Clettwr	SN 45100 42400	- *Impatiens glandulifera*	GB110062 039220	**Fail**
10549	Teifi	SN 50100 42500	- *Impatiens glandulifera*	GB110062 043565	**Fail**
881	Teifi	SN 55600 46300			
10552	Teifi	SN 52700 45600	- *Impatiens glandulifera*		
10553	Grannell	SN 52500 48400		GB110062 039230	**Pass**
10555	Dulas	SN 59800 51700		GB110062 039240	**Pass**
18496	Groes	SN 69596 60110		GB110062	**Pass**

				043490	
10556	Teifi	SN 60000 48900		GB110062 043566	**Fail**
10561	Teifi	SN 65600 57000			
838	Teifi	SN 64000 55500			
21766	Teifi	SN 62110 51350	- *Fallopia japonica*		
3214	Teifi	SN 69500 64400		GB110062 043501	**Pass**
10566	Teifi	SN 68500 63000			
797	Teifi	SN 75400 66000		GB110062 043540	**Fail**
22340	Teifi	SN 72885 66640	- *Fallopia japonica*		

The Afon Teifi SAC **fails** to meet the **Negative Indicators** targets.

6.5. Condition Assessment Discussion and Summary: Key Points for Afon Teifi

6.5.1. Overview

A summary of the results of the Condition Assessment for the attributes on the Afon Teifi are presented in Tables 6.17 and 6.18, with recommended pass (P) or fail (F) of the relevant target.

Table 6.17 Summary Condition Assessment: Afon Teifi SAC Units

Attribute	SAC Assessment Unit						SAC
	1	2	3	4	5	6.1	
Habitat structure							
Channel planform	P	P	P	P	F	P	F
Habitat Modification Score	F	F	F	F	F	F	F
Bank vegetation naturalness	F	F	F	F	P	P	F
Riparian zone naturalness	P	P	F	F	P	P	F
Woody debris	P	P	F	F	F	F	F
In-channel structures	P	F	F	P	P	P	F
Fine sediment							
Siltation	F	P	P	P	P	P	F
Negative indicators							
Alien/locally absent species	F	F	F	F	P	F	F

Table 6.18 Summary Condition Assessment: Afon Teifi WFD Units

Attribute	WFD Waterbody Assessment Unit															
	GB110062039070	GB110062043563	GB110062039010	GB110062039020	GB110062039041	GB110062039110	GB110062039140	GB110062043564	GB110062039220	GB110062043565	GB110062039230	GB110062039240	GB110062043490	GB110062043566	GB110062043501	GB110062043540
Habitat structure																
Channel planform	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	P
Habitat Modification Score	P	F		P	P	F	P	F	F	P	P	F	F	F	F	F
Bank vegetation naturalness	F	F		P	P	P	P	F	P	F	P	F	F	F	P	P
Riparian zone naturalness	P	P		F	P	P	P	F	P	F	F	P	P	F	P	P
Woody debris	P	P		P	P	P	P	F	P	F	P	F	P	P	F	F
In-channel structures	P	P		P	P	P	P	P	F	P	P	P	F	P	P	P
Fine sediment																
Siltation	P	P		P	P	P	P	P	P	P	P	F	P	P	P	P
Negative indicators																
Alien/locally absent species	F	F		F	F		P	F	F	F	P	P	P	F	P	F

6.5.2. Factors Influencing Condition Assessment Outcomes

The Afon Teifi along much of its length is an example of a relatively unmodified river due to its location in rural western Wales. For example, the middle section of the Afon Teifi in particular, features tight meanders and is hydrodynamic, with ox-bow lakes evident in the riparian zone downstream of Lampeter. There has been some development of the floodplain, of roads and small urban areas, although this represents a small proportion of the overall catchment and will constrain minimally the natural movement of the channel.

Historic alterations to the planform and river habitat (resectioning) are limited within the catchment. The section of river through Cors Caron SAC has been historically realigned and straightened, but this represents a small proportion of the catchment and an exception. The in-channel structures (bridges and weirs) are also low in number and sparsely distributed.

Many of the bridges pre-date the designation of the Afon Teifi as an SAC/SSSI river and are historic structures in themselves, therefore this should be considered throughout the analysis and interpretation. For example, the Grade II* listed bridge at Llechryd dates back to the 17th Century, but has a number of wide piers in the river channel causing upstream ponding and the formation of a middle channel bar downstream. This bridge, and similar structures in the catchment, have contributed to failures for survey sites for targets on channel planform, habitat modifications and in-channel structures when assessed against the stringent CSM targets. When assessing the compliance for the overall management units these have been considered. The ponding impact from the bridges, even with in-channel piers are relatively localised; flow dynamics and geomorphology are disturbed, but migration of fish and other species should not be greatly impacted. It is therefore recommended that the artificial modifications present at the time of designation should be taken into consideration when assessing the targets. In addition, consideration should be given when locating future RHS sites so that they are representative of the range of habitats within the management unit, but avoid areas where morphology and hydrology are uncharacteristically affected by anthropogenic influence, such as bridges.

However there are also artificial features of the Teifi that could be considered for future management to improve the naturalness and connectivity of the river. Weirs provide a greater barrier to migration and could be considered for future removal or modifications to improve in-channel connectivity. The channel straightening and deepening through the Cors Caron SAC, which occurred in the early 19th Century, could be restored to historic channel and increase connectivity between the river and the floodplain.

Extensive cattle grazed pasture has led to many of the survey sites, particularly on the Afon Teifi, recording improved or semi-improved grassland for the bank vegetation, which is considered to be relatively unnatural. This led to SAC management Units 1-4 failing targets for bank vegetation naturalness. The WFD waterbodies for the tributaries generally recorded more broadleaved woodland vegetation and therefore typically passed the targets. Bankside vegetation naturalness could be improved through increasing stock fencing alongside the river

to reduce the grazing pressure and disturbance, allowing recolonization of more natural vegetation.

Despite the prevalence of pasture within the riparian zone and on the banks, many RHS survey sites recorded large woody debris within the river channels, particularly on the tributaries. There was often mature bankside trees along the river, providing a natural source of large woody debris. The downstream sites of the Afon Teifi and the tributaries recorded woody debris more frequently than further upstream on the Afon Teifi, resulting from stretches of continuous bankside trees. In the middle reaches of the Teifi are where the riparian landuse is typically pasture and natural bankside trees are more sparsely distributed. Historically woodland was more extensive in this area, which is likely to have resulted in higher levels of associated woody debris. Over time, the aim should be to restore these conditions and for the current targets to be met. The stretch of river through Cors Caron SAC, however, would be less likely to have natural large woody debris due to the raised bog habitat with no bankside trees. This should be considered when assessing SAC Unit 5 and WFD Unit GB110062043501, which failed to meet the woody debris target.

Siltation was not recorded as a pressure for the habitat quality of the Afon Teifi and catchment. The substrates were predominantly coarse and stony, comprising gravel, pebbles and cobbles. There was no overlying siltation recorded in any of the survey sites. Many survey sites recorded poaching of the banks due to pasture within the riparian habitat, which was not always stock fenced. This will provide a source of sediment input into the Afon Teifi. However, only two survey sites recorded high levels of silt within the substrate; both sites were characterised by low energy flow habitats. The survey reach on the Afon Dulas had been recently dredged, indicating siltation has been an ongoing problem within the tributary. This low pressure from siltation provides good habitat conditions for the *Ranunculion* community, that typically prefers gravel substrates.

A report of survey results on the macrophyte communtiies following the LEAFPAC methodology undertaken of the Afon Teifi in 2012, identified silt from localised bank erosion and catchment management practices as a contributing factor impacting the *Ranunculion* vegetation communities within the sites surveyed (Harrison *et al*, 2013). Nutrient inputs and changes to the natural river morphology were also cited as potential contributing factors. The difference in the survey methodologies, scale of assessment unit and the CSM assessment may explain why silt was not identified as a pressure during the 2016 RHS surveys. The LEAFPAC method records the percentage of different substrate grain sizes over a 100 m stretch and additional notes were made on the level of overlaying silt in the survey sectors. In many of the 2012 macrophyte survey sites, silt comprised no more than a 20% component of the substrate and siltation was typically recorded at the margins (Harrison *et al*, 2013). In contrast, the RHS only records the dominant substrate within ten 1 m wide spot checks and overarching observations on siltation are made over a 500m reach. A consistent observation during both surveys was the dominant substrate in the Afon Teifi was coarse gravel and pebbles, which is favoured by *Ranunculion* vegetation. The different results could also be due to the placement of survey sites; the 2016 RHS survey sites did not overlap with the 2012 macrophyte survey sites. Alternatively, the river flows that preceded the survey may influence siltation; high flows may flush the silt from the river bed.

