River Axe SSSI

Condition Assessment

May 2025

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Citation

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Executive summary

A river SSSI is a protected riverine area designated for its special scientific interest, of which there are just over 44 across the whole of England. These rivers are recognised for their importance in terms of ecology, habitats and biodiversity, and exemplify the best rivers for nature and ecosystem services in the country.

The River Axe SSSI is protected for 13 km of its 35 km length, from the confluence with the Blackwater River to Colyford Bridge. The river holds significant ecological value, characterised by its diverse aquatic flora, rare invertebrates, and important breeding bird populations. Its base-rich, stable riverbed and varied geomorphology create ideal conditions for these species. The river supports protected species such as the nationally scarce short-leaved water-starwort and the endangered Atlantic salmon.

The previous assessment of the SSSI conducted by Natural England in 2010 found the river to be in unfavourable condition. In 2023, a new assessment was carried out to evaluate the current status of the SSSI. The SSSI was assessed against published UK attributes and targets (Common Standards Monitoring Guidance for Rivers) which identify the standards required for river special interests to be considered in favourable condition. The SSSI was assessed on the special interest feature rivers and streams, which encompasses several attributes including flow, water quality, habitat structure, fine sediment, negative indicators (invasive non-native species) and biological assemblages. A climate change risk assessment was also conducted.

The assessment found the River Axe SSSI Rivers and Streams feature to be in an **unfavourable, declining** condition, with numerous pressures identified such as physical modifications, poor riparian habitat quality due to heavily grazed and impoverished riparian structure, invasive plants, diffuse water pollution and siltation. Several mechanisms have been identified to help bring the SSSI into favourable condition. These include investigative and regulatory processes.

Landowner participation is cited as a vital requirement without which tangible change is unlikely to materialise. Natural England are committed to working alongside key stakeholders within the catchment to bring about positive change for the SSSI.

Contents

Introduction

Natural England monitors Sites of Special Scientific Interest (SSSIs) features in order to assess condition and determine whether conservation objectives are being met. Each SSSI feature is assigned one of the five following categories: **Favourable** condition indicates that the SSSI's designated features are being effectively conserved, with monitoring confirming they meet the required conservation objectives. **Unfavourable recovering** reflects situations where the features are not yet in a favourable state but are on a trajectory of improvement due to appropriate management measures being implemented. **Unfavourable - no change** describes features that are failing to improve, often due to insufficient management or ongoing external pressures, which must change to enable recovery. **Unfavourable declining** indicates a worsening condition where the features are deteriorating due to inadequate conservation efforts or escalating external threats. Finally, the **(Part)Destroyed** category signifies permanent damage to the SSSI feature, where recovery to a favourable condition is no longer possible, regardless of management interventions. If one or more of the feature's mandatory attributes do not meet their targets, then the feature is assessed as **unfavourable**. When features are assessed as unfavourable, an assessment of condition trend must then be carried out - whether the feature is recovering, no change or declining.

For this condition assessment, the River Axe was assessed on the SSSI feature 'Rivers and Streams', which encompasses the attributes flow, water quality, habitat structure, fine sediment, negative indicators, biological assemblages and indicators of local distinctiveness (Table 1). Some of the attributes have more than one measure. If one or more measure within a unit fails to comply with the CSM target the unit cannot achieve favourable status.

Summary Condition

Table 1: Summary condition by unit for each attribute and subsequent overall condition. F= Fail; P = Pass ND = No Data, NA = Not Applicable. Note, some cells are left blank.

Attribute	Unit 1	Unit 2	Unit 3
Flow			
Flow	P	P	P
Water Quality			
Organic pollution	As below:	As below:	As below:

Attribute	Unit 1	Unit 2	Unit 3
Ammonia(N) 90%ile	P	P	P
95%ile un-ionised ammonia	P	P	P
10%ile DO	P	P	F
BOD	ND	ND	ND
Reactive phosphorus	F	F	F
Trophic Diatom Index	F	F	F
Acidification	N/A	N/A	N/A
Other pollutants	F	F	F
Habitat Structure			
Channel planform	P	F	F
Habitat modification Score	P	F	F
Bank vegetation naturalness	F	F	F
Riparian zone naturalness	F	F	F
Large woody material	P	F	F
In-channel structures	P	F	F
Fine sediment			
Siltation	P	P	P
Negative Indicators			
Alien/locally absent species	F	F	F
Biological assemblages			
Plant community	ND	F	F

Attribute	Unit 1	Unit 2	Unit 3
General macroinvertebrates assessment			
AWICS (acidification tool)	N/A	N/A	N/A
PSI (siltation tool)	ND	ND	ND
Indicators of local distinctiveness			
Indicators of local distinctiveness	N/A	N/A	N/A
Overall condition of unit	Unfavourable	Unfavourable	Unfavourable

The River Axe SSSI extends for 13 kilometres from the confluence with the Blackwater River to the tidal limit near Colyford, meandering through a flood plain dominated by improved dairy pasture.

The SSSI supports an exceptionally diverse aquatic and marginal flora. A variety of plant communities are represented, including in the higher reaches a community type usually confined to sandstone catchments in Scotland. In the lower reaches, this gives way to a community more typical of rivers flowing slowly over clay. All of the community types represented within the SSSI have an above average diversity of higher plants.

The River Axe citation can be found here.

Section 1. Methods

The condition assessment follows the methods as set out in the JNCC Common Standard Monitoring Guidance for Rivers (2016).

Table 2: Online resources used for the assessment

Assessment	Data Source
Flow assessment	Hydrology explorer
Water Quality Assessment	WIMS (water quality)
Biological Assemblage Assessment	Ecology & Fish Data Explorer Water Framework Directive (WFD) classification data (more information on the WFD can be found online)
Habitat Structure Assessment	River Axe River Restoration Plan (RRP)

1a. Flow Assessment

The flow assessment was undertaken by the Environment Agency's Devon, Cornwall and Isles of Scilly (DCIoS) hydrology Team.

The assessment follows the standard methodology for undertaking flow compliance assessments defined by the Common Standards Monitoring Guidance (CSMG) for rivers and streams (JNCC, 2016). There are three assessment units within the River Axe SSSI / SAC (Special Area of Conservation). CSM guidance recommends that for each assessment unit within the designated reach, flow compliance should be assessed using the following temporal and spatial analysis methods:

- **Temporal:** daily observed and naturalised flows for the previous 6 years (2017-2022) should be plotted at any gauging station within the assessment unit, together with any flow targets:
  Flow targets for the Axe allow 5% deviation from natural flows at low flows (<Qn95); 10% at all other flows. A total of 10 days of continuous non-compliance, or 20 days of non-compliance overall is the maximum considered acceptable.
- **Spatial:** flow accretion diagrams should be generated for a range of flow conditions (Q99, Q95, Q80, Q50, Q30 and Q10) to identify any non-compliant stretches within the assessment units. o Non-compliance over a total river length of no more than 5% of an assessment unit should be considered acceptable if the increased impact on naturalised flows is not dramatic.

The CSM guidance (above) recommends undertaking the temporal flow compliance assessment at any gauging station within the assessment units. However, there is only one gauging station (Whitford) within the River Axe SSSI / SAC, in the lower reaches (unit 3) which would give a very limited evaluation of flow compliance across the whole SSSI / SAC. To address this, two further assessment points were selected upstream in units 1 and 2. These sites were located to capture any impacts of the high density of groundwater abstractions in the upper reaches of the River Axe and its tributaries, as there was no gauged flow data available at these points.

To estimate flow at the other two assessment points, the Whitford gauged flow was naturalised, then transposed to the other assessment point locations. To estimate influenced flow at the same points, upstream artificial influences were used to de-naturalise the natural flow estimates. See Appendix 6 for full methodology.

1b. Water Quality Assessment

Openly available water quality data were downloaded from the EA's Water Quality Archive covering the period 2000-2023.

Interactive plots of the WQ data can be viewed here.

Table 3 presents the data sets on the River Axe SSSI used for the condition assessment. Six existing long term EA water quality sampling points were identified within each of the three River Axe units (Figure 1). Data points relating to final effluents from sewage treatment works were not included as these were not sufficiently informative of the water quality within the river and hence the condition of the SSSI. Plotted data was analysed and quality assessed to detect anomalous records. Three years of monthly data was used to generate average and or percentiles to undertake the condition assessment, in line with CSM guidance.

Table 3: River Axe Water Quality Monitoring Locations.

