Frome Headwaters Chalk Stream Restoration Strategy

Dorset Wildlife Trust
Wessex Water YTL Group
Dorset Catchment Partnerships
Environment Agency
Natural England
Wild Trout Trust
Catchment Sensitive Farming — Working together for a healthy environment
Dorset Council

This strategy is designed to help partners work together to conserve and enhance the river's rich and diverse ecology.

VISION

The Steering Group and stakeholders have agreed on a vision that, through the work of this strategy and other aligned actions of partners and stakeholders:

- The Frome Headwater catchments will support thriving, clean rivers, which provide high-quality chalk stream habitats for a wide variety of fish and other wildlife. Local communities feel strongly connected to their river, valuing its health, wellbeing, and recreational benefits, and reaping economic benefits attached to sustaining the river's natural function, water quality and habitats.

- This vision underpins the governance and deliverables of the strategy, with all actions supporting its delivery.

Objective

The natural richness and diversity of Dorset's River Frome chalk catchment are recognised internationally and appreciated locally; the headwater catchments of the Wraxall Brook, River Hooke and the Frome itself are key to improving the whole river from source to sea; all of these streams are encompassed in the term 'Frome Headwaters.' This strategy targets local headwater improvements for benefits at a catchment scale, i.e., interventions in the Headwaters which also confer downstream benefits to the River Frome SSSI and beyond, to where the Frome drains to Poole Harbour.

The way to a healthier river

Chalk streams are globally rare river systems. The River Frome and its catchment are designated for their natural features both nationally and internationally, yet the catchment faces many challenges. Over time, the river has been modified along most of its length from source to sea, and only in a few places does an unchanged natural river exist.

Pressures on the river are many; pollution from urban land use, agricultural land use, water resource management, water supply and wastewater infrastructure, climate pressures and the legacy of historical channel modifications all inhibit the ecological potential of the river. None of these issues can be singled out, they all have interlinking, significant impacts.

This strategy is designed to help partners work together to conserve and enhance the river's rich and diverse ecology, to achieve what is termed "Good Ecological Status" (GES) under the Water Framework Directive (WFD) as adopted into UK law post-Brexit.

Purpose of the strategy

There is a strong record of partnership working in the headwaters of the River Frome catchment to repair and improve the water environment through the work of landowners, farmers, and conservation organisations. This strategy aims to bring these efforts together, enhance and focus them to achieve the best outcome for the river and its communities. These improvements will take time and careful planning; the strategy is written with the intention of this being achieved by working together with local stakeholders throughout the process.

Our environment is rapidly changing, and we need to change with it. The increase of extreme weather events such as flooding and drought, linked to climate change, has great impacts on our landscapes. With a growing knowledge of the catchment and acknowledgement of the value to be protected, the strategy focuses on key target areas to improve which support catchment-wide benefits.

The project targets three main functional parts of the river:

a) The headwaters

One option is to increase the resilience of headwater reaches to extreme weather by maximising upstream natural flood management measures, such as slowing water down in rain events by making space for water in the landscape before it flows into the river. These measures also help to reduce any pollutants such as nutrients and fine sediments getting into the river.

Where water flow is generated, the aim is to allow the landscape to act as a natural sponge, holding more water for longer in the catchment and slowly releasing it downstream, increasing infiltration into the soils, chalk, and aquifer, and reducing the impacts of drought on biodiversity and people.

Activity in these areas will be made up of many smaller projects with a cumulative benefit. These include:

- Management of soil structure, field surface runoff, soil loss and drainage.
- Creation of storage of runoff and displaced soil within the catchment, buffering unnaturally accelerated pathways to the river.
- Woodland creation and tree planting.
- Slowing the flow in source tributary streams.

b) The river

Within the river channel itself, habitat can be enhanced to improve water quality and biodiversity. This will be made up of many smaller projects such as:

- Installation of woody debris and leaky debris dams to slow the flow, improve water retention and in-river habitat through flow diversity, sediment transport reduction and a more diverse river channel morphology.
- Restricting livestock access to the river to reduce sediment and nutrient inputs.
- Removal of artificial barriers and water level controls to improve fish passage.
- Management of riparian trees to reduce/optimise shade.
- Control of invasive species and their spread.

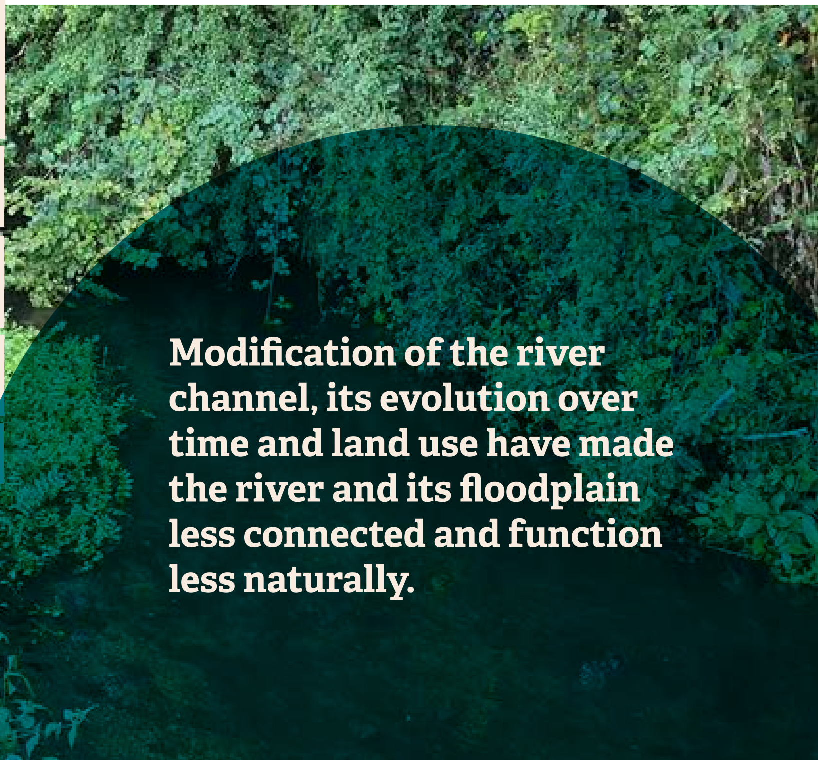
c) The floodplain

Modification of the river channel, its evolution over time and land use have made the river and its floodplain less connected and function less naturally. Reconnecting the river with its floodplain creates a more naturally functioning river with more biodiversity. This will be made up of many smaller projects:

- Realigning meandering channels back into the floodplain where historical activity for milling and water meadows has straightened and moved the river to the edge of the floodplain.
- Opportunities have been identified for full floodplain reconnection (referred to as 'Stage-0' stream evolution) to achieve a near-natural floodplain connection with the river in its headwater streams.
- Within the three headwater catchments there is a unique opportunity to monitor the impacts made by different interventions, specifically no intervention, human-designed intervention (restoration to 'Stage-0' form) and beaver eco-engineered intervention.

Next steps

The communities and wider stakeholders within the upper catchments are keen to support river restoration, giving the scheme good opportunities to make a positive impact. Restoration schemes have already made progress since 2020, notably on the River Hooke. The upcoming actions will continue the progress towards the vision with support from the stakeholders and partners.



Modification of the river channel, its evolution over time and land use have made the river and its floodplain less connected and function less naturally.