Himalayan balsam was the primary WFD high risk species recorded growing in the Afon Teifi. The survey sites in the mid to low reaches of the river were recorded as having a widespread, patchy distribution of Himalayan balsam, which had a high to very high amount of plants within a patch. A number of the tributaries to the middle reaches also recorded Himalayan balsam, including the Piliau, Clettwr, Ceri and Cych. There were fewer records of Himalayan balsam in the upper reaches of Afon Teifi (SAC Unit 4 and 5). Japanese knotweed was more localised, with defined stands recorded in nine survey sites on the Afon Teifi, located on the banks or on mid-channel islands/bars. It was also recorded on Afon Cych. Monitoring data from this contract will be made available and it is suggested that this is shared with river managers and stakeholders to assist with future development of control and management plans for these prevalent invasive species. Control measures should be targeted to prevent the further spread of these species and control their impact on native biodiversity within the catchment.

Beds of *Ranunculion* vegetation were observed in some of the RHS sites and the supporting habitat quality and structure, for example the presence of gravels was good, with no negative pressures on this habitat feature recorded. The SAC/SSSI targets are stringent, but the Afon Teifi catchment is considered to be a good example of a relatively natural, unmodified river. The tributaries typically passed the targets more frequently than the main river, due to less modifications and more natural riparian habitats. There are improvements that have been identified in the recommendations section (Section 6.6), although overall the Afon Teifi SAC is in a favourable condition.

6.6. Afon Teifi Recommendations

The following recommendations should be considered for the Afon Teifi:

- RHS sites should be located away from artificial structures e.g. bridges, which are not representative of the wider assessment units and therefore results in non-compliance of targets e.g. Site 25334 (Afon Teifi, Unit 1) and Site 10573 (Afon Clettwr, Unit 3).
- WFD assessment units are typically smaller and comprise fewer RHS sites, lowering confidence in the assessments. Re-distributing RHS sites or increasing the data set within the WFD units would improve the limitations from using small data sets for a complex river system.
- Stock fencing along the Afon Teifi would help improve the bank naturalness and reduce poaching, which would help improve the results of future assessments, for example of the sediment target.

Non-native species records will be held by Natural Resources Wales that have been collected through routine monitoring visits; this data should be used to supplement the records collected during this survey to inform the condition assessment of the negative features attribute. The data can be used to manage non-native species at the earliest practicable opportunity, especially in the upstream management units where species are currently not recorded as widespread.

7. Condition Assessment: Afon Eden

7.1. Overview

A photograph of each survey site, along with key features of interest/impact, are included within Appendix B. The Condition Assessment for the Afon Eden is composed of three broad attributes from the CSM guidance for rivers (JNCC, 2016), which will be assessed in detail within this section of the report:

- Habitat structure;
- Fine sediment;
- Negative indicators.

The Condition Assessment results will include the recommendation for whether the targets pass or fail; a summary description of the results of the assessment; and implications for the river in terms of ecological impact.

Some of the RHS sites overlap more than one SAC management unit and therefore the data are used to contribute towards both assessment units, where appropriate. Where data can be allocated to a specific unit e.g. for the large woody debris assessment, this is highlighted in the assessment. All RHS sites contribute to the Upper Eden WFD assessment unit.

7.2. Habitat Structure

The results from the morphological and habitat structure analysis for the Afon Eden are presented below.

7.2.1. Channel Planform

Target: Channel Planform
Channel form should be generally characteristic of river type, with predominantly unmodified planform. <5% of the assessment unit should be artificial, re-aligned or constrained.

The river planform (i.e. the shape of the river when viewed from above) of the Afon Eden should be natural, not artificially straightened or moved. Factors that contributed to the assessment include the cumulative presence of channel modifications, including any channel alterations and floodplain developments. Where banks have been reinforced or resectioned within the RHS sites, these are included within the assessment table as it will impact upon the future potential naturalness of the river planform.

Table 7.1. Channel Planform by SAC Management Unit.

Survey ID	River	Central Grid Reference	SAC Unit	Comment	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	8	Part of the section realigned and over-deepened representing between 10-20% of the assessment unit.	**Fail**

				Banks are also resections and reinforced. River runs adjacent to ex-conifer plantation.	
Aber	Bronaber	SH 70659 32285	11	Resectioned and reinforced banks. Minor road follows stream for a small section.	**Pass**
Pont-y-Grible	Eden	SH 70852 30477	12	Resectioned and reinforced banks. Minor road follows stream for a small section.	**Pass**
Byrdir	Eden	SH 71075 30109	36	Brydir natural. Ty'n-llwyn resectioned and reinforced. A470 some distance from channel, not a constraint.	**Pass**
Ty'n-llwyn	Eden	SH 71140 29632			
Bryn Eden	Eden	SH 71095 29202	15	Localised bank resectioned and reinforced	**Pass**

Table 7.2. Channel Planform by WFD waterbody.

Survey ID	River	Central Grid Reference	WFD Waterbody ID	Comment	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	GB1100640 54630	Channel realignment and over-deepening in the BryRe section represents <5% of the assessment unit. Localised bank resectioning and reinforcement.	**Pass**
Aber	Bronaber	SH 70659 32285			
Pont-y-Grible	Eden	SH 70852 30477			
Byrdir	Eden	SH 71075 30109			
Ty'n-llwyn	Eden	SH 71140 29632			
Bryn Eden	Eden	SH 71095 29202			

Overall, the Afon Eden has a relatively characteristic and natural planform. However, a proportion of the BrynRe site has experienced channel modification, including channel realignment and overdeepening (Appendix B1: Afon Eden SAC, Images 1 & 2). In addition, boulders have been placed in the channel and gravel has been added to this section as part of the "Pearls in Peril" project, which may influence the future channel planform. Downstream in the Afon Eden, banks have been reinforced and resectioned in places, which will influence the future channel planform due to changes to the erosional processes.

The Afon Eden SAC **fails** to meet the **Channel Planform** targets.

7.2.2. Habitat Modification

Target: Habitat Modification
>65% or more of condition monitoring sites should fall within the semi-natural HMS Class 1, with the remainder predominantly unmodified (Class 2).

The habitat modification scores (HMS) have been calculated manually, to provide an indicative classification of the RHS sites according to the degree of artificial channel and bank modification. The assessment tables include details from the RHS forms on the predominant bank and channel modifications within the survey stretches, for example whether there is evidence of reinforcement, resectioning, embankment or poaching within the RHS sites, especially where these have been recorded as extensive. This provides explanation of the key artificial influences within the catchment and the drivers behind the scores.

Table 7.3. Habitat Modification by SAC Management Unit.

Survey ID	River	Central Grid Reference	HMS Score	HMS Class	Comment	SAC Unit	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	1890	5	Extensive channel enhancements for the Pearls in Peril project to improve for salmonids and freshwater pearl mussel. Areas of both banks have been resectioned and reinforced. Deflectors have been introduced into the channel and there was a minor ford.	8	**Fail**
Aber	Bronaber	SH 70659 32285	690	4	Areas of both banks have been resectioned and reinforced. Three flow deflectors introduced into the upper reach.	11	**Fail**
Pont-y-Grible	Eden	SH 70852 30477	450	3	Areas of both banks have been resectioned and reinforced, with poaching present on the left bank. Weir and bridge within site.	12	**Fail**
						36	**Fail**
Byrdir	Eden	SH 71075 30109	60	2	Localised poaching.		

Ty'n-llwyn	Eden	SH 71140 29632	830	4	Areas of both banks have been resectioned and reinforced, with poaching present on the right bank. Major ford, minor weir and major footbridge at the SAC boundary.	15	**Fail**
Bryn Eden	Eden	SH 71095 29202	380	3	Areas of both banks have been reinforced, with sections of the right bank resectioned. Minor bridge.		

Table 7.4. Habitat Modification by WFD Waterbody.

Survey ID	River	Central Grid Reference	HMS Score	HMS Class	WFD Waterbody ID	Comment	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	1890	5	GB1100640 54630	Bank and channel modifications. In-channel structures. Localised poaching.	**Fail**
Aber	Bronaber	SH 70659 32285	690	4			
Pont-y-Grible	Eden	SH 70852 30477	450	3			
Byrdir	Eden	SH 71075 30109	60	2			
Ty'n-llwyn	Eden	SH 71140 29632	830	4			
Bryn Eden	Eden	SH 71095 29202	380	3			

Most RHS sites recorded localised artificial bank modifications including bank reinforcement and bank resectioning. However, this was not recorded as extensive at any site.

Bank poaching was recorded at three of the RHS sites. This reflects the predominant land management of low intensity grazing of the marshy grassland, which was not always fenced to prevent cattle access. Areas have undergone extensive fencing to minimise the impact of livestock on the watercourse. Poaching is likely to liberate sediment into the watercourse, which will have detrimental consequences for freshwater pearl mussel, an Annex II species for which the Afon Eden has SAC designation. Poaching should, therefore, be avoided and mitigated against wherever possible.