Site name	Site number	Open / Closed	Grid Reference	Unit	Years	Number of samples
River Axe At Axe Bridge	SW-70220104	open	SY2593192 648	3	2000 – 2024	300
River Axe U/S Colyton Stw	SW-70220119	open	SY2591392 715	3	2000 – 2024	369
River Axe At Whitford Bridge	SW-70220159	open	SY2622595 420	3	2000 - 2024	306

Site name	Site number	Open / Closed	Grid Reference	Unit	Years	Number of samples
River Axe At Slymlakes	SW-70220164	open	SY2804696713	3	2000 – 2024	221
Miscellaneous Upper Axe	SW-70239999	open	SY2830197300	2	2000 – 2024	361
River Axe At Bow Bridge	SW-70230103	open	SY2904998203	2	2000 – 2024	215
River Axe At Broom	SW-70230122	open	ST3259502481	1	2000 – 2024	235

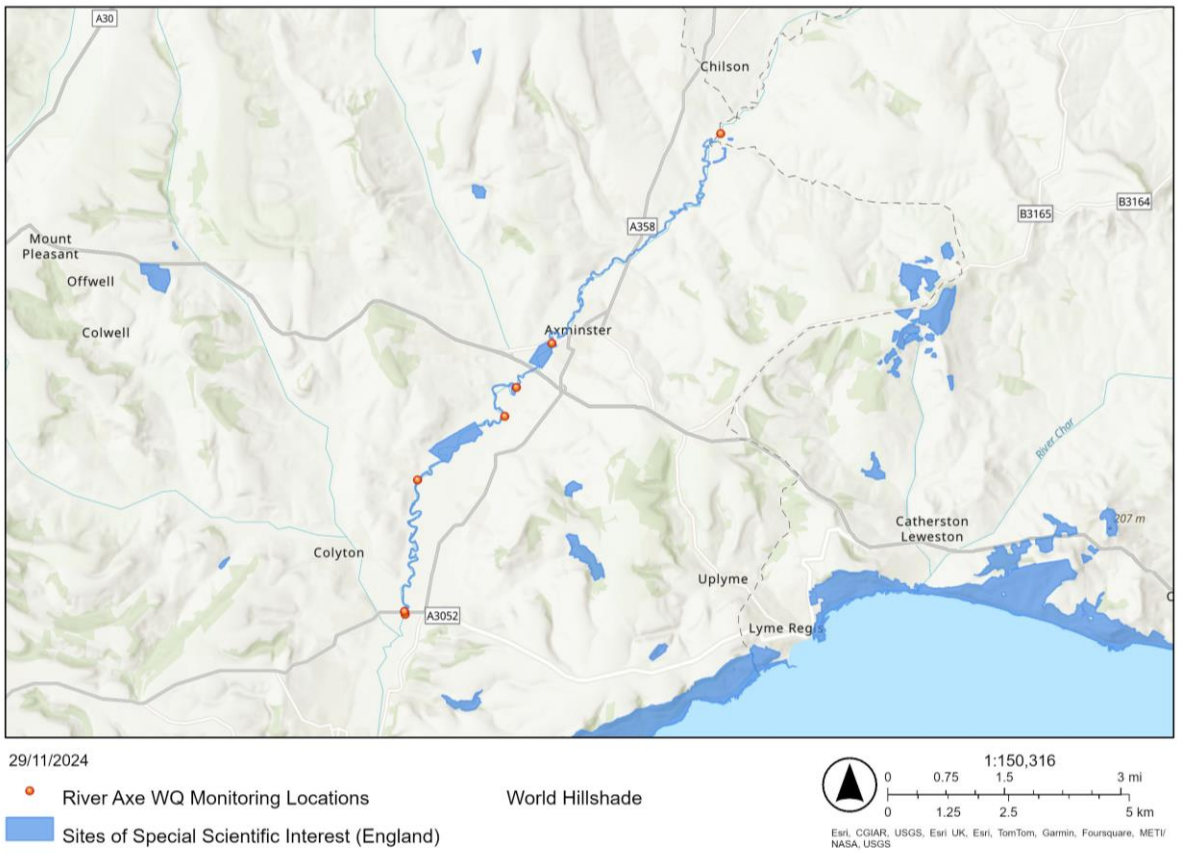

Figure 1: Environment Agency long-term water quality monitoring locations across the River Axe SSSI

Diatoms

EA WFD classification data & analysis was used to inform the Diatom assessment. Table 3 presents the relevant EA monitoring sites identified within each assessment unit (Figure 2), the number of diatom samples and sampling period available.

Table 3: Diatom Survey Data.

River	Unit	SITE_ID	Number Samples	Sample Date	NGR
AXE (DEVON)	1	9428	3	2020 - 2021	ST3263002480
AXE (DEVON)	2	9422	3	2020 - 2021	SY2902098330
AXE (DEVON)	2	9438	3	2020 - 2021	ST3075000020
AXE (DEVON)	2	170545	9	2019 - 2022	SY2788697133
AXE (DEVON)	2	170546	6	2019 - 2021	SY2790197346
AXE (DEVON)	2	201631	1	2020	SY2789597339
AXE (DEVON)	3	7633	4	2020 - 2022	SY2645095550
AXE (DEVON)	3	9406	3	2020 - 2021	SY2611094630

Figure 2: Environment Agency diatom monitoring sites across the River Axe SSSI

1c. Biological Assemblages

The assessment of plant community condition is based on the assessment of ecological status under WFD, using the LEAFPACS methodology.

EA WFD classification data & analysis was used to inform the biological assemblage assessment.

Plant Communities

Table 4 presents the relevant EA monitoring sites identified within each assessment unit (Figure 3), the number of macrophyte samples and sampling period available.

Table 4: River Axe Macrophyte Survey Data

CATCHMENT	Unit	NGR	SITE_ID	COUNT	Sample Date
AXE (DEVON)	1	ST3263002480	9428	2	2021
AXE (DEVON)	2	SY2902098330	9422	1	2021
AXE (DEVON)	2	ST3075000020	9438	1	2021
AXE (DEVON)	2	SY2788697133	170545	3	2019 - 2021
AXE (DEVON)	2	SY2789597339	201631	2	2020 - 2021
AXE (DEVON)	3	SY2645095550	7633	2	2017 - 2021
AXE (DEVON)	3	SY2611094630	9406	1	2021
AXE (DEVON)	3	SY2790197346	170546	1	2019

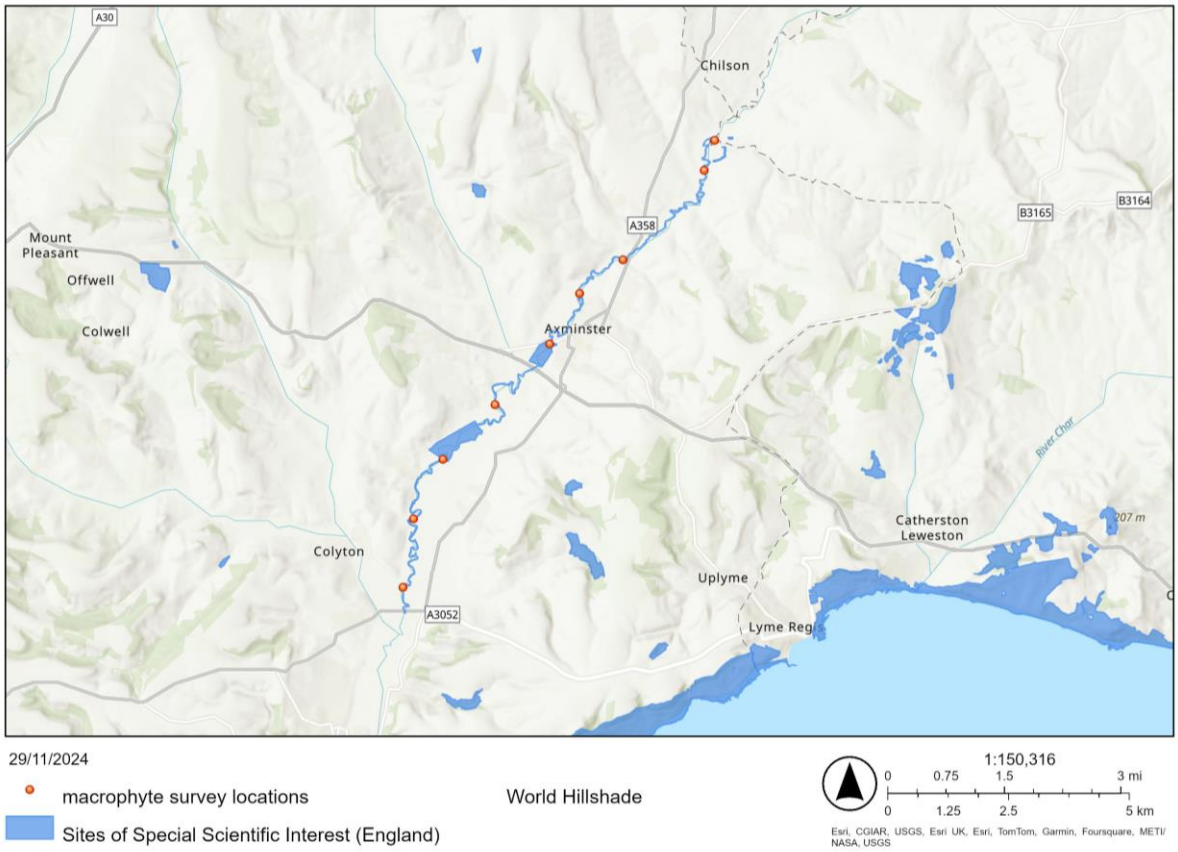

Figure 3: Environment Agency long term macrophyte monitoring sites across the River Axe SSSI.