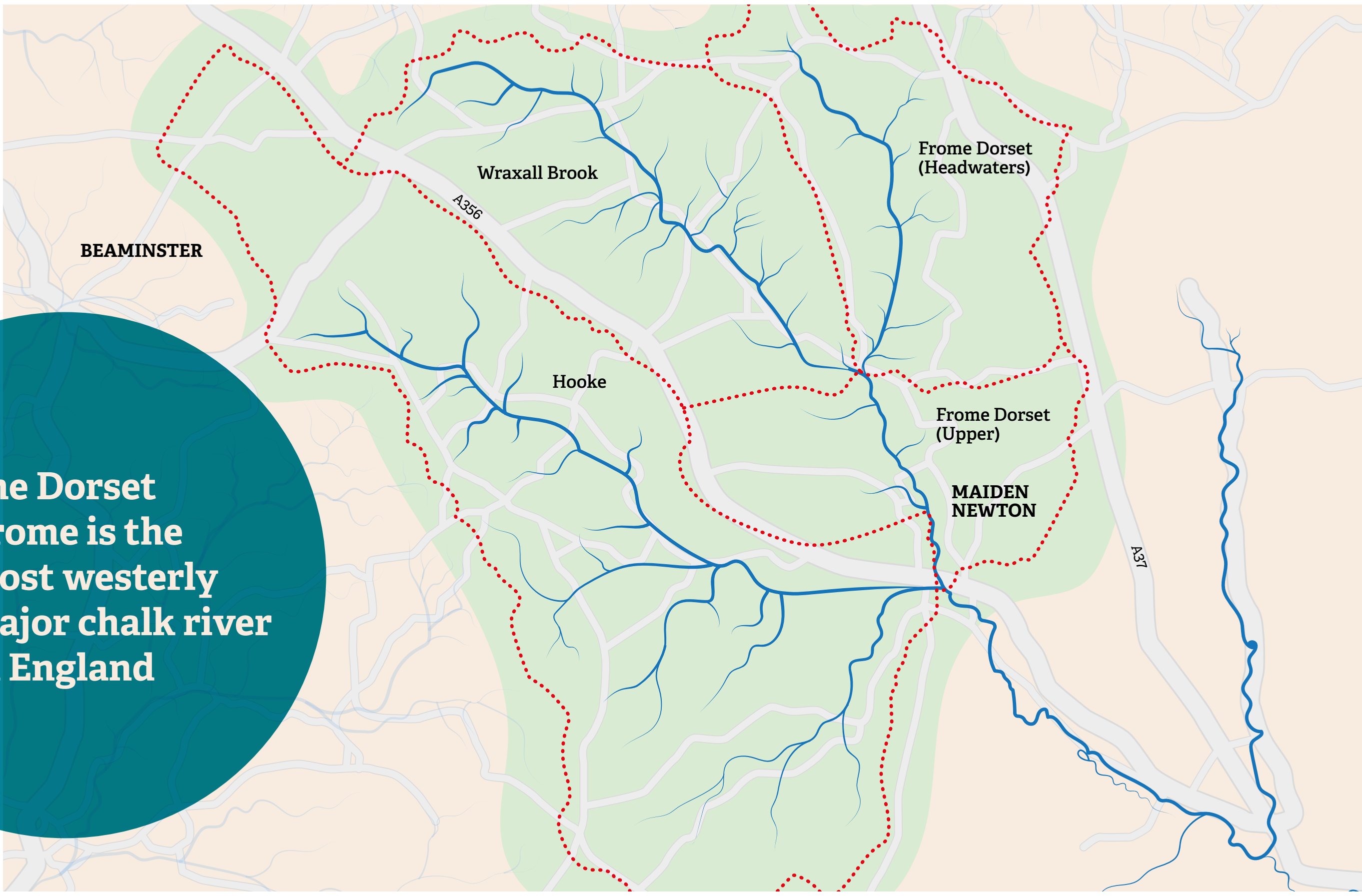
CONTENTS

1. DESCRIPTION OF THE CATCHMENT

1.1. The Frome Headwaters and its catchment

The Dorset Frome is the most westerly major chalk river in England, flowing southeast for approximately 60 km from the Dorset Downs, through Dorchester and onwards to form the northern fringe of the Isle of Purbeck before entering Poole Harbour. The river is designated a Site of Special Scientific Interest (SSSI) from Dorchester to Wareham based on the influences of chalk geology and the transition to mixed geology in its lower reaches. The headwaters include the source of the River Frome which rises at Evershot, the second-highest village in Dorset (175 m AOD). The source stream forms a small, seepage-fed stream for the first ~5.5 km of its course before receiving flow from the larger Wraxall Brook. The Frome therefore has the unusual distinction of being smaller than its main headwater tributary, and indeed previous work has considered the Wraxall Brook to be the main stem of the Frome (see e.g., Cannan & Armitage, 1999).

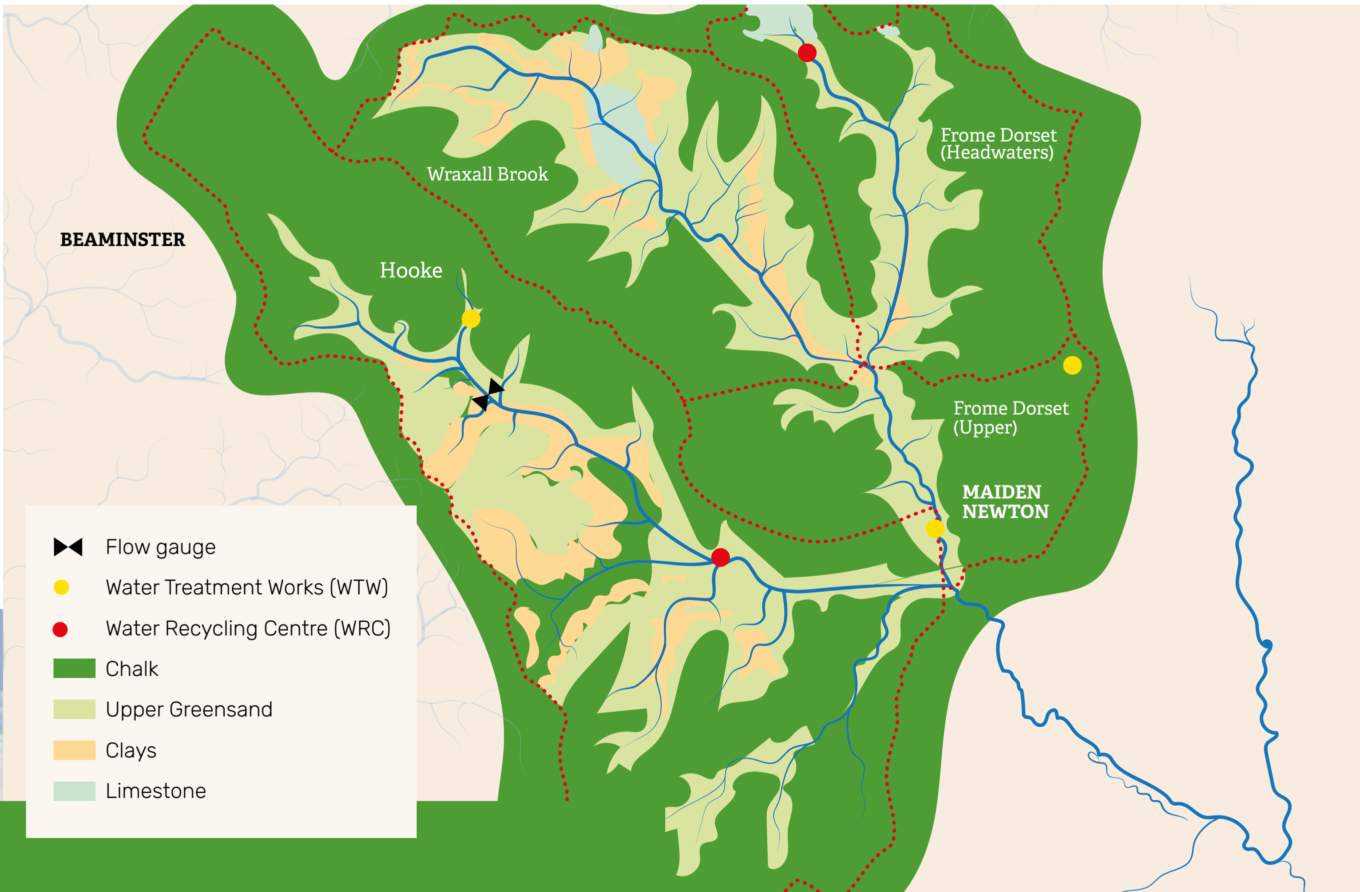
Figure 1 The River Frome, the Wraxall Brook and the River Hooke waterbodies .
Note that Frome Dorset (Headwaters) and Frome Dorset (Upper) are the official WFD waterbody names for the two Frome sections; for ease, this report respectively refers to them as the upper and lower Frome waterbodies.



The Dorset Frome is the most westerly major chalk river in England

Downstream of the Wraxall Brook confluence, the River Frome flows for a further ~4.5 km to merge with the River Hooke at Maiden Newton, which itself drains a catchment of broadly equivalent size. The Frome Headwaters Flagship Chalk stream Restoration Strategy area therefore encompasses four distinct WFD river waterbodies: (1) the River Frome upstream of the Wraxall Brook confluence (officially named Frome Dorset (Headwaters)); (2) the Wraxall Brook; (3) the River Frome downstream of the Wraxall Brook confluence to Maiden Newton (officially named Frome Dorset (Upper)); and (4) the River Hooke.

Figure 2 The River Frome Headwaters, Upper Frome and Wraxall Brook geology.



Geology within the catchment

The topography, flow, and sediment sources of the Wraxall Brook and Upper Frome catchment are influenced by underlying geology and soil types. Springs at the junction between permeable and impermeable bedrock geology are a key characteristic of the source tributaries of the river, providing the primary flow pathway. Once in the river channel network, modification through channel pathway constraints within the valley floor, pipe culvert structures at road/track crossings and channel re-alignment all influence the downstream flow of water and passage of sediment (both coarse and fine) through the catchment.