There were in-channel structures recorded in a number of the sites, including bridges (Appendix B1: Afon Eden SAC, Image 15, 18, 20 & 22), fords (Appendix B1: Afon Eden SAC, Images 13 & 23) and flow deflectors (Appendix B1: Afon Eden SAC, Image 16).

Overall, the assessment units failed to comply with the habitat modification target. However, many of the in-channel features and modifications have been undertaken to improve water retention in the catchment, improve flow diversity, reduce sediment inputs and improve the substrate to increase the quantity and quality of the river habitat for freshwater pearl mussel and salmonids.

The Afon Eden SAC **fails** to meet the **Habitat Modification** targets.

7.2.3. Bank Vegetation Naturalness

Target: Bank Vegetation Naturalness
Mean SERCON score for the assessment unit of 4 or 5

All survey sites on the Afon Eden achieved a high SERCON score, indicating the bank vegetation was of high naturalness throughout the RHS sites. SERCON scores were averaged over the SAC Management Unit (Table 7.5) and for the WFD waterbody (Table 7.6).

Table 7.5. Bank vegetation naturalness SERCON scores by SAC Management Unit.

Survey ID	River	Central Grid Reference	SERCON Score	SAC Unit	SAC Mean	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	5	8	5	**Pass**
Aber	Bronaber	SH 70659 32285	5	11	5	**Pass**
Pont-y-Grible	Eden	SH 70852 30477	5	12	5	**Pass**
				36	**5**	**Pass**
Byrdir	Eden	SH 71075 30109	5			
Ty'n-llwyn	Eden	SH 71140 29632	5			
				15	**5**	**Pass**
Bryn Eden	Eden	SH 71095 29202	5			

Table 7.6. Bank vegetation naturalness SERCON scores by WFD Waterbody.

Survey ID	River	Central Grid Reference	SERCON Score	WFD Waterbody ID	Mean	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	5	GB110064054630	5	**Pass**
Aber	Bronaber	SH 70659 32285	5			
Pont-y-Grible	Eden	SH 70852 30477	5			
Byrdir	Eden	SH 71075 30109	5			
Ty'n-llwyn	Eden	SH 71140 29632	5			
Bryn Eden	Eden	SH 71095 29202	5			

The bank vegetation along the Afon Eden and its tributaries was predominantly characterised by marshy grassland (41% of spot checks), unimproved grassland (26% of spot checks) and semi-natural deciduous woodland (31% of spot checks).

When assessing the Afon Eden SAC management units, all passed the target for bank vegetation naturalness.

When assessing the Afon Eden WFD waterbody, again, it passed with a mean SERCON score of 5.

The Afon Eden SAC **meets** the **Bank Vegetation Naturalness** targets.

7.2.4. Riparian Zone Naturalness

Target: Riparian Zone Naturalness
Mean SERCON score for the assessment unit of 4 or 5

The land-use within 5 m of the banktop of the Afon Eden survey points was dominated by rough/unimproved grassland/ pasture (the dominant land-type across 83% of spot-check points). Broadleaf/mixed woodland (semi-natural) made up a further 13% of survey points. The remaining percentages consisted of small amounts of coniferous plantation (1.5%), rock, scree and sand dunes (0.8%) and suburban/urban development (0.8%).

Table 7.7. Riparian zone naturalness SERCON scores by SAC Management Unit.

Survey ID	River	Central Grid Reference	SERCON Score	SAC Unit	SAC Mean	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	5	8	5	**Pass**
Aber	Bronaber	SH 70659 32285	5	11	5	**Pass**
Pont-y-Grible	Eden	SH 70852 30477	5	12	5	**Pass**
				36	5	**Pass**
Byrdir	Eden	SH 71075 30109	5			
Ty'n-llwyn	Eden	SH 71140 29632	5			
				15	5	**Pass**
Bryn Eden	Eden	SH 71095 29202	5			

Table 7.8. Riparian zone naturalness SERCON scores by WFD Waterbody.

Survey ID	River	Central Grid Reference	SERCON Score	WFD Waterbody ID	Mean	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	5	GB110064054630	5	**Pass**
Aber	Bronaber	SH 70659 32285	5			
Pont-y-Grible	Eden	SH 70852 30477	5			
Byrdir	Eden	SH 71075 30109	5			
Ty'n-llwyn	Eden	SH 71140 29632	5			
Bryn Eden	Eden	SH 71095 29202	5			

The riparian zone within 50 m of the Afon Eden SAC consisted of rough/improved grassland/pasture which was extensive across 100% of survey sites. Scrub and shrub was present in 91% sites throughout the WFD waterbody. Broadleaf/mixed woodland (semi-natural) was classified as extensive across 41% of sites, and present in another 41% of sites. Tall herb/rank vegetation was also recorded as present across 66% of sites. The remaining vegetation classes recorded as present during the surveys consisted of wetland (25%), broadleaf/mixed plantation (8%), coniferous plantation (8%) and improved/semi-improved grassland (8%). Due to the high naturalness of the riparian zone and surrounding habitat, all survey sites recorded SERCON scores of 5.

SERCON scores were averaged over the SAC Management Unit (Table 7.7) and for the WFD waterbody (Table 7.8).

With regard to individual SAC units, BrynRe (SAC unit 8), Byrdir (SAC unit 36) and Pont-y-Grible (SAC unit 12/36) the land-use within 5 m of the banktop consisted almost entirely of rough/unimproved grassland/ pasture, which along with their position in the wider catchment, may influence the amount of woody debris input to the watercourse. Broadleaf/mixed woodland (semi-natural) was recorded at a number of points within Bryn Eden (SAC unit 15), and occasionally within Aber (SAC unit 11) and Ty'n-llwyn (SAC unit 36/15).

All RHS sites on the Afon Eden fall within the same WFD waterbody, as such, the waterbody passes with regard to riparian zone naturalness, with an average SERCON score of 5.

The Afon Eden SAC **meets** the **Riparian Zone Naturalness** targets.

7.2.5. Woody Debris

Target: Woody Debris
Either 75% or more RHS sites have large woody debris 'present' **or** 10% or more of RHS sites have large woody debris as extensive.

Woody debris was recorded as present within two of the six RHS survey sites, although due to the upland nature of part of the catchment there would not be a natural presence of riparian trees throughout the surveyed assessment units.

Table 7.9. Woody debris by SAC Management Unit.

Survey ID	River	Central Grid Reference	Present or Absent	SAC Unit	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	Absent	8	**Pass** (trees naturally absent)
Aber	Bronaber	SH 70659 32285	Absent	11	**Pass** (trees naturally absent)
Pont-y-Grible	Eden	SH 70852 30477	Present	12	**Fail** (LWD most likely located downstream within Unit 36)
				36	**Fail**
Byrdir	Eden	SH 71075 30109	Absent		
Ty'n-llwyn	Eden	SH 71140 29632	Absent		
				15	**Fail**
Bryn Eden	Eden	SH 71095 29202	Present		

Table 7.10. Woody debris by WFD Waterbody.

Survey ID	River	Central Grid Reference	Present or Absent	WFD Waterbody ID	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	Absent (trees naturally absent)	GB110064 054630	**Fail** 66.7% of sites have LWD present or would not be expected to naturally have LWD.
Aber	Bronaber	SH 70659 32285	Absent (trees naturally absent)		
Pont-y-Grible	Eden	SH 70852 30477	Present		
Byrdir	Eden	SH 71075 30109	Absent		
Ty'n-llwyn	Eden	SH 71140 29632	Absent		
Bryn Eden	Eden	SH 71095 29202	Present		

BrynRe and Aber survey sites are situated in a predominantly rough/improved grassland/pasture and due to their position higher in the catchment, naturally did not contain any woody debris. Therefore it is recommended that these sites do not fail the assessment.

The Pont-y-Grible survey site falls within both Afon Eden SAC Unit 12 and Unit 36. Woody debris was recorded as present in this survey site. It is most likely to be recorded in the stretch within Unit 36, as the surrounding habitat comprises riparian trees, compared to SAC Unit 12, which was predominantly bordered by raised bog. Therefore, it is likely that the result is misrepresentative of SAC Unit 12 if it was assessed as complying with the target and consequently, it is recommended that this unit "fail" on woody debris content.

Although Byrdir and Ty'n-llwyn survey sites recorded no woody debris, they did possess broadleaf/mixed woodland in the riparian zone and overhanging boughs were recorded as extensive along the stretch. This suggests a high likelihood of woody debris entering the system, despite not being recorded at the time of survey. The downstream site Bryn Eden recorded woody debris as present (Appendix B1: Afon Eden SAC, Image 19). Large woody debris would be expected throughout Unit 15 due to the riparian trees and freshwater pearl mussels prefer shaded reaches, therefore these downstream management units are assessed as non-compliant (Skinner *et al*., 2003).