Macroinvertebrates

The assessment of the macroinvertebrate community condition is based on the assessment of ecological status under WFD. Two samples are collected annually (Spring & Autumn) via undertaking a 3 min pond net active sampling and 1-minute hand search (Environment Agency, 2017b).

River invertebrate data is collected by the Environment Agency and is assessed using the River Invertebrate Classification Tool (RICT). RICT compares the observed score with the predicted score under reference conditions.

Table 5 presents the relevant EA monitoring sites identified within each assessment unit (Figure 4), the number of macroinvertebrate samples and sampling period available.

Table 5: River Axe Macro-Invertebrate Survey Data

WATER_BODY	Unit	SITE_ID	NGR_10_FIG	Date	Count
AXE (DEVON)	3	7633	SY2645095550	2017 - 2022	36
AXE (DEVON)	3	9406	SY2611094630	2019 - 2022	5

WATER_BODY	Unit	SITE_ID	NGR_10_FIG	Date	Count
AXE (DEVON)	2	9422	SY2902098330	2017 - 2022	7
AXE (DEVON)	1	9428	ST3263002480	2020 - 2022	4
AXE (DEVON)	2	9438	ST3075000020	2020 - 2022	4
AXE (DEVON)	2	170545	SY2788697133	2020 - 2022	4

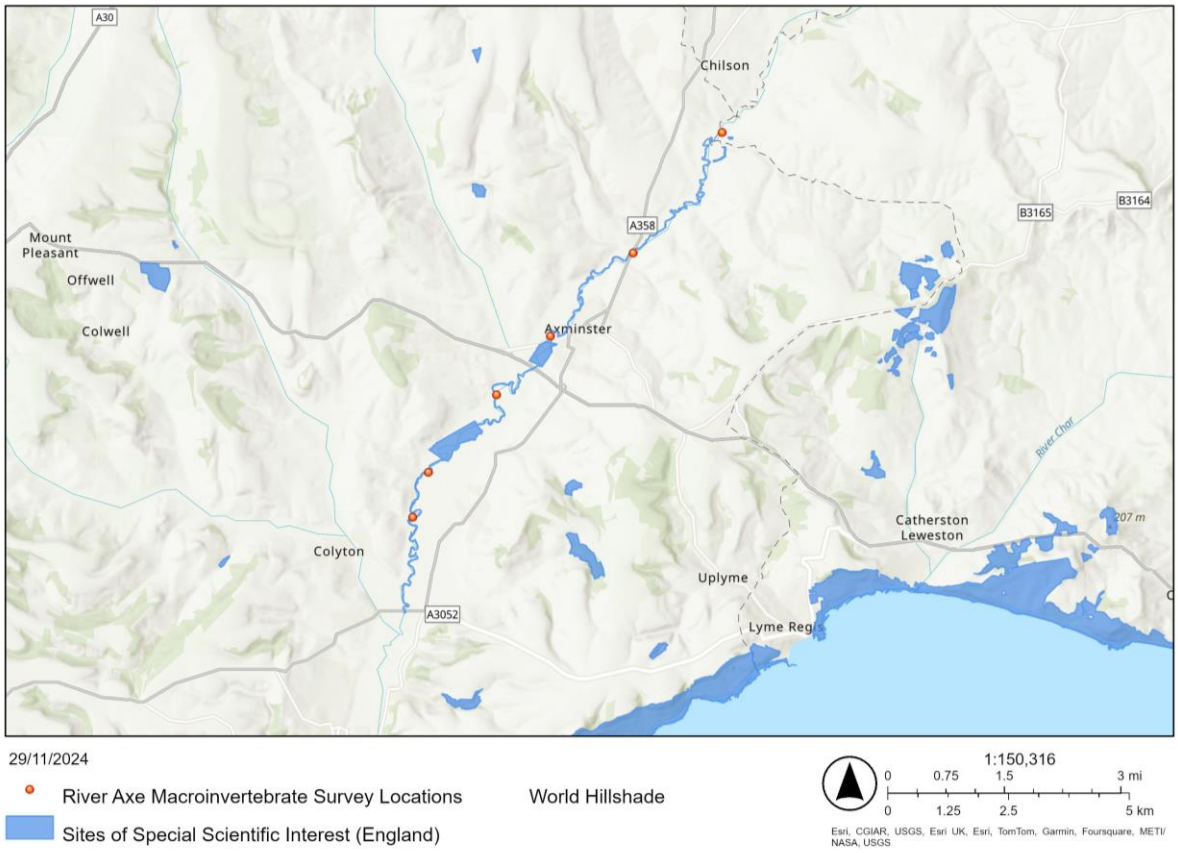

Figure 4: Environment Agency macroinvertebrate survey locations across the River Axe SSSI.

1d. Habitat Structure

The River Habitat Survey (RHS) is a method designed to characterise and assess the physical structure of freshwater streams and rivers, including recognition of vegetation types and basic geomorphological principles and processes.

RHS outputs are used to inform overall Condition Assessment of a SSSI unit and are carried out along a standard 500 m stretch of river channel, with observations made at ten equally spaced ‘spot checks’, with additional context provided by observations of land use

and valley form in the river corridor. The RHS surveys were carried out by Natural England DCiOS Area team members over a week period during August 2023 (Table 6).

- Nine RHS surveys were undertaken across the 3 SSSI units, resulting in ~35% coverage of the entire river length (Figure 5).
- RHS surveys were carried out by accredited surveyors on the 14th – 18th August 2023, according to the methodology given in the "River Habitat Survey Guidance Manual: 2003 Version" (Environment Agency, 2003).
- An assessment of the naturalness of the riparian vegetation at each transect was carried out by a Phase 1 habitat assessment according to the draft SERCON 2 guidelines.
- Completed RHS forms were submitted to the Environment Agency RHS team for inclusion on the national database.

River Habitat Survey data is used to calculate several different indices which classify the quality of the river habitat. The Habitat Modification Score (HMS) quantifies the impact of physical engineering structures on the river channel. The Habitat Quality Assessment (HQA) score is a measure of the diversity of natural habitat features, land use and floodplain features. This includes the channel substrate types, numbers of riffles & pools.

To interpret HQA scores, 'context analysis' is employed to assesses the site HQA score against the distribution of HQA score for similar sites. The score for each index is categorised into five classes. The HMS class describes the pressure and impact of engineering structures. The HQA classes are also on a scale of 1 (top 20% of similar sites) to 5 (bottom 20% of similar sites) and describes the pressure and impact from agricultural fine sediment and hydro morphological impact.

RHS scores were inputted into the RHS toolbox, to generate the following indices:

- Habitat modification (HMS)
- Habitat Quality (HQA)
- Riparian quality (RQI)
- Energy and dimensions
- Agricultural fine sediment (ASL, FSA and ASR)
- Hydromorphological indices (CSI, FRI, CVI , GAI) and
- Hydromorphological quality (HIR)

Only the Habitat Modification Scores is assessed against specific site targets. See Appendix 1 for the CSM targets and scores and Appendix 2 for the RHS surveys and summary of all attributes assessed during RHS / riparian Phase 1 habitat / macrophyte surveys.