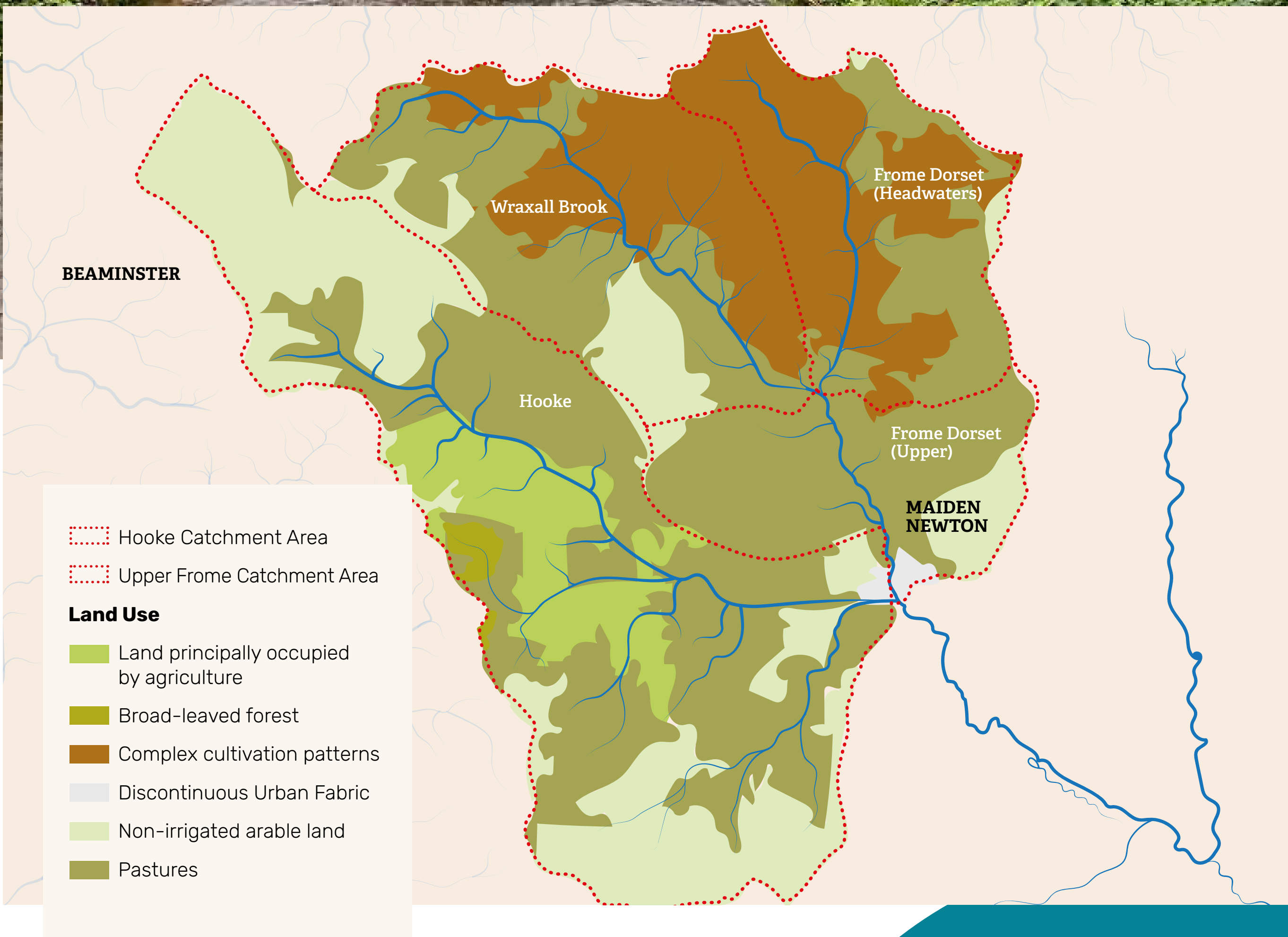


Figure 3 The RPA CROME Agricultural Land Classification for the Frome Headwaters, Wraxall Brook and Upper Frome – 2021.

Arable land use and associated high-risk sources of fine sediment are focused in specific areas within the catchment, with most used as pasture for livestock. Tree-lined channels are found throughout the catchment including significant reaches of woodland alongside the river. Woody debris within the channel is likely to be an important driver of creating flow variation in the river channel and encouraging a naturally wiggling channel.

The Wraxall Brook and headwaters of the Upper Frome have several designations along river reaches where sites are managed for nature conservation. Significant reaches managed for conservation are described in Section 2.2.

Arable land use and associated high-risk sources of fine sediment are focused in specific areas within the catchment, with most used as pasture for livestock.

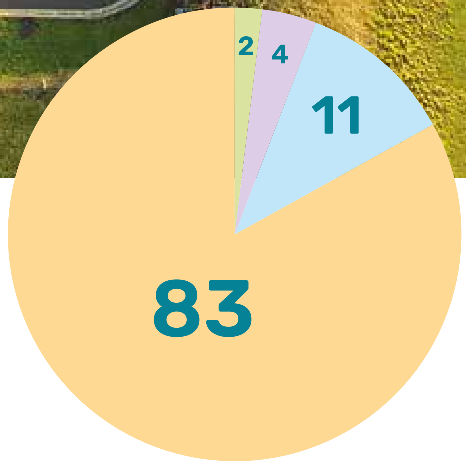
1.2 Catchment land use

The Upper Frome and Wraxall Brook catchment contains the villages of Rampisham, Cattistock and Frome St Quintin, and several smaller settlements. The River Hooke catchment contains the villages of Hooke and Toller Porcorum, and several smaller settlements, including Toller Whelme, Toller Fratrum and Wynford Eagle. The confluence of the river with the River Frome is at Maiden Newton.

Rural land use differs slightly between catchments and may have implications for runoff, nutrient delivery, and sediment generation. Permanent pasture dominates land use in the Wraxall Brook and Upper Frome catchments. By contrast, there is more arable land in the River Hooke, and more woodland.

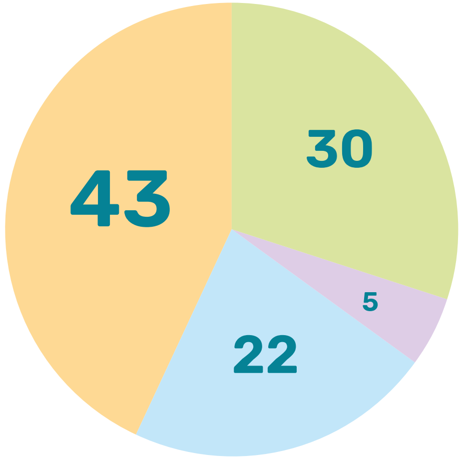
From the Rural Payments Agency (RPA) Crop Map CROME Agricultural Land Classification for 2021, the majority of the Upper Frome and Wraxall Brook catchment is used for agriculture, primarily permanent grassland for livestock grazing. A considerable land area consists of unimproved, semi-improved and improved grazing marsh, fen meadow and rush pasture. Arable crops are largely present on the upper catchment slopes. There are pockets of woodland throughout the catchment, but these are relatively small in area and percentage of land use.

Whilst permanent grassland is dominant in large parts of the River Hooke catchment, arable crops are more dominant in the upper River Hooke catchment and along the Wynford Eagle tributary. The land use in the River Hooke catchment is more mixed than in the other headwater areas. As with the Wraxall Brook and Upper Frome, woodland is present throughout the catchment. Within floodplain areas, a considerable area of land consists of unimproved, semi-improved and improved grazing marsh, fen meadow and rush pasture.



Upper Frome and Wraxall Book land use percentage

- Arable crops
- Woodland
- Permanent grassland
- Non-agricultural



River Hooke land use percentage

- Arable crops
- Woodland
- Permanent grassland
- Non-agricultural

Figure 4 Pie charts showing the Frome headwater waterbodies land use using the RPA CROME Agricultural Land Classification 2021 (%)