The Afon Eden SAC **fails** to meet the **Woody Debris** targets.

7.2.6. In-channel Structures

Target: In-channel Structures
Throughout the assessment unit, if present, structures should have no effect (or minor effect) on migration, sediment transport, and habitat structure. Assessments should include the upstream ponding effects that artificial structures have on flow patterns and habitat structure.

During the River Habitat Survey, artificial structures are classified as having a minor, intermediate or major impact. For example, when assessing fords: any crossing places will have at least a minor impact, with minor fords recording no artificial bank or bed material and negligible ponding; intermediate fords have artificial banks but natural channel substrate; and major fords have an artificial bank and bed substrate, which can cause significant ponding.

Table 7.11. In-channel structures by SAC Management Unit.

Survey ID	River	Central Grid Reference	RHS Result	SAC Unit	Additional Structures	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	1 x intermediate structures (1 weir/sluice & 1 ford); 12 x minor (5 bridges, 1 outfall/intake & 6 deflectors).	8	Some in channel structures are in place as enhancements (e.g.deflectors)	**Fail**
Aber	Bronaber	SH 70659 32285	3 x major deflectors; 1 x minor bridge and 2 watergates	11	Some in channel structures are in place as enhancements (e.g.deflectors)	**Fail**
Pont-y-Grible	Eden	SH 70852 30477	1 x intermediate weir/sluice and 1 x minor bridge	12		**Pass**
				36	Failed due to major ford, bridge and intermediate weir at the downstream end.	**Fail**
Byrdir	Eden	SH 71075 30109	1 x minor watergate			
Ty'n-llwyn	Eden	SH 71140 29632	2 x major structures (1 bridge & 1 ford), 1 x intermediate weir/sluice, 1 x minor cattle drinking bay			
				15		**Pass**
Bryn Eden	Eden	SH 71095 29202	1 x minor bridge			

Table 7.12. In-channel structures by WFD Waterbody.

Survey ID	River	Central Grid Reference	RHS Result	WFD Waterbody ID	Comment	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	1 x intermediate structures (1 weir/sluice & 1 ford); 12 x minor (5 bridges, 1 outfall/intake & 6 deflectors).	GB110064054630	Some in channel structures are in place as enhancements (e.g.deflectors)	**Fail**
Aber	Bronaber	SH 70659 32285	3 x major deflectors; 1 x minor bridge and 2 watergates			
Pont-y-Grible	Eden	SH 70852 30477	1 x intermediate weir/sluice and 1 x minor bridge			
Byrdir	Eden	SH 71075 30109	1 x minor watergate			

Ty'n-llwyn	Eden	SH 71140 29632	2 x major structures (1 bridge & 1 ford), 1 x intermediate weir/sluice, 1 x minor cattle drinking bay			
Bryn Eden	Eden	SH 71095 29202	1 x minor bridge			

SAC Management Unit 8 of the Afon Eden is represented by the BrynRe survey site. Fourteen in-channel structures were recorded in this section. These included two intermediate structures consisting of a weir and a ford (Appendix B1: Afon Eden SAC, Image 13), along with five minor bridges (Appendix B1: Afon Eden SAC, Image 1), one minor outfall/intake and six flow deflectors. One of the minor bridges had a hay bale underneath the bridge (Appendix B1: Afon Eden SAC, Image 14); it is not known whether this was intentionally placed in the river, but the result was that the flow was scouring the earth bank behind the two block stones, locally eroding the channel. This section had undergone recent management and river rehabilitation measures aimed at increasing flow diversity and increasing the suitability of the site for salmonids and freshwater pearl mussel, as part of the Pearls in Peril initiative. One such restoration method was the addition of boulder deflectors; these have been recorded as in-channel structures during the survey.

The Aber survey site falls within SAC Unit 11 and three major deflectors are recorded as present in the upper stretch of the reach (Appendix B: Afon Eden SAC, Image 16). One minor farm access bridge was recorded (Appendix B: Afon Eden SAC, Image 15), along with two watergates.

The Pont-y-Grible site within SAC Units 12 and 36 contained one example of an intermediate weir/sluice and a minor bridge (Appendix B: Afon Eden SAC, Image 18) that acted as the boundary between the two SAC units. Byrdir also falls within SAC Unit 36 and contained one minor Watergate (Appendix B: Afon Eden SAC, Image 21). Continuing further downstream and falling within SAC Units 36 and 15 was the Ty'n-llwyn survey site, which contained a major footbridge (Appendix B: Afon Eden SAC, Image 22) and a major ford (Appendix B: Afon Eden SAC, Image 23); the ford bed level was high within the channel, which led to an intermediate weir. Also present in the section was a minor cattle drinking bay (Appendix B: Afon Eden SAC, Image 24).

Bryn Eden also lies within SAC Unit 15 and contains only one minor in-channel structure (bridge), which has no in-channel structures (Appendix B: Afon Eden SAC, Image 20).

The Afon Eden SAC **fails** to meet the **In-channel Structures** targets.

7.3. Fine Sediment

Target: Fine Sediment
No unnaturally high levels of siltation as indicated by: (c) 'silting' highlighted in Section P of the RHS form ('Overall characteristics – major impacts') OR (d) One-third or more of the total number of RHS spot-checks in the assessment unit have (SI) as the predominant channel substrate

Freshwater pearl mussels require a silt free substrate. Siltation was not listed as a "major impact" in any of the RHS survey sites, and silt was recorded only twice as a substrate type across all spotcheck points on the Afon Eden. Consequently, all SAC units and WFD waterbodies "pass" the target with regard to fine sediment.

Table 7.13 Fine sediment condition assessment by SAC management unit

Survey ID	River	Central Grid Reference	Section P	No. spot checks (SI)	SAC Unit	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	No	0/10	8	**Pass**
Aber	Bronaber	SH 70659 32285	No	1/10	11	**Pass**
Pont-y-Grible	Eden	SH 70852 30477	No	1/10	12	**Pass**
Byrdir	Eden	SH 71075 30109	No	0/10	36	**Pass**
Ty'n-llwyn	Eden	SH 71140 29632	No	0/10		
Bryn Eden	Eden	SH 71095 29202	No	0/10	15	**Pass**

Table 7.14 Fine sediment condition assessment by WFD waterbody.

Survey ID	River	Central Grid Reference	Section P	No. spot checks (SI)	WFD Waterbody ID	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	No	0/10	GB110064054630	**Pass**
Aber	Bronaber	SH 70659 32285	No	1/10		
Pont-y-Grible	Eden	SH 70852 30477	No	1/10		
Byrdir	Eden	SH 71075 30109	No	0/10		
Ty'n-llwyn	Eden	SH 71140 29632	No	0/10		
Bryn Eden	Eden	SH 71095 29202	No	0/10		

The Afon Eden SAC **meets** the **Siltation** targets.

7.4. Negative Indicators

Target: Negative indicators
No high-impact alien species established (i.e. self-sustaining populations). Standard checklists of species are based on those used for WFD assessments. A site will be assessed as unfavourable when there is good evidence that any non-native species or locally absent species is causing an impact on site integrity.

No invasive non-native species were recorded along the Afon Eden in any SAC management units. Consequently, all SAC units and WFD waterbodies "pass" with regard to negative indicators.

Table 7.15. Negative Indicators by SAC management unit

Survey ID	River	Central Grid Reference	INNS	SAC Unit	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	None	8	**Pass**
Aber	Bronaber	SH 70659 32285	None	11	**Pass**
Pont-y-Grible	Eden	SH 70852 30477	None	12	**Pass**
				36	**Pass**
Byrdir	Eden	SH 71075 30109	None		
Ty'n-llwyn	Eden	SH 71140 29632	None		
				15	**Pass**
Bryn Eden	Eden	SH 71095 29202	None		

Table 7.16. Negative Indicators by WFD waterbody.

Survey ID	River	Central Grid Reference	INNS	WFD Waterbody ID	Pass/ Fail
BrynRe	Crawcwellt North	SH 69945 32852	None	GB110064054630	Pass
Aber	Bronaber	SH 70659 32285	None		
Pont-y-Grible	Eden	SH 70852 30477	None		
Byrdir	Eden	SH 71075 30109	None		
Ty'n-llwyn	Eden	SH 71140 29632	None		
Bryn Eden	Eden	SH 71095 29202	None		

The Afon Eden SAC **meets** the **Negative Indicators** targets.