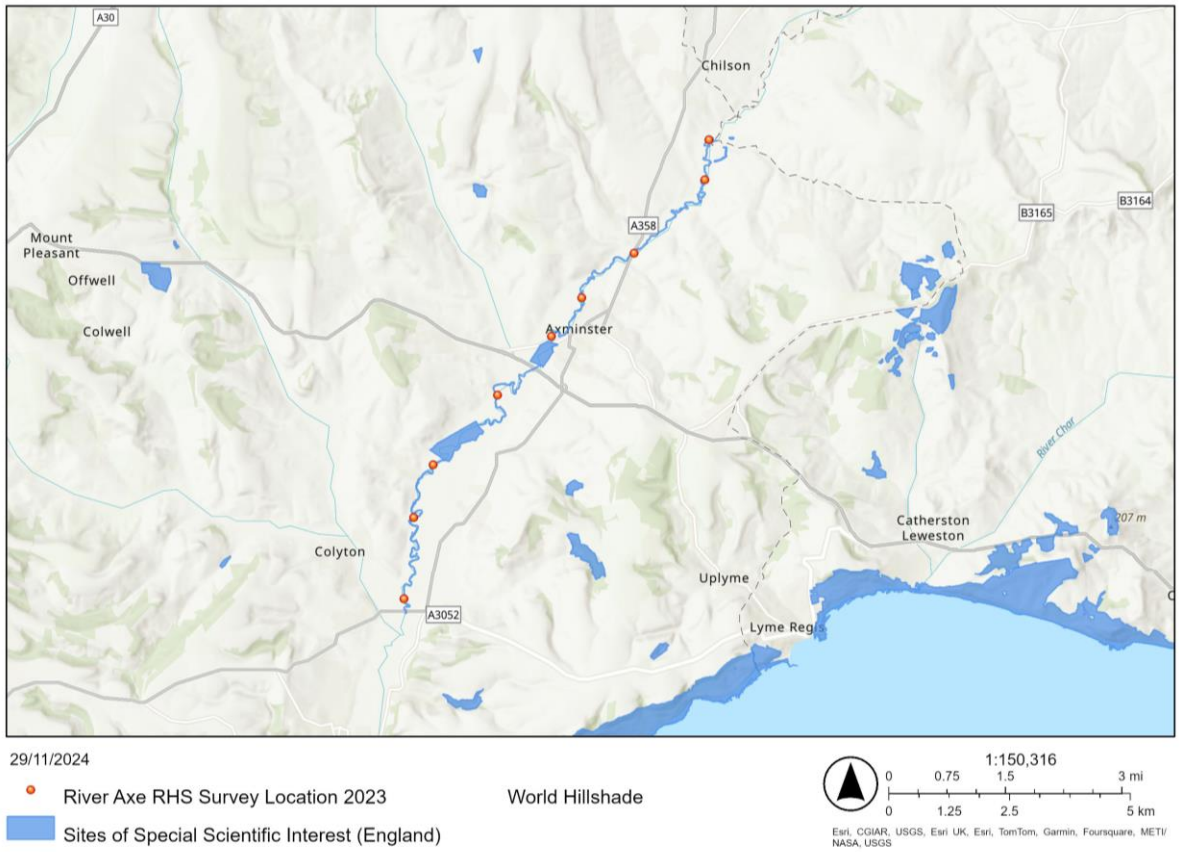

Figure 5: River Habitat Survey locations 2023 across the River Axe SSSI

Fluvial audit of the bed & bank

An assessment of the bed & bank stability was undertaken alongside the RHS Surveys. 9 surveys in 250m long sections were assessed on the 14th – 18th August 2023. The reaches were mapped using Field Maps. Wollman samples were also undertaken within the 250m sections in both stable and unstable cobble-gravel reaches (where this was feasible). See Appendix 4 for further methods & attribute collection.

1e. Siltation

Field observations were used (as part of the RHS survey) to determine the impact of siltation. Silt as the predominant channel substrate & ‘major impacts’ from siltation are both recorded as part of the standard RHS survey.

1f. Negative Indicators

Both the river habitat and macrophyte survey data was used to inform the assessment of negative indicators (invasive non-native plant species) due the plant species information available from these surveys.

Table 6: RHS & (NE) Macrophyte Survey Locations.

Site #	Unit	Spot check 1 GR	Spot check 6 GR	End of site OS GR	Survey Date & Lead Surveyor	Comment
1	1	ST3246902319	ST3232902340	ST3228702219	16.08.2023 – FM	2021 RHS Survey location
2	2	ST3224401708	ST3223301511	ST3218601400	16.08.2023 - FM	2021 RHS Survey location
3	2	SY3054299885	ST3075000020	ST3080800083	16.08.2023 - NBD	new location (EA macroinvertebrate site)
4	2	SY2963599198	SY2965399113	SY2965998954	15.08.2023 – FM & NBD	2021 RHS Survey location
5	2	SY2899698167	SY2902098330	SY2910498418	17.08.2023 – NBD	new location (EA macroinvertebrate site)
6	2	SY2785596931	SY2788697133	SY2782397209	16.08.2023 – NBD	new location (EA macroinvertebrate site)
7	3	SY2675695816	SY2653595710	SY2654895552	17.08.2023 - NBD	2021 RHS Survey location
8	3	SY2613294598	SY2611094630	SY2613094720	18.08.2023 – NBD	new location (EA macroinvertebrate site)
9	3	SY2588893182	SY2588892953	SY2598192801	18.08.2023 - NBD	2021 RHS Survey location

Section 2. Results and Discussion

2a. Flow

Table 7: CSMG Flow Targets

<Qn95 (low flows)	<5% deviation from daily naturalised flow
Qn50-95 (low – moderate flows)	<10% deviation from daily naturalised flow
Qn10-50 (moderate – high flows)	<10% deviation from daily naturalised flow
>Qn10 (high flows)	<10% deviation from daily naturalised flow

Compliance with target: PASS

Deviation from natural flow remains within the CSMG targets along the entire SSSI/SAC. Daily observed flows throughout the 6-year assessment period (2017-2022) were compliant at all three assessment points; remaining within the most stringent CSMG target of 5% deviation from natural flow during periods of low flow (<Qn95) for 100% of the assessment period.

See Appendix 6 for the full flow compliance assessment report.

2b. Water Quality

Compliance (Dissolved Oxygen) = Fail

Compliance (Total Ammonia) = Pass

Compliance (Ortho-P, 1 year, 3 year) = Fail

Compliance (Ortho-P, growing season mean) = Fail

Compliance (Hazardous Chemicals) = Fail

Organic Pollution

The Axe is passing in units one and two for its organic pollution targets. For total ammonia and un-ionised ammonia, the Axe is passing for all units. The Axe passes its dissolved oxygen targets for units one and two, however fails for unit three due to the most downstream WQ site (River Axe at Axe Bridge), which averaged 80% dissolved oxygen in

2022. High nutrient levels in the river are also reflected in the biological assemblage's assessment, which is failing for diatoms and illustrates the river is highly eutrophic (WFD WB: moderate status).

Reactive Phosphorous

The River Axe is significantly failing its phosphorus targets in all units for the one year, three year and growing season mean. Target exceedance for Phosphorus ranges from 70 – 170%.
See Appendix 3 for long term water quality data plots for Phosphorus and Nitrogen.
Analysis of long-term trends illustrates that there has been a reduction in both Phosphorus and Nitrogen concentration in the river over the last 20 years, however as demonstrated in Table 8, water quality targets in the River Axe are not being achieved and for Phosphorus require significant reductions.

The occurrence of excessive nutrients in the waterbody can impact on the competitive interactions between high plant species and between higher plant species and algae, which can result in a dominance in attached forms of algae, and a loss of characteristic plant species. This is reflected in the biological results from the macrophyte surveys. Changes in plant growth and community composition can have implications for the wider food web, and the species present. Increased nutrients and the occurrence of eutrophication can also impact on the dissolved oxygen levels in the waterbody, also impacting on biota within the river. High nutrient levels in the waterbody may be contributing to the dissolved oxygen failure in the lower axe.

Table 8: River Axe Water Quality Condition Assessment. P indicates Compliance with Target. F indicates target exceedance/non-compliance and a failure against the water quality target.

			Average/ % target exceedance	Average/ % target exceedance	Average/ % target exceedance	Average/ % target exceedance	Average/ % target exceedance	Average/ % target exceedance
			Unit 1	Unit 2	Unit 3	Unit 3	Unit 3	Unit 3
Parameter	**Unit**	**Target**	**Broom***	**Bow Bridge**	**Slymlakes**	**Whitford Bridge**	**U/S Colyton STW**	**Axe Bridge**
Organic pollution								
10%ile Dissolved Oxygen (DO)	% saturation	85.00	94.0 **P**	92.8 **P**	88.5 **P**	88.1 **P**	83.3 F	82.1 F
Mean Biological Oxygen Demand (BOD)	Mg L -1	4.00	N/A	N/A	N/A	N/A	N/A	N/A
90%ile Total Ammonia	(NH3-N, mg L-1)	0.15	0.04 **P**	0.06 **P**	0.08 **P**	0.09 **P**	0.09 **P**	0.12 **P**
95%ile un-ionised Ammonia	(NH3-N, mg L-1)	0.025	0.0018 **P**	0.0013 **P**	0.0015 **P**	0.0012 **P**	0.0023 **P**	0.0020 **P**
Ortho-P								