Recreation

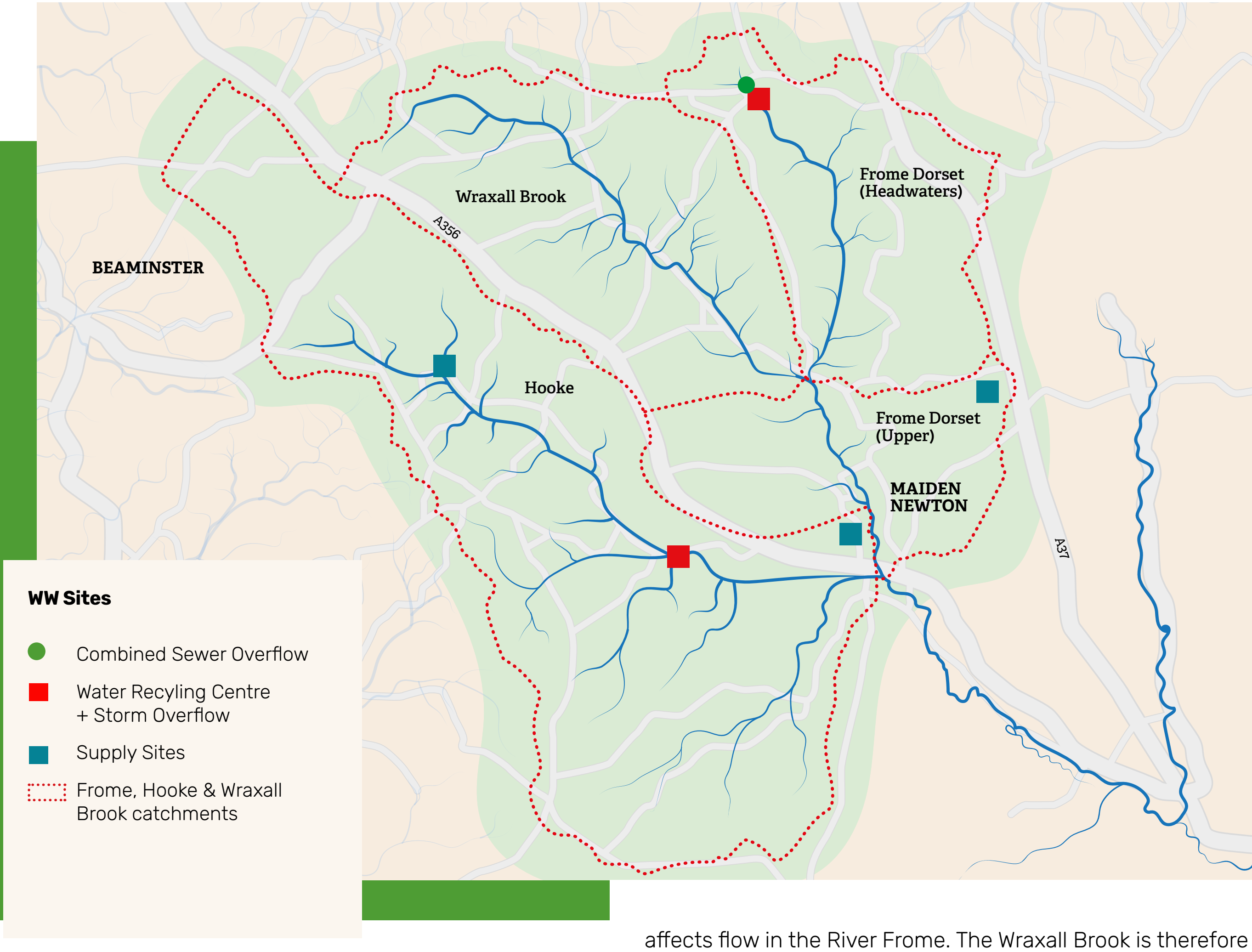
Several footpaths traverse the strategy area, with the Macmillan Way running roughly parallel to the Frome from Evershot to Maiden Newton and the Wessex Ridgeway and Jubilee Trail crossing the Hooke catchment. The latter two routes converge at the Dorset Wildlife Trust Kingcombe Visitor Centre on the banks of the river, used as a base by visitors for walking, bird-watching, and attending wildlife courses and workshops. The other popular stretches of riverside in the area are at Maiden Newton, where both the Hooke and Frome are readily accessible from public footpaths.

The headwaters of the Frome support relatively little recreational fishing, apart from a mile-long beat on the Wraxall Brook downstream of Lower Wraxall, managed by Casterbridge Fisheries Ltd, and a further wild trout beat on the Hooke managed by Wessex Fly Fishing and Chalk Streams Ltd. There is also coarse fishing available on several lakes at Higher Kingcombe, adjacent to the River Hooke, which is partly managed by Dorchester and District Angling Society.

Water company assets in the catchment

Wessex Water is the only water company to operate within the strategy area providing both supply and wastewater services.

Figure 5 Wessex Water supply and waste assets in the strategy area.



Water supply

Wessex Water has three sources of abstraction within the strategy area; at Hooke Springs, Cattistock and Maiden Newton, permitted through abstraction licences issued by the Environment Agency (EA). These are listed in descending order of licensed volume in Table 1 1. The abstraction licence for Hooke Springs contains a provision to protect flow in the River Hooke, known as a minimum prescribed flow (MPF). The licence only allows abstraction when flow in the River Hooke exceeds 3.41 Ml/d (megalitres per day). When abstraction plus river flow is less than 6.36 Ml/d, the MPF is reduced to 2.27 Ml/d.

Abstraction from Hooke has not been limited due to the MPF in the last 8 years.

Abstraction at Hooke affects flow in the River Hooke, whereas abstraction at Cattistock and Maiden Newton affects flow in the River Frome. The Wraxall Brook is therefore not impacted by abstraction, except for private water sources, which appear to be present at Rampisham and Lower Wraxall.

Both Hooke Springs and Cattistock are sources with significant Cryptosporidium risk, therefore abstracted water undergoes Ultra-Violet (UV) treatment before chlorination. All three sources are in the Poole Harbour Nitrate Vulnerable Zone (NVZ), an area deemed to be at high risk from agricultural nitrate pollution.

Water from Hooke Springs supplies Tollerdown Storage Reservoir at the top of the valley and in turn the villages of Mosterton, South Perrott and Corscombe, which are outside of the Frome catchment, as well as Hooke village itself. The Cattistock boreholes supply Wardon Hill Storage Reservoir, serving Frome St Quintin, Cattistock, Holywell, Evershot and just over the watershed, Batcombe. The Maiden Newton source serves its namesake, the largest village in the strategy area, as well as Toller Porcorum and Chilfrome.

Table 1 1 Overview of Wessex Water abstraction sources in the strategy area

Abstractions	Hooke Springs	Cattistock	Maiden Newton
Type	Springs	Boreholes	Borehole + well
Licensed volume	20.5(Ml/wk)	2.73(Ml/d)	0.64(Ml/d)
Licensed volume (Ml/yr)	1064	475	232
Daily equivalent (Ml/d)	2.92	1.30	0.64
Average abstraction in 2023 (Ml/d)	2.53	0.65	0.27
Limit on peak output	N/A	Borehole pump capacity	Licence limiter

The historical abstraction rates from each source are summarised in Figure 6 below. The data show that over recent years, the Cattistock source has been used for around 35% of its licensed volume and the Maiden Newton source has been used for around 50% of its licensed volume whereas, the proportional usage of Hooke Springs is higher, at around 80%.

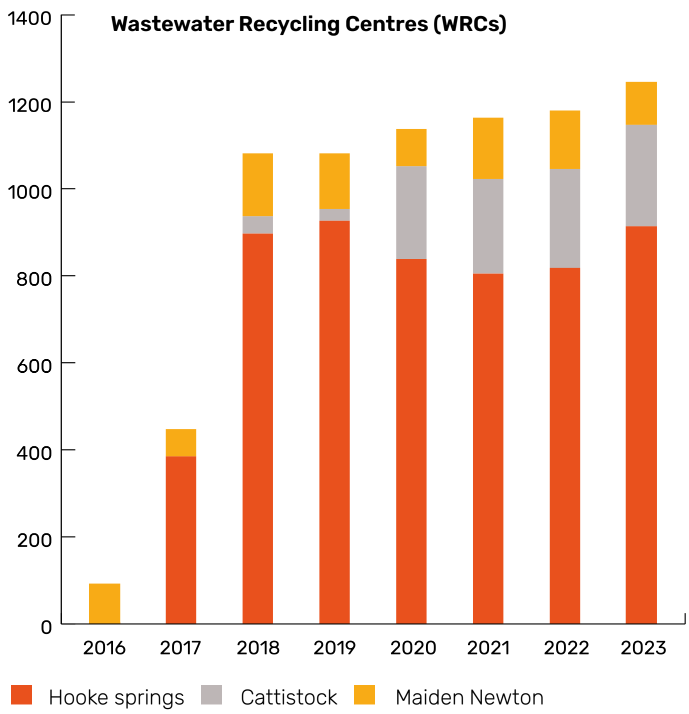


Figure 6 Annual output of Wessex Water abstractions in the strategy area since 2016

Wastewater Recycling Centres (WRCs)

There are two WRCs within the strategy area, at Evershot and Toller Porcorum, Table 1 2 shows an overview of the permits for each WRC. Evershot WRC is located in Frome St Quintin SSSI and discharges into the River Frome, serving approximately 1,445 people with a treatment capacity (full flow treatment; FFT) of 44 m3/d. Toller Porcorum WRC discharges into the River Hooke and serves approximately 295 people with an FFT of 31 m3/d. Both WRCs have event duration monitoring for their storm overflows (SO) which record data at two-minute intervals.

Maiden Newton WRC discharges into the River Frome downstream of its confluence with the River Hooke, though it serves properties within the strategy area, around Maiden Newton, Tollerford and Cattistock. Evershot and Toller Porcorum WRCs only serve their immediate villages, leaving much of the strategy area, including Hooke, Rampisham and Frome St Quintin, unconnected to mains sewerage.

Table 1 2 Overview of Wessex Water WRC permits in the strategy area.

WRCs	Evershot WRC	Toller Porcorum WRC
Population equivalent (PE)	1,445	295
Ammoniacal nitrogen consent (mg/l, 95% limit)	3	10
BOD ATU consent (mg/l, 95% limit)	12	20
Dry weather flow (m3/d)	146	77
Suspended solids (mg/l, 95% limit)	24	30
Flow to full treatment (l/s)	3.4	4.03

Storm overflows

Storm overflows (SOs) are part of a legacy 'combined sewer' system, which carries both surface water (run-off from roofs, gutters, roads etc) and the foul water from homes and industries, together in one pipe. Combined rainwater and sewage are then transported to a WRC to be treated. During a storm event, heavy or prolonged rainfall can rapidly increase the flow in a combined sewer and cause it to become overwhelmed. SOs are designed to release excess the diluted stormwater into rivers or the sea when this happens to prevent sewer overflows elsewhere in the network, including customers' homes.