7.5. Condition Assessment Discussion and Summary: Key Points for Afon Eden

7.5.1. Overview

A summary of the results of the Condition Assessment for the Afon Eden are presented in Table 7.17, with recommended pass (P) or fail (F) of the relevant target.

Table 7.17. Summary Condition Assessment: Afon Eden

Attribute	SAC Assessment Unit					SAC	WFD Waterbody
	8	11	12	36	15		GB 110064054630
Habitat structure							
Channel planform	F	P	P	P	P	F	P
Habitat Modification Score	F	F	F	F	F	F	F
Bank vegetation naturalness	P	P	P	P	P	P	P
Riparian zone naturalness	P	P	P	P	P	P	P
Woody debris	P	P	F	F	F	F	F
In-channel structures	F	F	P	F	P	F	F
Fine sediment							
Siltation	P	P	P	P	P	P	P
Negative indicators							
Alien/locally absent species	P	P	P	P	P	P	P

7.5.2. Factors Influencing Condition Assessment Outcomes

The Afon Eden is remote, with an upland character along much of its length. Despite this, the channel has been modified and has a number of artificial features, which have led to the channel failing to comply with targets relating to human intervention.

There are a small number of intermediate or major bridges and fords within the surveyed reach of the Afon Eden, that cause a disruption to the natural river hydrology and geomorphology. Vehicles that use fords to cross the river can introduce sediment into the channel or disturb the channel substrate; this is problematic due to the sensitivity of freshwater pearl mussels to silt within the channel. The ford within Ty'n-llwyn, in particular impacts upon channel migration due to it creating a step change in levels within the river. Replacing the fords with bridges would reduce silt loading to the catchment.

Historically, human management of the Afon Eden has negatively impacted the natural channel geomorphology and flow regime. Boulders and gravel have been dredged from sections of the river, rendering the habitat unsuitable to support freshwater pearl mussels (Killeen, 1997). The Pearls in Peril Project has introduced

in-channel features to increase flow diversity within the channel and encouraging areas of natural sediment deposition to provide suitable habitat for freshwater pearl mussels and salmonids. However, in placing artificial features within the channel, this contributes to habitat modification scores within the survey sites, despite the aim of the structures to enhance the river habitat rather than negatively impact upon it. Where this has occurred, it has been highlighted within the assessment to be considered as exceptions when assessing compliance against the targets.

The bank and riparian vegetation is considered to be highly natural within the Afon Eden. The upstream habitats are situated within raised bog/marshy grassland, with more semi-natural deciduous woodland moving downstream in the stream. Invasive non-native species were not recorded in the channel or on the banks within any survey sites. Targets relating to vegetation naturalness and native vegetation were found to be compliant.

The pattern in the catchment vegetation influences the natural baseline occurrence of large woody debris within the Afon Eden. The upstream sites would naturally be devoid of large woody debris, although the downstream sites should have debris within the channel. During the survey woody debris was only recorded in two sites on the Eden. Overhanging boughs were recorded as extensive in the downstream reaches, which will provide a future source of woody material. The overhanging bankside trees also provide channel shading, which regulates water temperatures and algal growth, creating good habitat conditions for freshwater pearl mussel (Skinner et al., 2003).

Freshwater pearl mussels are sensitive to siltation within the substrate, which blocks the interstitial spaces in the coarse substrate suffocating juveniles, as well as impacting on salmonid redds (Skinner et al., 2003). The riparian wet grass pasture is subject to low intensity grazing, retaining the natural vegetation. Stock fencing has been installed along long sections of the river, which has meant bank poaching was restricted, limiting excessive sediment inputs. Siltation was not recorded as a problem within the assessment units. This contrasts with previous assessments which have noted that siltation is a significant problem on the Eden (Garrett and Thomas 2012). This may be be attributed to the survey methodology. RHS does not record subsurface siltation, drapes of mud over coarse material or silt within interstitial substrate, even though these may indicate siltation problems for species of interest, in this case freshwater pearl mussel (Naden et al., 2003).

The Afon Eden – Cors Goch Trawsfynydd SAC river habitat structure has been historically modified and degraded with respect to the requirements of freshwater pearl mussel, for which the river has been designated. However, recent habitat and bank management enhancements have improved the river hydrological and geomorphological processes, which should result in better habitat provision for the freshwater pearl mussels. Potential sources of silt introduction are being managed, although could be further improved through the removal of the fords. The Afon Eden has high bank naturalness, including riparian trees, to provide large woody debris and shading in the downstream sections and there are no records of non-native invasive species.

7.6. Afon Eden Recommendations

The following recommendations should be considered for the Afon Eden:

- Should the SAC Management Units continue to be used as the assessment unit, it is recommended that consideration is given to align the RHS sites within the management unit or additional comments are made to attribute features of interest to the relevant SAC unit.
- The Upper Eden WFD waterbody assessment unit is large and encompasses a change in river character between the sites upstream compared to downstream. Management actions may need to be more targeted within the waterbody to account for different habitat requirements and riparian land uses, for example large woody debris.
- Non-native species are not currently recorded within the catchment, any records on the Afon Eden should be managed at the earliest practicable opportunity to avoid spread within the catchment. Himalayan balsam, for example, can cause bank destabilisation due to exposed soil during the winter.
- Further sampling of sediment levels in the river would be useful; specifically of the river bed substrate in order to allow assessment of the habitat quality for pearl mussels.

8. References

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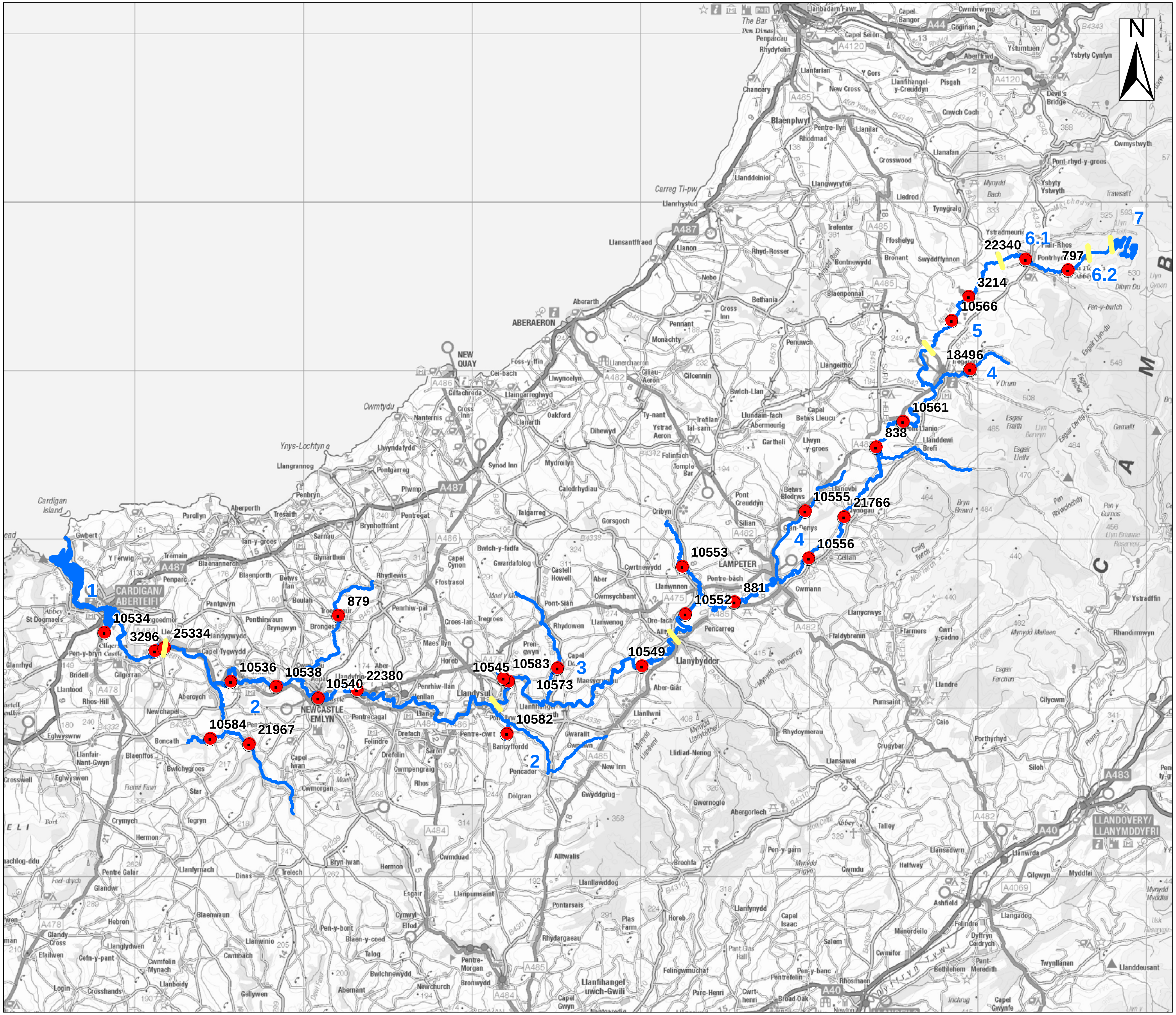
Appendix A. Site Survey Locations