			Average/ % target exceedance	Average/ % target exceedance	Average/ % target exceedance	Average/ % target exceedance	Average/ % target exceedance	Average/ % target exceedance
			Unit 1	Unit 2	Unit 3	Unit 3	Unit 3	Unit 3
Parameter	**Unit**	**Target**	**Broom***	**Bow Bridge**	**Slymlakes**	**Whitford Bridge**	**U/S Colyton STW**	**Axe Bridge**
1 year mean	Mg/L	0.05	0.11 129.0% **F**	0.0952 90.40% **F**	0.105 110.0% **F**	0.11 129.0% **F**	0.10 100.0% **F**	0.140 170.0% **F**
3-year mean	Mg/L	0.05	0.11 129.0% **F**	0.0882 76% **F**	0.0954 93.0% **F**	0.1040 107.0% **F**	0.1227 145.0% **F**	0.1376 180.0% **F**
Growing season mean	Mg/L	0.05	0.11 129.0% **F**	0.08 69.30% **F**	0.094 94.0% **F**	0.09 81.0% **F**	0.09 84.6% **F**	0.014 176.0% **F**

Hazardous Chemicals

The River Axe also failed its WFD classification for Chemical - Priority hazardous substances (2019) for the following parameters: Benzo(g-h-i)perylene, Mercury and Its Compounds, Perfluorooctane sulphonate (PFOS) & Polybrominated diphenyl ethers (PBDE) (Table 9).

Table 9: WFD Chemical Classification (WFD WB: Lower Axe)

Chemical - Priority hazardous substance	Classification	Chemical - Priority hazardous substance	Classification
Benzo(a)pyrene	Good	1,2-dichloroethane	Good
Benzo(b)fluoranthene	Good	Aclonifen	Good
Benzo(g-h-i)perylene	Fail	Alachlor	Good
Benzo(k)fluoranthene	Good	Benzene	Good
Cadmium and Its Compounds	Good	Bifenox	Good
Dioxins and dioxin-like compounds	Good	Cybutryne	Good
Heptachlor and cis-Heptachlor epoxide	Good	Cypermethrin (Priority)	Good
Hexabromocyclododecane (HBCDD)	Good	Dichloromethane	Good
Hexachlorobenzene	Good	Dichlorvos (Priority)	Good
Hexachlorobutadiene	Good	Fluoranthene	Good
Hexachlorocyclohexane	Good	Lead and Its Compounds	Good
Mercury and Its Compounds	Fail	Nickel and Its Compounds	Good
Nonylphenol	Good	Terbutryn	Good
Pentachlorobenzene	Good	Trichloromethane	Good
Perfluorooctane sulphonate (PFOS)	Fail	Other Pollutants	Good

Chemical - Priority hazardous substance	Classification	Chemical - Priority hazardous substance	Classification
Polybrominated diphenyl ethers (PBDE)	Fail	Aldrin, Dieldrin, Endrin & Isodrin	Good
Quinoxyfen	Good	Carbon Tetrachloride	Good
Tributyltin Compounds	Good	DDT Total	Good
Priority substances	Good	para - para DDT	Good

Table 10: Summary WFD WQ Assessment River Axe SSSI (WFD WB: Lower Axe).

Classification Item	2013	2014	2015	2016	2019	2022
Physico-chemical quality elements	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Acid Neutralising Capacity	ND	High	High	High	High	High
Ammonia (Phys-Chem)	High	High	High	High	High	High
Dissolved oxygen	High	High	High	High	High	High
Phosphate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Temperature	High	High	High	High	Good	High
pH	High	High	High	High	High	High

Diatoms

Target: High Ecological Status
Lower Axe = Moderate status (units 1, 2 & 3)

Compliance = **Fail** (2022 classification)

Table 11.a: Overall classification of Diatom status by unit

Unit	Pass/Fail
1	FAIL
2	FAIL
3	FAIL

Table 11.b: Diatom metrics, indicative WFD classification and corresponding unit condition

SSSI assessment unit	Average normalised Trophic Diatom Index (TDI) Ecological Quality Ratio (EQR) and indicative WFD class	Number of non-compliant samples (EQR < 0.8)	Total number of diatom samples* (since 2021)	Unit condition (PASS/FAIL)
Unit 1 / 2: Broom, 9428	0.64, 0.53 (light, TDI 5)	2	2	FAIL
Unit 1 / 2: Forde Br, 9421	0.7	1	1	FAIL
Unit 2: U/S Kilmington STW, 170546	0.96, 0.87, 0.73	1	3	PASS
Unit 2: D/S Kilmington STW, 170545	0.88, 0.48, 0.46 (DNA)	2	3	FAIL
Unit 2: Bow Bridge, 9422	0.66, 0.55, 0.6 (light, TDI 5)	3	3	FAIL
Unit 2: Weycroft, 9438	0.54, 0.48, 0.58 (light, TDI 5)	3	3	FAIL
Unit 3: Whitford Br. 7633	0.76, 0.5, 0.5 (light, TDI 5)	3	3	FAIL
Unit 3: Cownhayne, 212692	No data available yet			N/A
Unit 3: Nunford Dairy, 9406	0.76, 0.54, 0.48	3	3	FAIL

2c. Biological Assemblages

Source: EA open source WFD Data.

Table 12: WFD Summary Biological Assessment Results for the River Axe SSSI (WFD WB: Lower Axe).

Classification Item	2013	2014	2015	2016	2019	2022
Ecological	Moderate	Moderate	Poor	Poor	Moderate	Moderate
Biological quality elements	Moderate	Moderate	Poor	Poor	Moderate	Moderate
Fish			Poor	Poor		Good
Invertebrates	High	High	High	High	High	High
Macrophytes and Phytobenthos Combined	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Macrophytes Sub Element	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Phytobenthos Sub Element	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

Plant Communities

Compliance = **Fail** (2022 classification)

Target Macrophytes and Phytobenthos Combined = High Ecological Status

Upper Axe = Good
Lower Axe = Moderate

Table 13: Macrophyte unit summary condition

Unit	Pass/Fail
1	NA
2	FAIL
3	FAIL

LEAFPACS analysis of the macrophyte community against a reference natural state indicate the plant community is significantly impoverished. This increases the weight of evidence that the River Axe is significantly impacted by anthropogenic eutrophication.

Table 14: Macrophyte metrics and WFD classification scores

SSSI Unit	River macrophyte nutrient index (RMNI)	Number of macrophyte taxa (NTAXA)	Number of functional groups (NFG)	Filamentous green algae cover (ALG)	Ecological Quality Ratio (EQR)	WFD macrophyte classification
Unit 1	N/A	N/A	N/A	N/A	N/A	N/A
Unit 2	7.81	19	14	45	0.35	POOR
Unit 2	7.73	16	14	21.3	0.45	MODERATE
Unit 2	7.38	12	9	8	0.62	GOOD
Unit 2	7.59	20	14	39.2	0.39	POOR
Unit 3	7.61	20	13	18.05	0.5	MODERATE
Unit 3	7.75	26	15	41.8	0.37	POOR
Unit 3	7.56 (EQR 0.70)	28	16	21.8	0.481	MODERATE

Macroinvertebrates

Compliance = **Pass** (2022 classification)

Target = High Ecological Status

Upper Axe = high status (outside of site boundary)
Lower Axe = high status (units 1, 2 & 3)

2d. Habitat Structure

The River Axe is a relatively small, active river with riffle-run/glide/pool sequences. The river displays a low gradient channel within a wide generally symmetric floodplain greater than 10 channel widths. The channel cross-section is typically U-shaped with steep or vertical banks of 1-2 metres.

Flow is varied reflecting generally good morphological diversity, which includes runs, riffles, pools, dead water, and glides. The bed substrate was predominately gravel-pebble with occasional areas of silt and sand.

The banks were predominantly comprised of earth. Evidence of natural functioning is present throughout, erosional and depositional features such as eroding cliffs, mid, side and point bars and mature islands are common. Fine deposits occur with moderate frequency while coarse deposits have a low frequency. Channel deposits are predominantly berms, mid-channel bars, point bars and sidebars.

Extensive modifications and poor riparian habitat is extensive, constraining the natural structure & functioning of the river system. Where cattle access is prevalent, erosion of the riverbanks and significant widening of the channel has been observed. This has been correlated with the destabilising the channel bed and as a result the cobble-gravel substrate which is critical for Ranunculus spp to root and form beds has been lost.

Channel Planform

Target: Channel form should be generally characteristic of river type, with predominantly unmodified planform and profile. ≤5% of the assessment unit should be artificial, re-aligned or constrained. For naturalness of the profile using transect data the target is a score for the assessment unit of 4 or 5 (see Appendix 4 of the monitoring protocol). No RHS site to have any of the eight categories of bank profile modification (Section I in RHS 2003 form) recorded as ‘extensive’.