Sometimes groundwater, held within rocks and soil, also gets into drains and sewers. This is known as groundwater infiltration and normally happens during or after heavy or prolonged rainfall. Most homes are connected to a public sewer in the road through private drains which carry the foul water from baths, washing machines and toilets. When groundwater is high, it can be forced into public sewers and private drains through small cracks in pipes or inspection chambers. Over time, these small flows can inundate sewers and cause flooding.

Increasing the size of sewers is expensive and disruptive. However, works are undertaken daily to line and seal pipes across the region. Additionally, nature-based solutions such as wetlands and reedbeds are used, where appropriate, to filter groundwater.

There are three SOs within the strategy area, at Evershot and Toller Porcorum WRCs and Evershot Common, on the Frome just upstream of Evershot WRC (Figure 5). All the SOs have been identified as frequently spilling overflows (FSOs) under Stage 1 of the Storm Overflows Assessment Framework (SOAF), exceeding the average count threshold of 40 spills/year (Table 1 3). Toller Porcorum is part of Wessex Waters Infiltration Reduction Plan and will have additional stormwater storage capacity by March 2025 to reduce overflow spills. All 3 SOs are scheduled for further improvement works by 2030.

Table 1-3 Overview of Wessex Water storm overflows in the strategy area.

	Evershot Common SO	Evershot WRC SO	Toller Porcorum WRC SO
NGR	ST 57608 04621	ST 57802 04367	SY 56612 98026
Average annual spill count (last 3 yrs.)	71	48	43
Average annual spill duration (last 3 yrs.)	109	396	213
Estimated annual spill count due to hydraulic incapacity	58	45	Not assessed
Frequent spiller? (threshold = 40 spills)	YES	YES	YES
Spill cause/ mechanism	Rain/surface water	Rain/surface water	Groundwater ingress

1.3.Catchment processes and geomorphology

A specific survey of the landscape of the river called a fluvial audit, is a technical approach to assessing the habitat and hydrology of a river and its catchment. The audit of the Frome Headwaters has taken a baseline understanding of geomorphological processes and overlaid the findings of walkover surveys to identify where working with natural processes, natural flood management (NFM) and channel enhancement or restoration options would improve the river habitat and function. To understand the catchment, the audit included:

- Developing a database to assess the geomorphological and hydrological condition of the catchment, as well as sediment-related issues.
- Mapping the river into morphological reach types based on sediment processes, floodplain connectivity, hydraulic habitat, bank instability zones, as well as areas of channel modification and barriers to fish passage.
- Analysing runoff and sediment pathways from the catchment slopes to identify at a field scale potentially significant sources of sediment and associated nutrient delivery into the river.
- Provided a solution-focused understanding at the reach scale along with wider catchment scale issues informing the development of potential NFM measures to reduce flood risk and gain multiple benefits.

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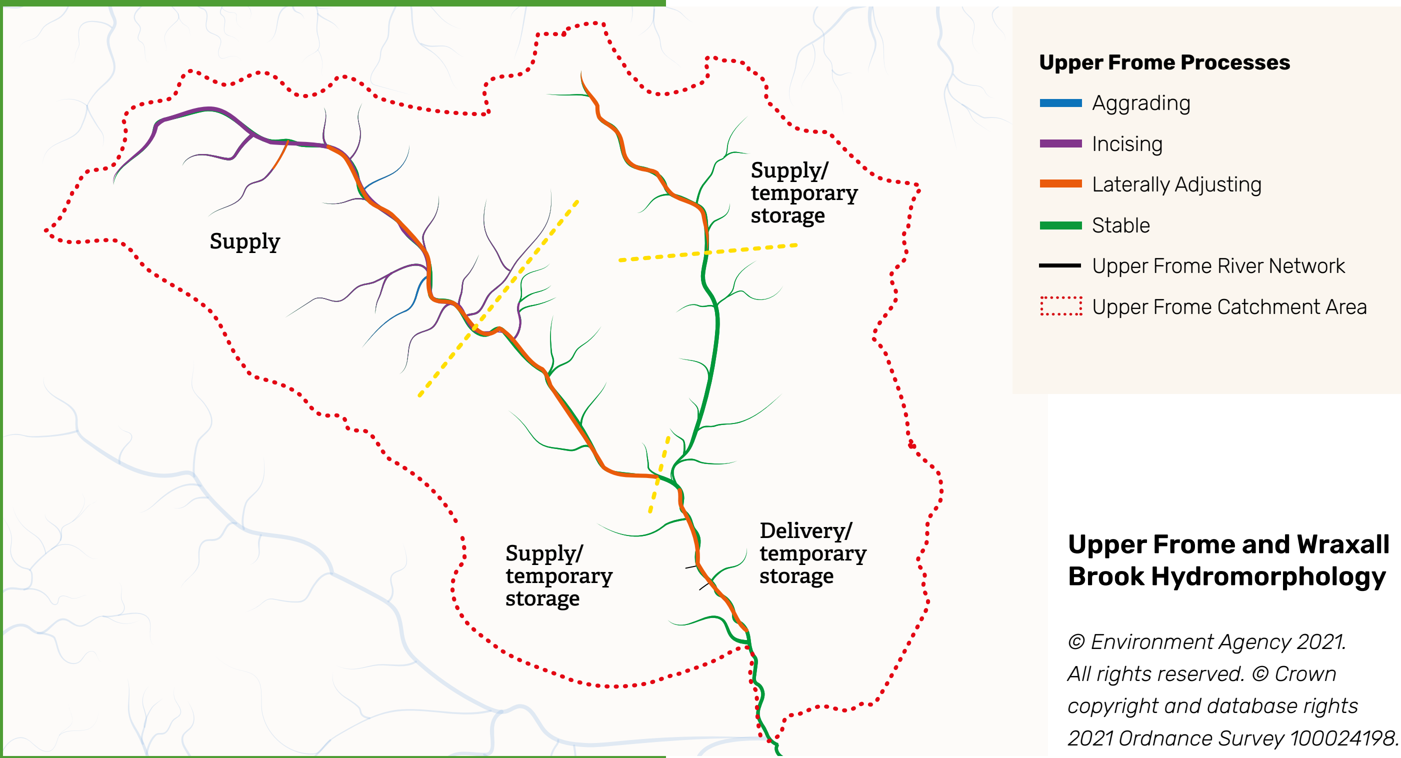
River Frome headwaters and Wraxall Brook

Based on the fluvial audit, the catchment has been divided to summarise the relative importance of hydro morphological elements in the functioning of the Upper Frome and Wraxall Brook catchment. The audit summarises the reaches of the river where different natural processes are occurring and how this impacts the movement of sediment (coarse and fine) within the catchment. The catchment can be crudely divided into areas which are net providers of flow and sediment; stores of sediment; and areas where both factors are operating.



Upper Frome and Wraxall Brook Hydromorphology

Sediment supply areas result from the following:

- Specific field-scale issues where diffuse runoff and soil loss from fields are concentrated to develop rills or flow pathways, often enhanced by drainage from fields. These pathways are then connected to the stream or river network at specific points.
- Concentration of spring sources into flow channels which are often straight and incised, so they have no connection with the adjacent floodplain. The channels provide an efficient pathway to channel the springs' flow and concentrate any associated overland flow that joins.

Sediment supply/temporary storage areas are characteristically:

- Reaches of the tributary streams or rivers where bank erosion is active and obvious, along with associated in-channel storage of fine (sand-clay sized particles) material as a covering of the bed of the channel.
- Areas where both flow and sediment factors are operating tend to be reaches which receive flow and sediment sources and the river adjusts morphologically to the changing conditions.

Sediment delivery and storage catchment areas are:

- Modified channels that have been straightened to remove flow variability and alter the natural energy of the river to provide efficient passage of water through a reach.
- Reduced gradient channels which lead to in-channel deposition and connection to the adjacent floodplain.