Afon Teifi Site Locations with SAC Units



Cyfoeth Naturiol Cymru
Natural Resources Wales

Legend

Survey Site Locations

River Teifi SAC Units

0 5 10 15

Kilometers

Natural Resources Wales

River Habitat Surveys 2016

Figure A1
Afon Teifi
Survey Sites & SAC Units

 Date: February 2017 | Scale: 1:225,000 @A3 | Drg.Ref: TL/8641/A1

Afon Teifi Site Locations with WFD Waterbody Units

Cyfoeth Naturiol Cymru
Natural Resources Wales

Legend

- Survey Site Locations
- River Teifi WFD Units
- River Teifi

0 5 10 15
Kilometers

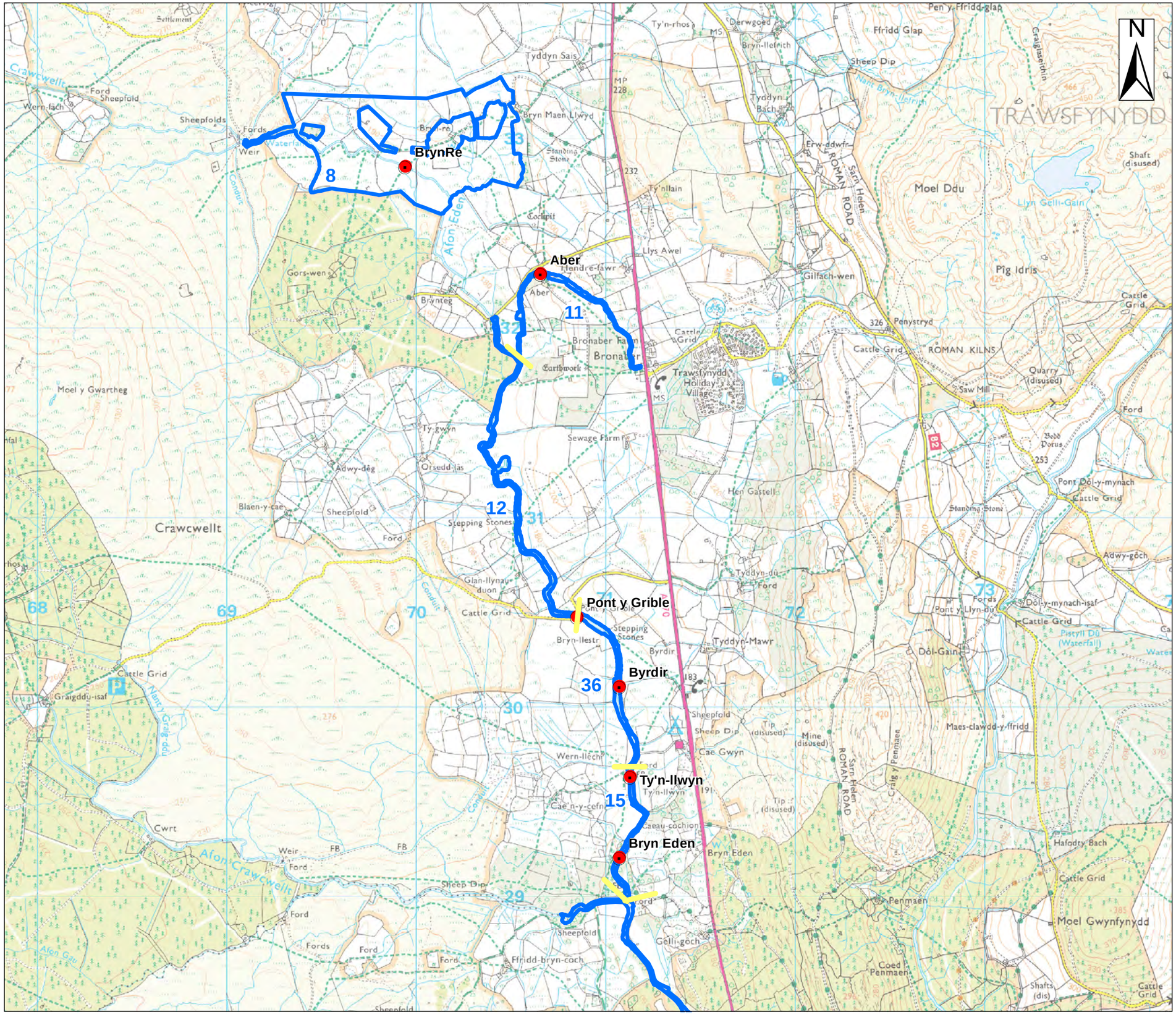
Natural Resources Wales

River Habitat Surveys 2016

Figure A2
Afon Teifi
Survey Sites & WFD Units

Date: February 2017 | Scale: 1:225,000 @A3 | Drg.Ref: TL/8641/A2

Afon Eden Site Locations with SAC Units



Cyfoeth Naturiol Cymru
Natural Resources Wales

Legend

- Survey Site Locations
- River Eden SAC Units

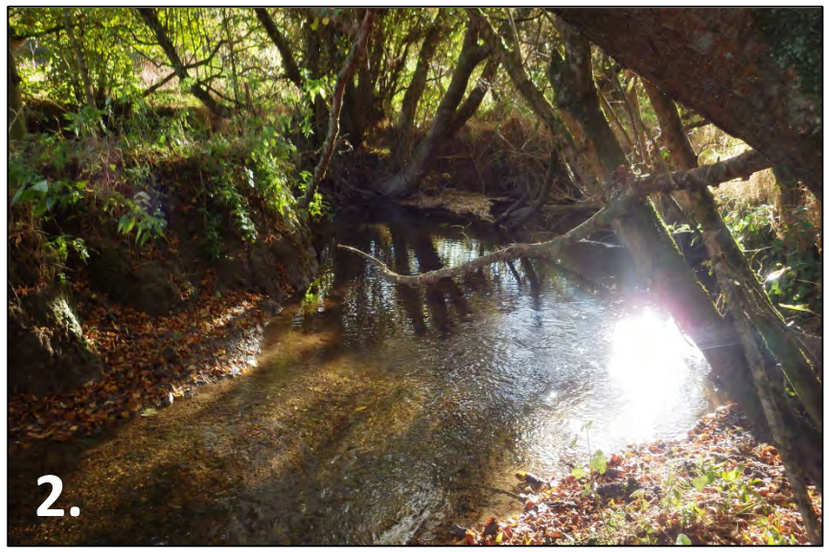
Natural Resources Wales

River Habitat Surveys 2016

Figure A3
Afon Eden
Survey Sites & SAC Units

Date: February 2017 | Scale: 1:20,000 @A3 | Drg.Ref: TL/8641/A3

Appendix B. Survey Site Photographs



Cyfoeth Naturiol Cymru
Natural Resources Wales

Images 1-2: General site topography

Site ID: 10534
Afon Piliau
CGR: SN 18200 44500
Survey Date: 07/11/2016.

Images 3 - 4: General site topography

Site ID: 3296
Afon Teifi
CGR: SN 21200 43400
Survey date: 27/10/2016

Images 5 - 6: General site topography

Site ID: 25334
Afon Teifi
CGR: SN 21776 43602
Survey date: 27/10/2016

Cyfoeth Naturiol Cymru
Natural Resources Wales

Image 7: An example of exposed bedrock (Site ID 3296)

Image 8: An example of a minor outfall (Site ID 3296)

Image 9: An example of a vegetated mid-bar (Site ID 25334)

Image 10: An example of a major in-channel structure (Site ID 25334)

Image 11: An example of large woody debris (Site ID 10534)

Image 12: An example of large woody debris (Site ID 10534)

Cyfoeth Naturiol Cymru
Natural Resources Wales

Images 1 - 2: General site topography

Site ID: 10536
Afon Teifi
CGR: SN 25700 41600
Survey Date: 07/11/2016.