Compliance = **FAIL**

RHS surveys 1 & 2 pass for the naturalness profile target score, however surveys 7, 8 & 9 recorded channel modifications as ‘extensive’ & scored below the threshold. Analysis of aerial images demonstrates that a significant proportion (> 5%) of the River Axe is constrained from lateral movement due to the railway line (Figure 4) and / or has been historically straightened, for example the 400m stretch at Westford Mill (Figure 4) throughout the assessment units.

Other modifications include the A35 Axminster Bypass scheme. Extensive modifications were carried out along the Axe as part of WWII stop lines, these were frequently encountered throughout the RHS / fluvial audit surveys and included: embankment creation, cuttings across meanders, dredging, pill box and anti-tank block installation.

Cattle access is having a significant impact on the channel planform. Cattle grazing of the bank top and riparian vegetation is significant and extensive throughout the catchment. The impact of cattle access varies from widening by an additional 1-2m where access is more restricted, to width increases 3-4 times natural channel where there is extensive cattle access to the watercourse. Unrestricted cattle access results in the channel planform becoming highly unstable and meanders rapidly elongate and migrate.

The Axe River Restoration Report documents 3,740m have been straightened/reinforced**, which comprises approximately 29% of the channel length**. The plan comprehensively documents the re-alignment, reinforcement & embankment of the River Axe, further analysis of the impacts of the modifications can also be found in the report. The report concludes that … 'localised channel modifications such as weirs, rail and road bridge abutments, embankments, channel re-alignments, bank protection and adjoining land management practices, conducted throughout the last 200 years, have interfered with the natural behaviour of the river channel'.

The channel modifications result in a loss of natural channel dynamics and connectivity to the floodplain, reduces the habitat diversity and ecological functioning of the river.

Table 15: River Planform Assessment

ECS	RHS site numbers	Mean Score	<5% artificial, aligned or constrained	Pass (Yes/No)
River Axe ECS 1	1	5	Yes	Yes
River Axe ECS 2	2,3,4,5,6	4.6	No	No
River Axe ECS 3	7,8,9	1.33	No	No

Habitat Modification and Quality Score

Target: Habitat Modification Score (HMS) ≥65% or more of condition monitoring sites falling into semi-natural HMS class 1, with the remainder predominantly unmodified HMS class 2 with no (or minimal) deterioration from the last monitoring cycle.)

Compliance = **Fail**

Table 16: HMS, HQA & RHQ HIR Results.

Unit	Site Ref	Habitat Modification Score	Habitat Modification Class	Pass/Fail
1	**1**	**10**	**1**	**Pass**
2	**2**	**100**	**2**	**Pass**
2	**3**	**380**	**3**	**Fail**
2	**4**	**75**	**2**	**Pass**
2	**5**	**310**	**3**	**Fail**
2	**6**	**0**	**1**	**Pass**
3	**7**	**2170**	**5**	**Fail**
3	**8**	**290**	**3**	**Fail**
3	**9**	**950**	**4**	**Fail**

The physical habitat of the River Axe has been modified including reinforcements & re-sectioning from historic WWII defences, transport infrastructure & historic re-alignment, as detailed below in-channel structures. This is reflected in the results for habitat modification scores, which fail to achieve the target required of over 65% of condition monitoring sites achieving the semi-natural HMS Class 1.

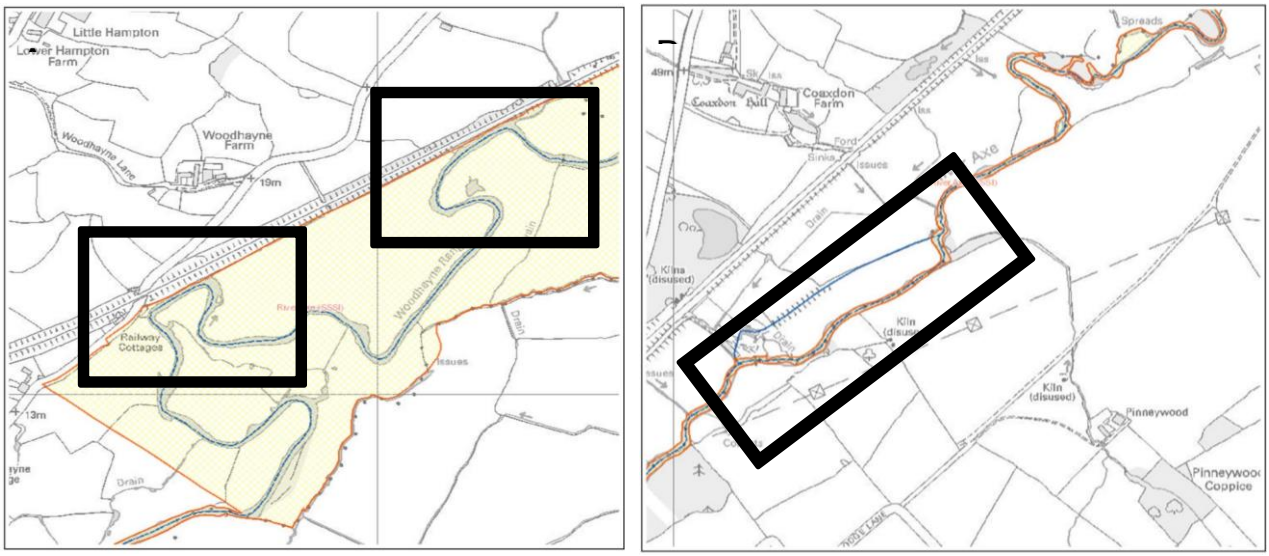

Figure 6 Aerial images. A. Laterally constrained movement due to Railway line. B. Historically straightened section 'Mill Race'

Fluvial Audit

The fluvial audit has produced a detailed baseline survey of the bed and bank geomorphology of the River Axe. The survey results demonstrate that holes in the cobble-gravel strata are prevalent throughout the axe river corridor.

Unrestricted cattle access was strongly correlated with destabilised cobble-gravel bed including unnatural holes in the bed cobble-gravel strata & widening of the channel. The *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation is dependent on a stable cobble gravel bed. This vegetation cannot survive in silty clay rivers. Area of river bed destabilisation and extensive holes in the river bed were correlated with reduced/no *Ranuculus/Callitricho* bed cover. Conversely, where cattle access had been restricted / not prevalent the river reaches cobble gravel strata remained largely intact & extensive beds of *Ranuculus/Callitricho* vegetation were observed.

The results of the fluvial audit including maps of the survey reaches are detailed in Appendix 4.

Bank vegetation naturalness

Target - Mean SERCON score for the assessment unit of 4 or 5

Compliance **= Fail**

Improved grassland dominates the vegetation community for the majority of the Riparian corridor. While there are small sections of un-improved and good semi-improved grassland and a couple of sections with semi-natural deciduous tree cover, the habitat is generally uniform improved grassland resulting in an overall average score of 1 for the site.

Units 1 and 2 for the previous condition assessment also failed for bank vegetation naturalness, however unit 3 passed. This would suggest that the quality of the bank vegetation has declined in the last decade since the previous assessment of unit 3.

The bank vegetation diversity is limited with a noticeable lack of bankside trees. Bankside trees are important for stabilising the bank and providing refugia for a range of aquatic and riverine species including otter & fish. There is limited aquatic / marginal vegetation covering the bank, which is likely contributing to accelerated bank erosion and results in restricted natural functioning of the river system.

Table 17: Bank Vegetation naturalness

Unit	RHS site	Total points	Score	Mean score	Pass /Fail
1	Axe1	15	0	0	Fail
2	Axe2	1	0	1	Fail
2	Axe3	39	2	1	Fail
2	Axe4	6	0	1	Fail
2	Axe5	0	0	1	Fail
2	Axe6	46	3	1	Fail
3	Axe7	0	0	1	Fail
3	Axe8	0	0	1	Fail
3	Axe9	0	0	1	Fail

Riparian zone vegetation naturalness

Target - The mean SERCON score for naturalness (derived from individual survey sites) should be 4 or 5

Compliance = **Fail**

The results of the riparian zone vegetation naturalness reflect the bank vegetation naturalness, the riparian corridor is generally uninform & comprised predominantly of intensive grassland, with an average means score for the site of 1.67. There is a significant lack of diversity including a lack of suitable tree cover and floodplain wetland species resulting in limited heterogeneity of the riparian habitat.

The lack of a natural, well established riparian corridor results in minimal buffer between the intensively managed pastoral land which is prevalent throughout the Axe catchment. Lack of a suitable buffer is likely contributing to increased nutrient and silt pollution entering the watercourse, which is reflected in the survey results for water quality & other biological attributes including macrophytes.