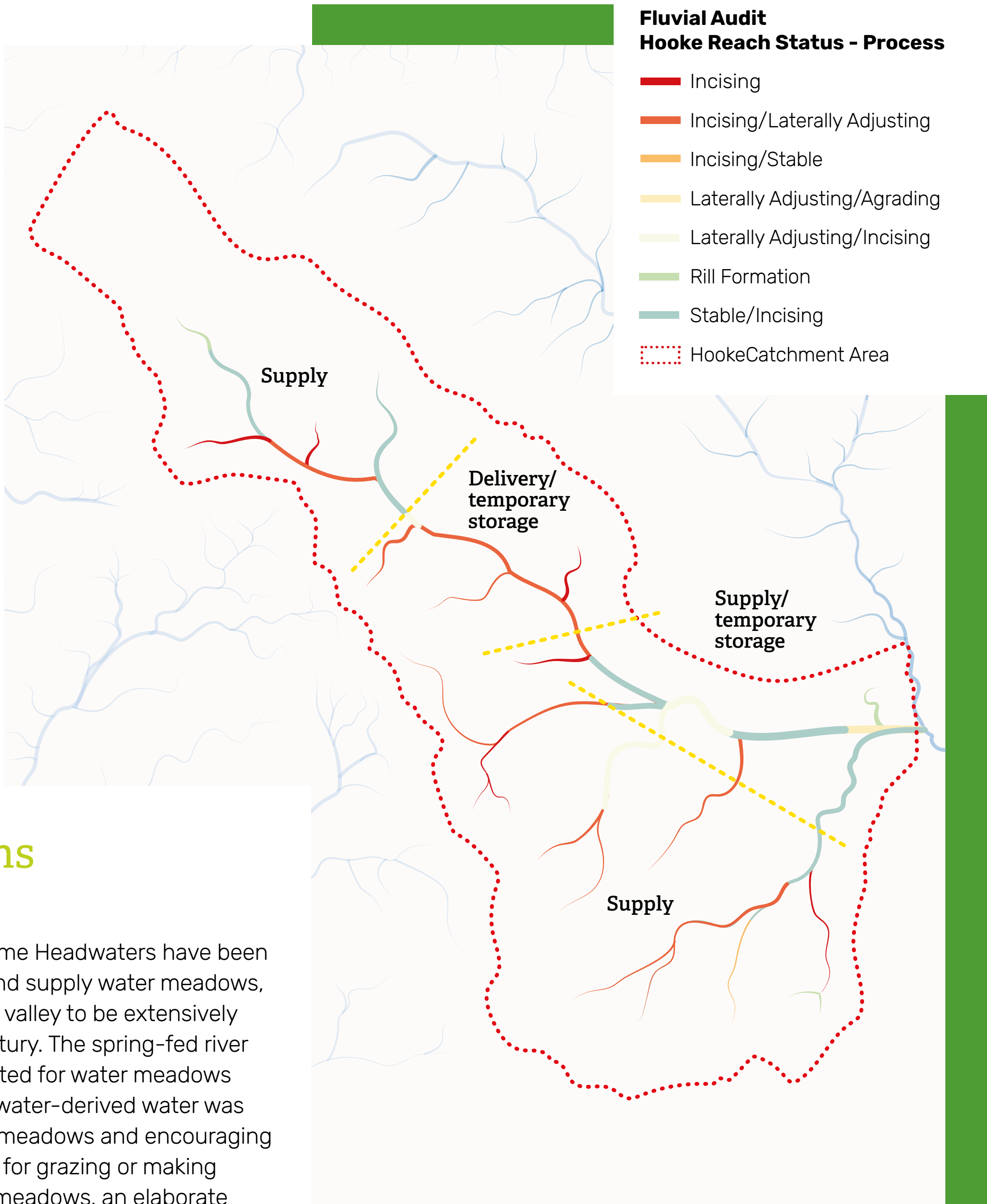
River Hooke

As with the Upper Frome and Wraxall Brook catchments, the Hooke can be broadly divided into areas which are net providers of flow-related factors (sources or stores of sediment) and areas where both factors are operating. Flow providing areas result from the following:

- Efficient pathways by concentration of spring sources into flow channels which are often straight and incised, so they have no connection with the adjacent floodplain.
- Straightened and modified channels which remove flow variability and provide efficient passage of water through a reach.

The sediment source areas are characterised by:

- Specific field-scale issues which concentrate into shallow soil channels or flow pathways, often enhanced by routes along tracks or roads.
- Reaches of tributary streams or rivers where bank erosion is active and obvious.



River Hooke Hydromorphology

River modifications

Historically, the channels of the Frome Headwaters have been modified and controlled to create and supply water meadows, which also caused the wider Frome valley to be extensively altered during the seventeenth century. The spring-fed river from the chalk geology was well suited for water meadows and the temperature of the groundwater-derived water was ideal for keeping the frost from the meadows and encouraging an early growth of grass to be used for grazing or making hay. To manage water levels in the meadows, an elaborate system of hatches, channels, and drains was installed. The water meadow systems were maintained for more than three hundred years and were of importance to agricultural activities, especially on the River Hooke floodplain, most notably at Toller Porcorum and Toller Fratrum.

The floodplain water meadow systems became much less important in the early twentieth century, with dramatic declines in livestock farming along the River Frome, meaning watering became much less important.

Higher rates of erosion create exposed, overhanging banks and channel margins therefore supporting relatively little emergent plant growth

1.4. Ecology in the catchment

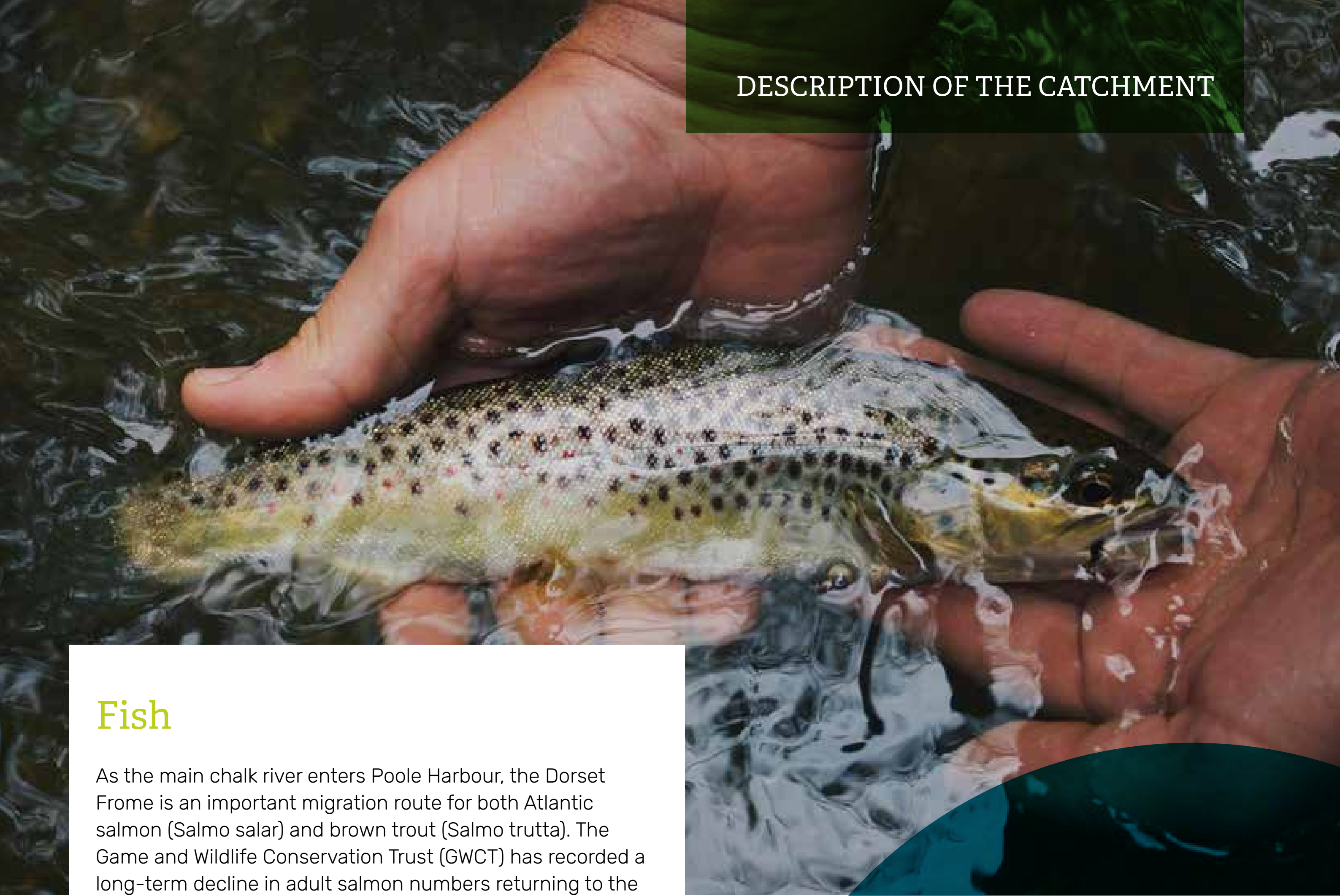
Plants and invertebrates

The macrophyte (plant) and macroinvertebrate (mostly insect) communities of the Frome's headwaters experience subtly different environmental influences from those of other chalk streams, reflecting the underlying geology and its consequences for hydrology and water chemistry. 'Classic' chalk streams with very stable flows, such as those of the Hampshire Basin and the Frome itself further downstream, are characterised by the seasonally predictable growth and retreat of aquatic plants. They correspondingly support an invertebrate community that is largely governed by the habitat features and flow pathways associated with submerged macrophytes (e.g., Ranunculus, Berula, Callitriche), mosses (Fontinalis) and encroaching marginals (Rorippa, Apium).