Images 3 - 4: General site topography

Site ID: 10538
Afon Teifi
CGR: SN 28400 41300
Survey date: 07/11/2016

Images 5 - 6: General site topography

Site ID: 10582
Afon Gwyddil
CGR: SN 42100 38500
Survey date: 30/10/2016

Images 7 - 8: General site topography

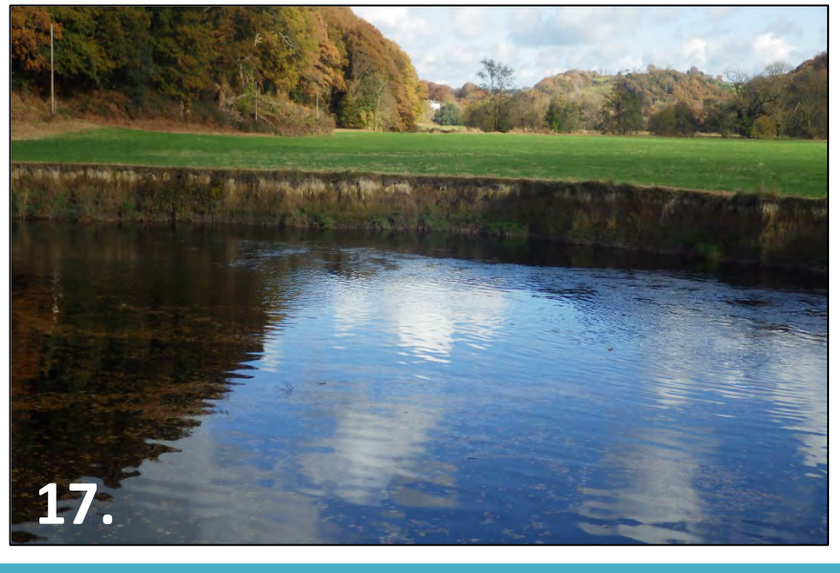
Site ID: 21967
Afon Cych
CGR: SN 26800 37882
Survey Date: 11/11/2016.

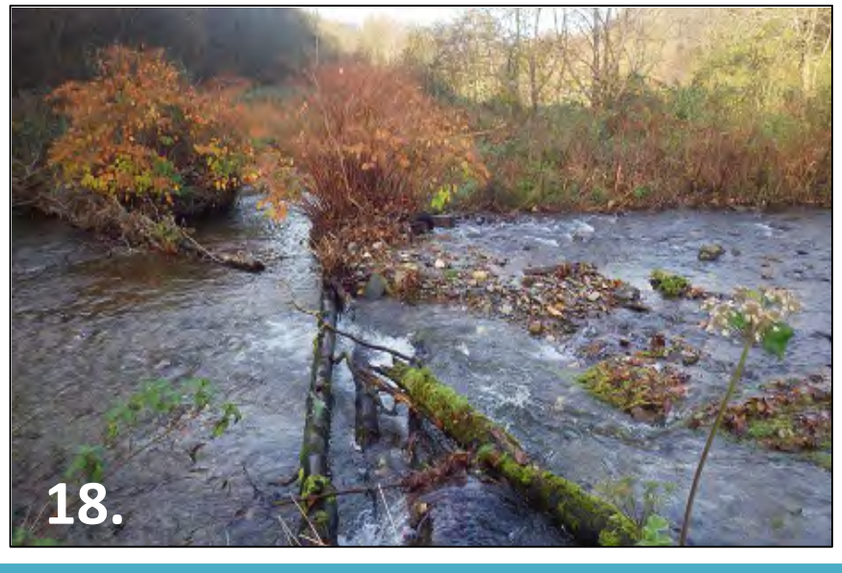
Images 9 - 10: General site topography

Site ID: 879
Afon Ceri
CGR: SN 32100 45500
Survey date: 11/11/2016

Images 11 - 12: General site topography

Site ID: 10583
Afon Cerdin
CGR: SN 41900 41800
Survey date: 01/12/2016





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Images 13 - 14: General site topography

Site ID: 22380
Afon Teifi
CGR: SN 33210 41085
Survey Date: 07/11/2016.

Images 15 - 16: General site topography

Site ID: 10540
Afon Teifi
CGR: SN 30900 40600
Survey date: 28/10/2016

Image 17: Example of an eroding cliff (Site ID: 10538).

Image 18: Examples of vegetated (with Japanese knotweed) and un-vegetated mid-bars (Site ID 21967)

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Image 19: Example of in-channel woody debris (Site ID 10582).

Image 20: Example of vegetated boulders (Site ID 10582).

Image 21: Example of a major in-channel structure (redundant rail bridge) (Site ID 22380).

Image 22: Example of a poached area of river bank (Site ID 22380).

Image 23: Example of a gabion basket revetment (Site ID: 10583).

Image 24: Example of a minor outfall (Site ID: 10583).

Images 1 - 2: General site topography

Site ID: 10545
Afon Teifi
CGR: SN 42200 41600
Survey Date: 31/10/2016.

Images 3 - 4: General site topography

Site ID: 10573
Afon Clettwr
CGR: SN 45100 42400
Survey date: 01/12/2016

Images 5 - 6: General site topography

Site ID: 10549
Afon Teifi
CGR: SN 50100 42500
Survey date: 31/10/2016

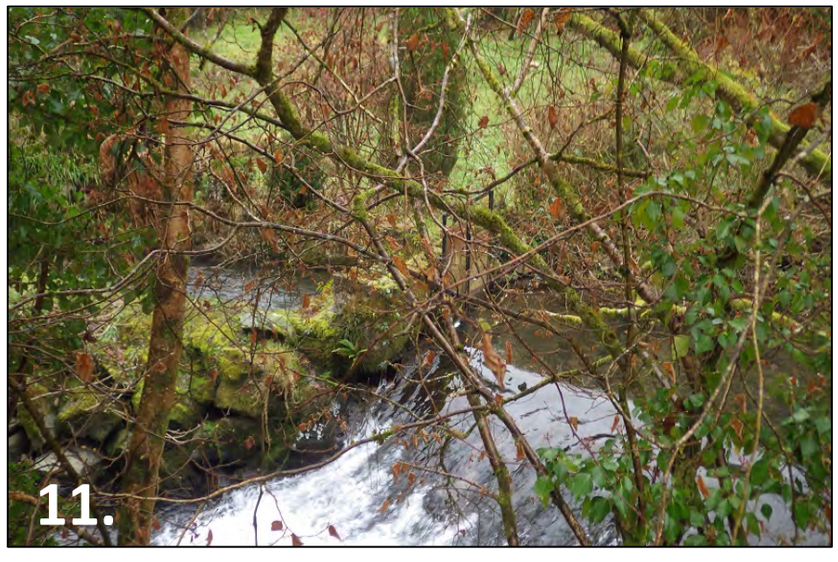

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Image 7: Example of a minor bridge (Site ID 10573)

Image 8: Example of an intermediate bridge (Site ID 10573)

Image 9: Example of a weir on the Afon Clettwr (Site ID 10573)

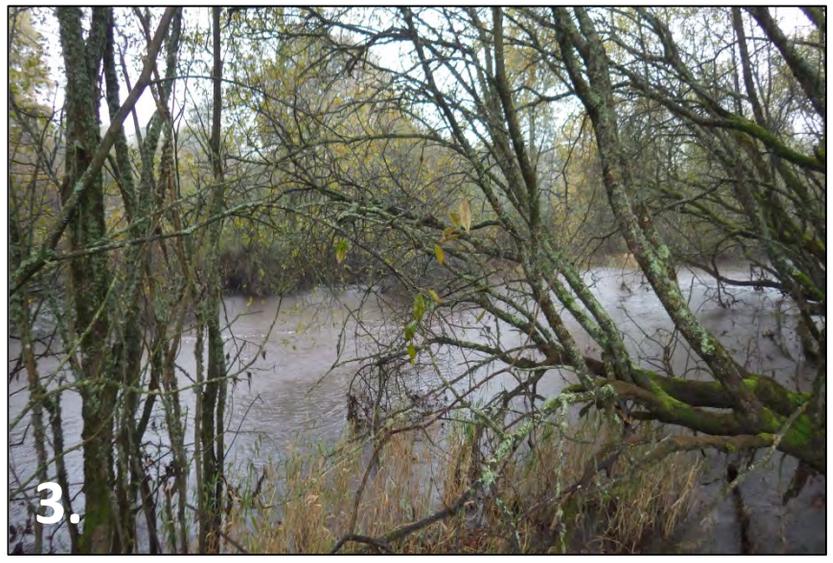
Image 10: An off-channel water wheel on the Afon Clettwr (Site ID 10573)

Image 11: A mill leat present above a weir on the Afon Clettwr (Site ID 10573)

Image 12: A resectioned and reinforced section of the channel (Site ID 10573)

Images 1 - 2: General site topography

Site ID: 881
Afon Teifi
CGR: SN 55600 46300
Survey Date: 08/11/2016.



Images 3 - 4: General site topography

Site ID: 10552
Afon Teifi
CGR: SN 52700 45600
Survey date: 08/12/2016

Images 5 - 6: General site topography

Site ID: 10553
Afon Grannell
CGR: SN 52500 48400
Survey date: 05/12/2016

Images 7 - 8: General site topography

Site ID: 10555
Afon Dulas
CGR: SN 59800 51700
Survey Date: 02/11/2016.