Table 18: Riparian zone vegetation naturalness

Unit	RHS site	Final score	Mean Score	Pass/Fail
1	**Axe1**	**2**	**2**	**Fail**
2	**Axe2**	**2**	**1.8**	**Fail**
2	**Axe3**	**3**	**1.8**	**Fail**
2	**Axe4**	**1**	**1.8**	**Fail**
2	**Axe5**	**1**	**1.8**	**Fail**
2	**Axe6**	**2**	**1.8**	**Fail**
3	**Axe7**	**1**	**1.3**	**Fail**
3	**Axe8**	**2**	**1.3**	**Fail**
3	**Axe9**	**1**	**1.3**	**Fail**

Large Woody Debris

Target - 75% or more RHS sites have woody debris ‘Present’ OR 10% or more of RHS sites have large woody debris ‘Extensive’. River Habitat Survey data. At least 5 RHS sites should be examined for this target – if fewer than 5 sites are available, assessment units should be amalgamated.

Compliance = **Fail**

Woody Debris recorded ‘present’ at 33% of sites, no sites recorded woody debris as extensive. The lack of riparian trees is resulting in little availability of LWD. LWD is an essential component of a healthy and functioning lowland river system & bankside trees are important for providing a range of habitat types, including holts for otters, creating different flow types, pools and stabilising the riverbanks.

Table 19: Results of LWD analysis

Unit	RHS site	WD_Present	WD_Extensive	Pass/Fail
1	Axe1	1	0	Pass
2	Axe2	1	0	Fail
2	Axe3	1	0	Fail
2	Axe4	0	0	Fail
2	Axe5	0	0	Fail
2	Axe6	0	0	Fail
3	Axe7	0	0	Fail
3	Axe8	0	0	Fail
3	Axe9	0	0	Fail
Mean	**All**	**0.3**	**0**	Fail

In-Channel Structures

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

Compliance = **FAIL**

The impact of in-channel structures along the Axe have been well documented. The 2010-12 river condition survey reported that seven weirs and 17 bridges were located along the SSSI reach, in some cases impounding flow and interrupting sediment transfer & bank reinforcement accounted for 10% of the overall bank structure, inhibiting lateral channel migration and sediment availability. The 2019 River Restoration Plan lists the number, location and impact of in-channel features in detail, along with suggested restoration measures - Chapter 4 Channel Modifications & restoration measures.

Significant impoundments which interrupt the natural geomorphic processes and limits the morphological diversity include but are not limited to:

- The rail embankments - cuts across the floodplain and channel & constrains frequent flood flows.
- Weycroft weir - impounds the straightened channel upstream and retains the channel in slightly elevated position above the floodplain to the northwest.
- Weycroft Bridge - its embankments constrain the floodplain.
- Town Weir - impounds a short section of river, but in combination with the rail embankment abruptly redirects flows to the west.
- Whitford gauging weir – reduces the morphological diversity and interrupts natural geomorphological processes.

It is noted in the River Axe Site Improvement Plan:

> "a major cause of unfavourable/declining condition is the presence of unnecessary and obstructive buildings and structures along the watercourse. Artificial channel modifications can cause reduced flow and increased siltation, altering the physical structure of the river and its ability to support special features. In addition, artificial barriers can significantly impair characteristic migratory species from carrying out essential life-cycle movements e.g. weirs at Axminster and Weycroft where fish passes are required. The River Restoration Project aims to remove inappropriate structures where possible."

The impact of these structures can cause changes to the aquatic species composition and abundance as well as change the bank and riparian zone structure. The weirs also pose significant impairment to migration of characteristic species, especially eel and lampreys. See Table 20 for a summary of in-channel features by unit.

Table 20: Summary of significant in-channel structures by unit

Unit	Type & Number of artificial structures	Barrier effect assessment
1	• Bridge: 1	Minor effect
2	• Anti-tank defences: throughout • Bank revetments: throughout • Rail embankments: throughout • Weirs: Weycroft weir, Town weir, Bowbridge A35 blockstone weir (3) • Bridges: Stoney bridge & axminster flood defence scheme, Weycroft bridge (2)	Major
3	• Anti-tank defences: throughout • Bank revetments: throughout Rail embankments: throughout • Weirs: Whitford gauging station blockstone weir (1) • Bridges: Whitford gauging station bridge (1)	Major

2e. Fine Sediment

Target - 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 unit have silt (SI) as the predominant channel substrate.

Compliance = **Pass**

Confidence in this assessment of impact of siltation is low. The RHS surveys may not be appropriate for picking up the impact of siltation – especially the accumulation of silt in interstitial spaces between gravels/pebbles etc. Whilst sediment was not the predominant substrate of the channel a more thorough analysis of sedimentation has not been undertaken. The 2014 River Axe SAC Site Improvement Plan identifies Siltation as a pressure on the Axe. It is highlighted in the plan that widespread siltation is caused by a range of factors including high particulate loads, active bank erosion, lack of riparian vegetation/trees, livestock poaching and presence of Himalayan balsam. Himalayan balsam is extremely widespread in the catchment compromising the riverbank stability & contributing to the transfer of sediment, particularly fine material, to the river channel. These pressures were identified during the survey & whilst this is not reflected in the outputs from the RHS siltation is a pressure throughout the River Axe.

Wolman sampling was undertaken during the RHS surveys & whilst this was not formally assessed during the survey the cobbles and gravels were commonly coated in silt & filamentous algae.

Table 21: Summary of Silt Assessment

Unit	RHS site	Unvegetated Silt_Deposits	Silt_Channel Substrate	Silting_Overall Characterisitcs	Pass (Yes/No)
1	Axe1	0	0	0	Yes
2	Axe2	0	1	0	Yes
2	Axe3	0	0	0	Yes
2	Axe4	1	0	0	Yes
2	Axe5	0	0	0	Yes
2	Axe6	0	0	0	Yes
3	Axe7	0	0	0	Yes

Unit	RHS site	Unvegetated Silt_Deposits	Silt_Channel Substrate	Silting_Overall Characterisitcs	Pass (Yes/No)
3	Axe8	0	0	0	Yes
3	Axe9	0	0	0	Yes

2f. Negative Indicators

Target: No high-impact alien species established (i.e. self-sustaining populations). Standard checklists of species are based on those used for WFD assessments1.

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.

Compliance = **Fail**

Himalayan Balsam was present in every assessment unit and extensive throughout the riparian corridor of many of the section assessed, comprising the bank stability and outcompeting native flora, negatively impacting on site integrity.

This was similarly reported in the 2019 River Restoration plan '*Himalayan balsam is extensive on the banks of the River Axe'* & in the 2011 ECUS condition assessment report and is an established long-term problem on the Axe. The 2019 plan also reported that 'Diseased alders suffering from Phytophthora root disease are also extensive within the Axe catchment'. Whilst this was not recorded in the RHS survey, it adds to the weight of evidence to support FAIL for the compliance assessment target.

Himalayan Balsam out competes native species for space and light reducing natural biodiversity. Banks dominated by Himalayan balsam are at a greater risk of bank and soil erosion during winter when balsam dies back.

Section 3. Climate Change Risk Assessment

3a. Rivers and Streams

Risk = 4 HIGH

Freshwater ecosystems are inherently vulnerable to the impacts of climate change. A warmer, drier, and more unpredictable climate is likely to cause significant pressure on the River Axe and its ecology. The River Axe is particularly susceptible due to its degraded ecology, lack of tree cover, anthropogenic eutrophic waters, and modified geomorphology. An unstable and unfavourable ecological system is less resilient to a changing climate.

Increasing temperature is likely to exacerbate the impact of nutrient enrichment as warmer waters provide optimal conditions for algae to proliferate. Warmer waters are also likely to result in greater oxygen sags, combined with the likely increase in algal proliferation, algal blooms and associated fish kills are likely to increase in frequency / or severity. Cold water species such as salmonids are particularly vulnerable & warming waters can reduce and even inhibit juvenile recruitment of fish.

Increased storm frequency and severity could cause significant impact on the River Axe, from ripping out macrophyte beds such as *Ranunculus,* to increasing erosion and destabilization of the cobble-gravel bed. The geomorphological impacts documented in this condition assessment are likely to be exacerbated by more severe rainfall and storms.

Prolonged periods of low rainfall are also likely to provide optimal conditions for algal blooms, oxygen sags and fish kills. Climate change increases the likelihood of drought which will have significant consequences on freshwater ecology.

Key actions to mitigate the impacts of climate change include extensive tree planting along the banks of the river, especially in the headwaters. Reducing and removing channel modifications which slow the flow will also be important for mitigating warming waters. Significantly reducing the sources and pathways of both diffuse and point pollution are also essential for improving the sites resilience and reducing the impacts of water temperature on the water chemistry.