At the top of the Frome, the typically flashier response to rainfall produces higher-energy streams and more mobile streambeds, limiting instream plant growth and instead, carving out invertebrate habitat niches through picking up, carrying and depositing sediment and the features this creates (e.g., gravel bars, scour pools). Higher rates of erosion create exposed, overhanging banks and channel margins therefore supporting relatively little emergent plant growth, particularly where banks are poached by livestock.

The mixed geology of the Frome's headwaters gives rise to relatively low alkalinities, while the prevalence of greensand elevates phosphate levels. As a result, the streams harbour an unusually high proportion of semi-eutrophic plant species, which on other chalk rivers would typically be found further from the source, including duckweeds (Lemna spp.) and pondweeds (Potamogeton spp.; Haslam, 1978). These are accompanied by an invertebrate community that is taxonomically distinct from that found further downstream towards Dorchester, with higher numbers of species characteristic of moderately nutrient-enriched environments (e.g., leptocerid caddisflies, caenid mayflies) and adapted to lower alkalinities (leuctrid stoneflies). There also appear to be more species adapted to swiftly flowing water (e.g., heptageniid mayflies) and fewer affiliated with Ranunculus (e.g., brachycentrid caddisflies, simuliid blackflies; Cannan & Armitage, 1999).

The countless headwater springs and seepages across the catchments of the Frome, Wraxall Brook and Hooke are known to support diverse wet woodland and fen plant communities (reflected in the SSSI designation of several such sites). They are also likely to harbour distinctive invertebrate assemblages comprising crenophiles (species preferring spring habitats) suited to carbonate-rich, thermally stable waters. As such conditions are highly localised, these habitats could be home to regionally or nationally scarce species.



Fish

As the main chalk river enters Poole Harbour, the Dorset Frome is an important migration route for both Atlantic salmon (Salmo salar) and brown trout (Salmo trutta). The Game and Wildlife Conservation Trust (GWCT) has recorded a long-term decline in adult salmon numbers returning to the Frome since the late 1980s, paralleling population collapses on other rivers feeding the North Atlantic and thus pointing towards a large-scale environmental pressure, likely to be warming sea temperatures (GWCT, 2021). Catchment-specific pressures on fish populations in the headwaters of the Frome include instream barriers to migration, water quality issues and degradation of salmonid spawning habitat due to fine sediment accumulation, bank poaching, and loss of marginal cover and flow.

The fish community of the Frome Headwaters is dominated by brown trout, bullhead (Cottus gobio) and European eel (Anguilla anguilla), with brook lamprey (Lampetra planeri) widely present and both common minnow (Phoxinus phoxinus) and stone loach (Barbatula barbatula) locally abundant. Grayling (Thymallus thymallus) are also present and coarse species such as roach (Rutilus rutilus) may be found downstream of ponds and lakes connected to the river network. Salmon are routinely recorded at Maiden Newton, but this is generally assumed to be their upstream spawning limit (GWCT, 2020).

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1.5. Hydrology in the catchment

River flow has been measured at an EA weir in Hooke Village since 1992 and is used to monitor the effect of abstraction from the public water supply at Hooke Springs (Figure 7). There is a further river monitoring site at Maiden Newton, just downstream of the Hooke/Frome confluence, which provides a flow record back to 2014.

River Hooke

The flow record from the gauging station on the Hooke suggests a trend over the last 10-15 years towards (a) more extreme spate events, with the high-flow winters of 2012-13 and 2013-14 particularly notable; (b) greater interannual flow variability; and (c) less seasonally predictable high flow events.

Figure 7 Daily flow duration curve (FDC) for the Hooke river flow.

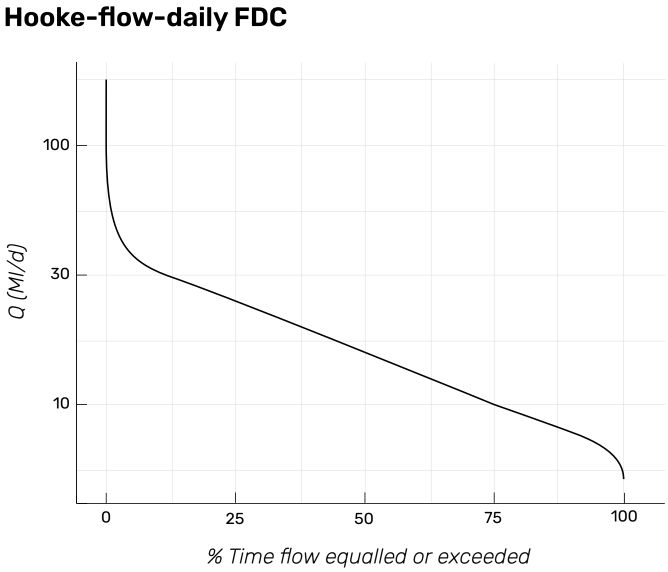
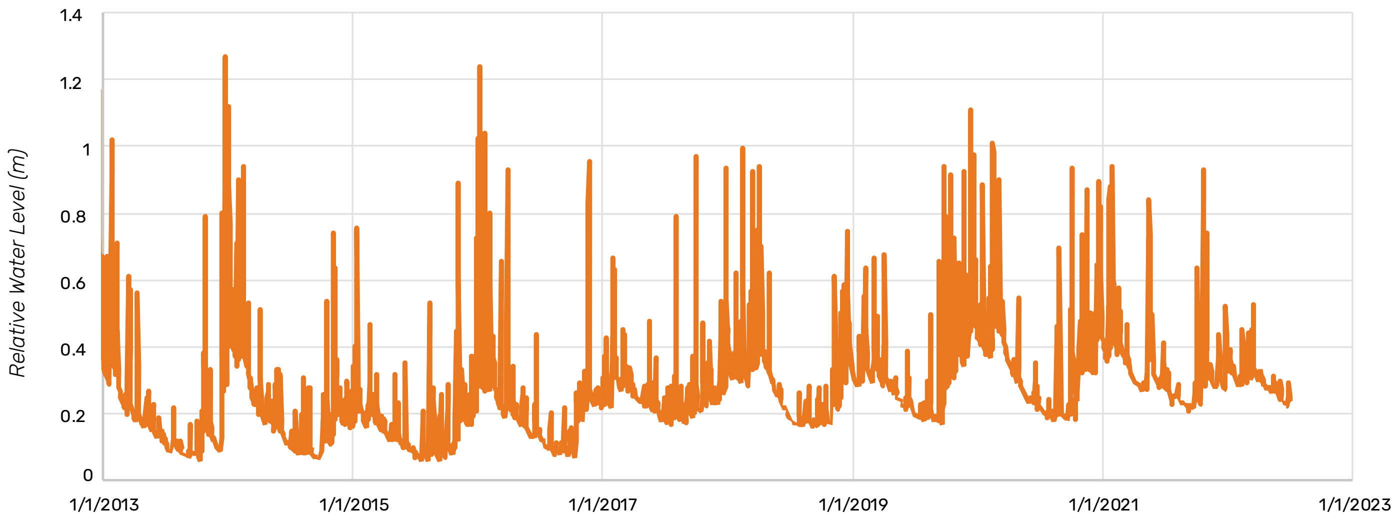


Figure 8 Seasonal change in water level at Maiden Newton with spikes showing how the river responds to rainstorm events and extreme events in the recent past.

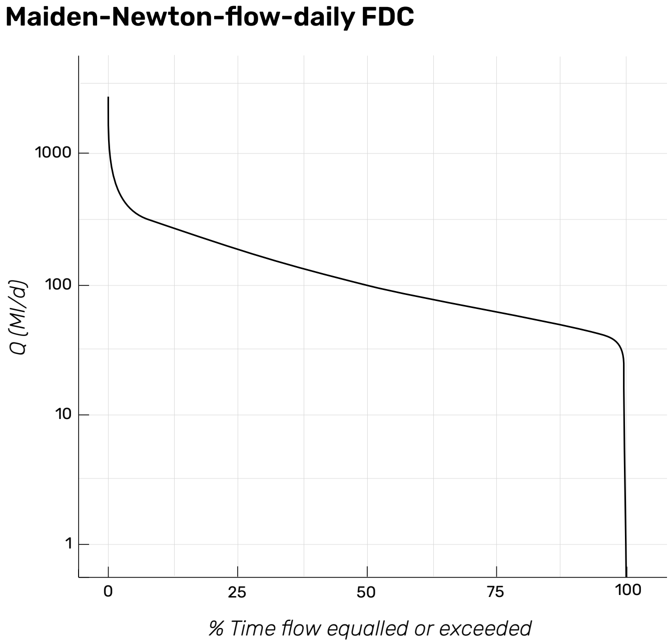


Flow peaks (shown in the Figure 8 below) recorded in November 2016, March 2020, October 2020 and 2021 contrast with the more consistent high-flow window of December-February observed over the earlier part of the record. In most years minimum flows are reached in mid-September to early-October, highlighting the dominance of the groundwater contribution to streamflow despite the mixed catchment geology.