Images 9 - 10: General site topography

Site ID: 18496
Afon Groes
CGR: SN 69596 60110
Survey date: 24/11/2016

Images 11 - 12: General site topography

Site ID: 10556
Afon Teifi
CGR: SN 60000 48900
Survey date: 02/11/2016

Images 13 - 14: General site topography

Site ID: 10561
Afon Teifi
CGR: SN 65600 57000
Survey Date: 02/11/2016.

Images 15 - 16: General site topography

Site ID: 838
Afon Teifi
CGR: SN 64000 55500
Survey date: 03/11/2016

Images 17 - 18: General site topography

Site ID: 21766
Afon Teifi
CGR: SN 62110 51350
Survey date: 03/11/2016

Image 19: Example of a section reinforced with boulders (Site ID 881)

Image 20: Example of poaching by livestock (far bank), and a vegetated side-bar (near bank) (Site ID 10553)

Image 21: Example of woody debris on the Afon Grannell (Site ID 10553)

Image 22: An example of an eroding cliff on the Afon Grannell (Site ID 10553)

Image 23: An example of a minor bridge on the Afon Dulas (Site ID 10555)

Image 24: An example of submerged vegetation (Site ID 10555).

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Image 25: An example of a watergate present on the Afon Groes (Site ID 18496)

Image 26: An example of resectioned bank and channel on the Afon Groes (Site ID 18496)

Image 27: An example of a poached section of the Afon Teifi (Site ID 10556)

Image 28: An example of a historic embankment (Site ID 10561)

Image 29: An example of a major bridge (Site ID 21766).

Image 30: An example of a reprofiled and resectioned section of channel (Site ID 21766).

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Images 1-2: General site topography

Site ID: 3214
Afon Teifi
CGR: SN 69500 64400
Survey Date: 28/11/2016.

Images 3 - 4: General site topography

Site ID: 10566
Afon Teifi
CGR: SN 68500 63000
Survey date: 18/11/2016

Images 5 - 6: General site topography

Site ID: 797
Afon Teifi
CGR: SN 75400 66000
Survey date: 24/11/2016

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Images 7 - 8: General site topography

Site ID: 22340
Afon Teifi
CGR: SN 72885 66640
Survey Date: 24/11/2016.

Image 9: Historically deepened channel on the Teifi (Site ID 3214).

Image 10: Remnant of historic off-set embankment (Site ID 10566).

Image 11: An example of poached riverbank (Site ID 797).

Image 12: An example of a minor outfall into the Afon Teifi (Site ID 22340).

Images 1-2: General site topography

Survey ID: BrynRe
SAC Unit: 8
Afon Crawcwellt North
CGR: SH 69945 32852
Survey Date: 05/11/2016.

Images 3 - 4: General site topography

Survey ID: Aber
SAC Unit: 11
Afon Bronaber
CGR: SH 70659 32285
Survey Date: 05/11/2016.

Images 5 - 6: General site topography

Survey ID: Pont-y-Gribble
SAC Unit: 12/36
Afon Eden
CGR: SH 70852 30477
Survey Date: 04/11/2016.

Images 7 - 8: General site topography

Survey ID: Bryn Eden
SAC Unit: 15/36
Afon Eden
CGR: SH 71095 29202
Survey Date: 04/11/2016.

Images 9 - 10: General site topography

Survey ID: Byrdir
SAC Unit: 36
Afon Eden
CGR: SH 71075 30109
Survey Date: 04/11/2016.

Images 11 - 12: General site topography

Survey ID: Ty'n-llwyn
SAC Unit: 36/12
Afon Eden
CGR: SH 71140 29632
Survey Date: 04/11/2016.

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Image 13: An example of an intermediate ford (BrynRe).

Image 14: A minor bridge present on the Afon Eden with a bale blockage. The bank is also undercut behind the bridge footing (BrynRe).

Image 15: A minor bridge present on the Afon Bronaber (Aber).

Image 16: Deflectors present in the upper reach of the Afon Bronaber (Aber).

Image 17: An example of a vegetated mid-bar and asymmetric bank heights (Pont-y-Gribble).

Image 18: An example of a minor bridge on the Afon Eden (Pont-y-Gribble).

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Image 19: An example of woody debris present on the Afon Eden (Bryn Eden).

Image 20: An example of a minor bridge over the Afon Eden, with a reinforced bank (Bryn Eden)

Image 21: An example of a watergate present on the Afon Eden (Brydir).

Image 22: An example of a major footbridge present on the Afon Eden (Ty'n-llwyn).

Image 23: An example of a major ford present across the Afon Eden (Ty'n-llwyn).

Image 24: An example of a drinking bay on the Afon Eden (Ty'n-llwyn).

Appendix C. Invasive Species Survey Data

Site ID	River	Species	Grid Reference	Survey Date	Amount	Treated	Notes
10534	Piliau	Himalayan balsam	SN 18156 44374	07/11/16	High	No	
3296	Teifi	Himalayan balsam Japanese knotweed Rhododendron	HB and JK present in patches along whole length of both banks. Rhododendron and laurel on left bank between points 5-10.	27/10/16	High – very high High – very high High – very high	No No Some cutting	Some cutting of Rhododendron and laurel to retain footpath access
25334	Teifi	Himalayan balsam Japanese knotweed	HB and JK present throughout reach	27/10/16	High High	No No	Extensive stand of JK on mid-channel island between points 5 and 6. Less below point 4. Extensive stands of JK and HB above bridge on left bank
10536	Teifi	Himalayan balsam Japanese knotweed	HB present on right bank at points 8 and 10. JK present of left bank	07/11/16	High – very high High – very high		Change of ownership on right bank with fringe of tall herb.
10538	Teifi	Himalayan balsam Japanese knotweed	SN 28240 41398 SN 28388 41389 and very large stand opposite point 7.	07/11/16	High Medium – very high	No No	
10582	Gwyddil	Himalayan balsam	In patches along whole length	30/10/16	Medium	No evidence	Significant stand of JK on bank top approx. 20 m from river. No evidence of JK along watercourse.
21967	Cych	Himalayan balsam Japanese knotweed	Both are present in stands along whole length (both banks).	11/11/16	Very high Very high	Some limited evidence of JK management	Some stands are very significant.

879	Ceri	Himalayan balsam Laurel	Whole length on left bank, upper third of reach on right bank	11/11/16	Very high High	No No	Right bank is grazed for 2/3 of reach. Laurel is at the bottom of site (left bank) below the bridge.
22380	Teifi	Himalayan balsam Japanese knotweed	In wet woodland on right bank and in small patches along left bank. In patches along length of right bank.	07/11/16	High High	No No	Left bank is grazed to top of bank with small areas of tall herb associated with willow. Right bank is ungrazed along bank top.
10540	Teifi	Japanese knotweed	SN 30940 40600	28/10/16	High	No	Left bank opposite central point and on left bank in carr.
10545	Teifi	Himalayan balsam Japanese knotweed	Both in patches along whole length	31/10/16	High High	Some	Management consists of flailing of bankside vegetation by farmer
10573	Clettwr	Himalayan balsam	In patches along whole length	01/12/16	Medium	No	
10549	Teifi	Himalayan balsam	SN 49913 42382	31/10/16	Medium	No	HB present on vegetated side bars on left bank at end of reach where no grazing occurs.
10552	Teifi	Himalayan balsam	Patchy along whole length	08/11/16	High (overall)	No	
21766	Teifi	Japanese knotweed	SN 62062 51318	03/11/16	High – very high	No evidence	Stand on left bank consisting of young plants.
22340	Teifi	Japanese knotweed	SN 73051 66492	24/11/16	Low	No	In front of WWDC pump station

Data Archive Appendix

Data outputs associated with this project are archived in 118482 on server–based storage at Natural Resources Wales.

The data archive contains:

[A] The final report in Microsoft Word and Adobe PDF formats

[B] A full set of maps produced in JPEG format

[C] RHS data stored in WISKI, Natural Resources Wales' database

[D] Phase I data for survey sites data in spreadsheets

[E] Invasive pecies data for survey sites in spreadsheets alongside speadsheets of RHS data and Phase 1 data

[F] A full set of images of survey sites in .jpg format.

Metadata for this project is publicly accessible through Natural Resources Wales' Library Catalogue https://libcat.naturalresources.wales (English Version) and https://catllyfr.cyfoethnaturiol.cymru (Welsh Version) by searching 'Dataset Titles'. The metadata is held as record no 118482.

Published by:
Natural Resources Wales
Maes y Ffynnon
Ffordd Penrhos
Bangor
Gwynedd
LL57 2DW

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