Conclusion

The 2010 condition assessment reported numerous pressures impacting the River Axe SSSI including physical modifications such as weirs, poor riparian habitat quality due to heavily grazed and impoverished riparian structure, invasive plants, diffuse water pollution and siltation. The results of this assessment illustrate that the pressures facing the Axe in 2023 remain broadly the same as 2010 and the River Axe remains in an unfavourable and declining state. There is limited new information which this condition assessment brings to light, however it confirms that even with long-term investment in the catchment from CSF & EA regulation, the river is not on a trajectory to being restored.

Water quality remains unfavourable, this assessment is supported by the plant community and diatom assessment which illustrates that the river is impacted by anthropogenic eutrophication.

The quality of the riparian habitat is extremely poor and unsuitable to support a SAC river designated for its macrophyte assemblages, the surrounding land use is highly intensive, cattle access is heavily impacting the geomorphology and structural integrity of the river, and the intensive farming practices throughout the catchment are wholly unsuitable for supporting a healthy and naturally functioning river system.

Himalayan balsam is prevalent throughout the catchment and is compromising the structural integrity of the bank, and there is a noticeable lack of riparian trees.

In the upper section especially, although also in sections of the middle and lower catchment, the river channel is highly incised and disconnected with the floodplain. A high proportion of the river is re-sectioned/re-aligned or re-enforced; significant in-channel river restoration is required to restore the river planform.

The fluvial audit has demonstrated that the stability of the bed in a number of reaches is low, the stable cobble gravel bed which is characteristic of this river type and is the foundation for the SAC designation has been destabilised. The stable cobble gravel bed has been lost in a number of places and deep holes are forming, this is most noticeable where cattle access is prevalent.

A significant shift in the riparian land management in the catchment is required to restore the river to a healthy & ecologically functioning state. Without significant changes the river & its ecology is likely to collapse and will be permanently destroyed. As highlighted in the 2019 River Restoration plan:

‘Landowner participation is key to delivery and detailed discussions and agreement with landowners about specific river reaches is recognised as being an essential part of developing detailed restoration projects and undertaking site specific actions in coming years’.

Driving restoration of the River Axe will need to come from the land managers who own the river & its banks. Without their dedicated co-operation, commitment & ingenuity to find creative solutions, tangible change is unlikely to materialise.

Section 4. Pressures

River health reflects the health of the wider catchment & the combined influence from a range of pressures all contributes to the failing status of the River Axe. The pressures come from a diverse range of sources, including direct impacts such as combined sewer overflows to indirect influences from wider land management practices. Many pressures are a result of historic interventions such as river channel realignment and legacy in-channel structures.

Appendix 5 details a full list of pressures, mechanisms & actions with their suggested owners & timeline. This can also be found on Designated Sites View. The below is a summary of the key pressures:

Pollution

The River Axe is impacted from eutrophication due to anthropogenic influences, predominantly from agriculture.
Refer to the River Axe Nutrient Management Plan, Natural England Pollution Risk Assessment: Axe Catchment & Axe Nutrient Management River Axe Catchment Assessment - An investigation to Assess the impact of South West Water Assets in the River Axe Catchment for further detailed information on the sources of pollution.
- Diffuse: Livestock & Arable
- Point: WwTW, CSO's, Septic Tanks

Physical Modification

Refer to the river restoration plan for further details on the impacts to River Axe Geomorphology (EA & NE, 2019).
- Cattle access is a clear pressure on the structural integrity of the riverbank and bed.
- Interruption of natural geomorphological process and floodplain flow distribution due to railway infrastructure, floodplain embankments, bank protection and historic structures.
- Low morphological diversity and interruption to natural geomorphological processes caused by channel modifications particularly Weycroft and Town Weirs.
- Lack of mature riparian corridor, especially trees is resulting in eroding & destabilisation of the bank

Invasive species

- Himalayan Balsam is prevalent throughout the catchment.

Siltation

- Cattle access - increases fine sediment deposition within the channel, caused by erosion

and bank grazing. This can lead to poor bank and riparian habitat structure and diversity and alteration of channel form; can cause change to aquatic species composition and abundance.
- Fine sediment delivery through bank failure and livestock poaching at discrete locations.

Land management

- Limited riparian vegetation, with grazing pressure to the bank top.

Section 4. Mechanisms and Actions

There are multiple action plans published and projects currently being implemented across the Axe catchment. These include the Environment Agency- Catchment Sensitive Farming (CSF) regulatory project, the Upper Axe Landscape Recovery Project, River Axe CSF engagement, the 'Triple Axe' Catchment partnership group and citizen science groups.

The following are high level recommendations for restoring the River Axe to favourable condition. Appendix 5 details mechanisms & actions with their suggested owners & timeline. For detailed plans refer to the following:

- 'Triple Axe' An Action Plan for the River Axe Catchment 2021 – 2026
- Restoring the River Axe Site of Special Scientific Interest and Special Area of Conservation: River Restoration Plan
- River Axe Site Improvement Plan
- River Axe Nutrient Management Plan

Re-notification

Whole site notification to include the adjacent supporting river habitat (buffer minimum 10m), upstream headwaters & major tributaries. This would enable improved monitoring and investment in the upstream areas of the catchment. The current SSSI designation restricts the ability to restore the river at the catchment scale, which is the scale required for favourable condition to be achieved for the site.

Land management

Land management pressures such as overgrazing and livestock-caused erosion/siltation will continue to be managed through the following initiatives:

- Catchment Sensitive Farming (CSF) – Natural England
- Countryside Stewardship (CS) – Natural England, Environment Agency
- Environment Agency compliance visits and enforcement of the Farming Rules for Water

These mechanisms will address key pressures such as:

- livestock management - restrict cattle access from the water course.
- Restore riparian corridor & stabilise banks through creating (min) 10m wide corridors & tree planting.
- Reduce cattle numbers.

River Restoration

The condition assessment has identified multiple pressures in the form of physical modifications to the watercourse as well as weirs and other structures.

These pressures will be addressed through the following mechanisms:

- Updating of current River Restoration Plan
- Implementation of River Restoration Plan to design and deliver River Restoration Projects
- Catchment-wide collaborative schemes involving key stakeholders including the transport sector

Pollution

Pollution issues in the catchment will be addressed through the following mechanisms:

- Diffuse pollution – Diffuse Water Pollution Plan
- Water company discharges causing pollution – AMP9 investigation
- The Axe is a Nutrient Neutrality catchment, and the Local Council will continue to implement this strategy
- Land management schemes (above) also address agricultural diffuse pollution

Invasive species

Invasive plant species will be addressed across the catchment through the development of an invasives control programme.

References

Acland, D., Maben, J., Saunder, G (2021). ‘Triple Axe’ An Action Plan for the River Axe Catchment 2021 – 2026.

Cossens, J (2019). River Axe N2K Catchment Regulatory Report Project.

ECUS (2011). River Axe SSSI Common Standards Monitoring

Environment Agency (2001) ‘Axe & Lim Local Environment Agency Plan’. EA, Exeter.

Environment Agency (2004). Catchment Geomorphological Action Plan: The River Axe Catchment. Detailed Geomorphological Survey (Report A)

Environment Agency (2004). Catchment Fluvial Geomorphological Audit of the Axe Catchment. Detailed Geomorphological Survey (Report B).

Environment Agency (2003) River Habitat Survey in Britain and Ireland, Field Survey Guidance Manual: 2003 Version.

Environment Agency (2019) Sediment Impacts in the Axe Catchment EA, Exeter.

Environment Agency & Natural England (2019). Restoring the River Axe Site of Special Scientific Interest and Special Area of Conservation: River Restoration Plan:

JNNC (2016). Common Standards Monitoring Guidance Rivers. ISSN 1743-8160 (online).

Natural England (1994). Geological site documentation / management brief: River Axe.

Natural England (2014). Site Improvement Plan: River Axe.

West Country Rivers Trust (2014). Natural England Pollution Risk Assessment: Axe Catchment.

Wood (2020). River Axe Nutrient Management Plan.

River Axe Catchment Assessment - An investigation to Assess the impact of South West Water Assets in the River Axe Catchment.

Appendices

To request any of the appendices, please contact the Devon, Cornwall and IoS area team mailbox at devoncornwallandislesofscilly@naturalengland.org.uk citing this report.

Appendix 1 - CSM targets and scores

Appendix 2 - RHS surveys and summary of all attributes assessed during RHS / riparian Phase 1 habitat / macrophyte surveys

Appendix 3 - Long term water quality data plots for phosphorus and nitrogen

Appendix 4 – Fluvial Audit

Appendix 5 – Pressures and Mechanisms Tables

Appendix 6 – Flow Assessment

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