The flow record from the gauging station on the Hooke suggests a trend over the last 10-15 years towards more extreme spate events

Monitoring of flows at Maiden Newton (Figure 9) shows that most of the time, flow in the River Frome, downstream of its confluence with the Hooke, is approximately five times higher than that at Hooke village. The signal of seasonal flow peaks, such as the October 2020 and October 2021 events, is similarly apparent in the record, though minimum annual flows generally appear to be detected earlier than on the upper Hooke (mid-July to mid-September). This could reflect the greater influence of greensand relative to chalk across the Frome, Wraxall Brook and lower Hooke, and the relatively high density of flow-attenuating features (lakes, ponds) upstream of Hooke village, thus delaying the impact of autumn rainfall at the top of the Hooke relative to the wider strategy area.

Figure 9 Daily flow duration curve (FDC) for Maiden Newton river flow



Geological complications mean the headwaters of the River Frome do not respond like a traditional chalk stream. The impact of headwater catchment geology means short peaks in flow as a response to rainfall and runoff from catchment slopes are experienced. These contrast with smaller changes in water level for longer durations that are typical of a pure chalk stream.

The catchment is therefore more vulnerable to the effects of climate change where extremes of weather are experienced. These include short intense periods of rainfall (at any time of year) and prolonged periods of drought.

2. DESIGNATIONS AND DRIVERS

2.1. The 2022 Water Framework Directive (WFD) classification

Based on the latest classification cycle (2022), three of the four constituent WFD waterbodies fail to achieve good ecological status (GES), reflecting moderate classifications for fish, macrophytes, and/or phosphate. Frome Headwaters achieved moderate status for phosphate, with both agriculture and sewage discharge cited as the EA's Reasons for Not Achieving Good (RNAG; Table 2 1).

Relative to the previous (2019) assessment cycle, there has been no change in the overall ecological status of any of the waterbodies. For the River Hooke, the overall biological quality elements have declined from good to moderate due to the decline in macrophytes from good to moderate. However, the physicochemical quality elements have improved from moderate to good due to improvement in phosphate levels from moderate to good. This means there was no overall change in the River Hooke's ecological status.

Table 2 1 WFD classifications of the four water bodies in the strategy area for the latest assessment year (2022).

	Frome (Headwaters)	Frome (Upper)	River Hooke	Wraxall Brook
Waterbody ID	GB108044009620	GB108044009780	GB108044009800	GB108044009610
Hydro-morphological designation	not designated artificial or heavily modified	not designated artificial or heavily modified	not designated artificial or heavily modified	not designated artificial or heavily modified
Length (km)	5.64	4.43	11.28	8.03
Catchment area (km²)	13.82	10.09	40.26	19.21
Overall Water Body	Moderate	Good	Moderate	Moderate
Ecological	Moderate	Good	Moderate	Moderate
Biological quality elements	Moderate	Good	Moderate	Moderate
Macrophytes and Phytobenthos Combined	Good	Good	Moderate	Good
Fish	Moderate	Good	Not assessed	Moderate
Invertebrates	High	High	High	High
Hydro-morphological Support Elements	Supports Good	Supports Good	Supports Good	Supports Good
Hydrological Regime	Supports Good	Supports Good	Does not support good	High
Morphology	Supports Good	Supports Good	Supports Good	Supports Good
Physico-chemical quality elements	Moderate	Good	Good	Good
Ammonia (Phys-Chem)	High	High	High	High
Dissolved oxygen	High	High	High	High
pH	High	High	High	High
Phosphate	Moderate	Good	Good	Good
Temperature	High	High	High	High
Chemical	Fail (PHS)	Fail (PHS)	Fail (PHS)	Fail (PHS)
RNAG	Phosphate (agriculture) Phosphate (sewage discharge)		Phosphate (agriculture) Phosphate (sewage discharge) Flow (below EFI but not causing ecological failure)	

2.2. Other designations and drivers

Conservation designations

There are several nationally important terrestrial Sites of Special Scientific Interest (SSSIs) in the strategy area, most of which are components of a larger internationally important Special Areas of Conservation (SAC), namely West Dorset Alder Woods SAC (Figure 10). The strategy area covers most of the West Dorset Alder Woods SAC, offering an opportunity to ecologically re-connect this highly fragmented, valley-side wetland ecosystem. There is considerable scope for improving the extent and habitat quality of the West Dorset Alder Woods, including associated wetland habitats of springs and seepages; this strategy is at an appropriate scale to maximise these opportunities and there are synergies between the Restoration Action Plan (See section 6.) and nature recovery across the strategy area.

Of the 15 discrete parcels of land that together constitute the SAC, 12 are found in the strategy area, with the other three lying in the catchment of the Mangerton Brook to the west (Table 22). There is also a single National Nature Reserve (NNR) at Kingcombe on the Hooke. The whole strategy area is also part of the Dorset National Landscape (DNL).

Figure 10 Sites with conservation designations in the strategy area.

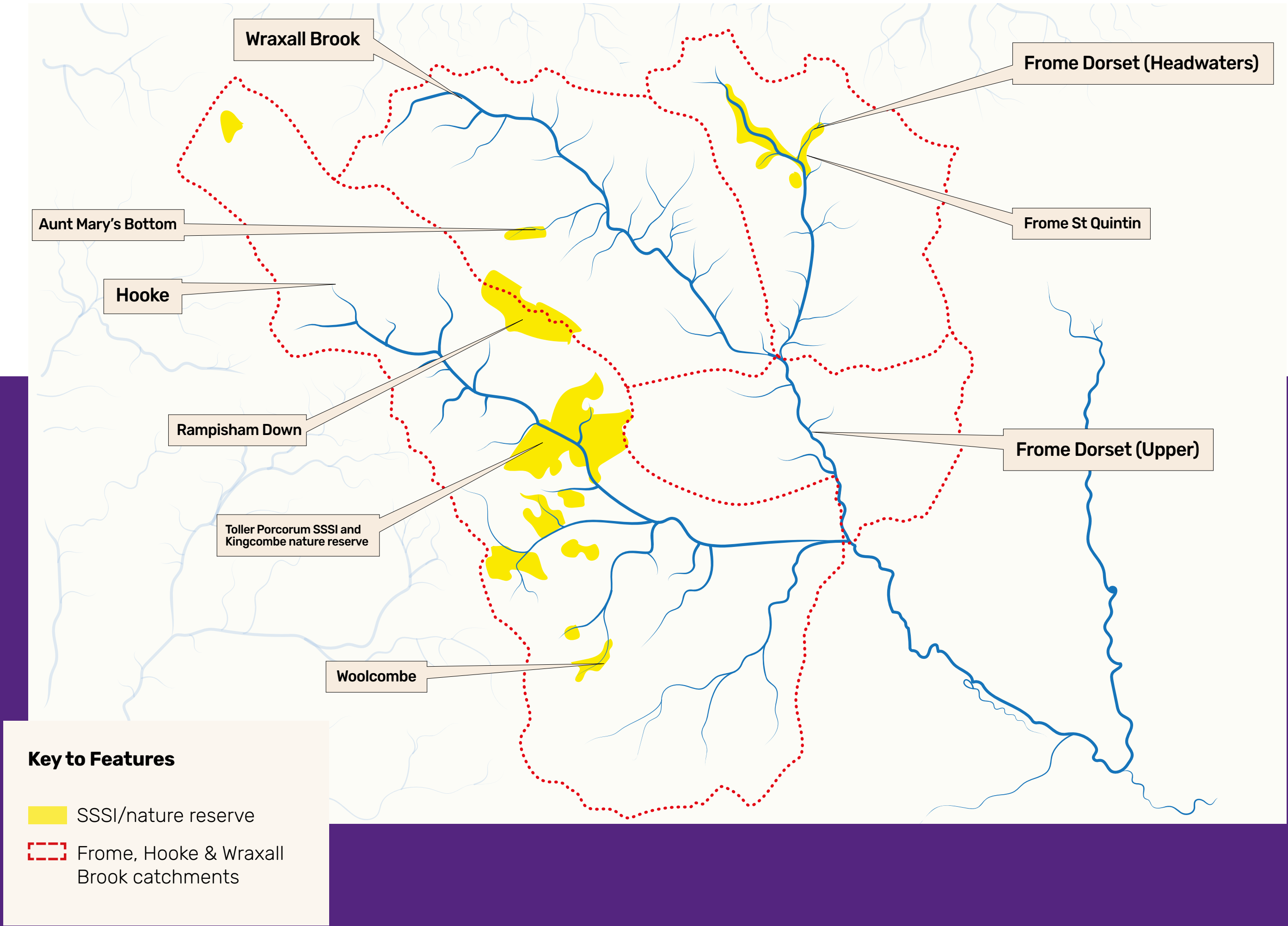


Table 22 List of sites with conservation designations in the strategy area.

Name	Type	Catchment	Area (ha)	Description	Date notified
West Dorset Alder Woods	SAC	Multiple	329	Mixed ash-alder woods developed along the headwaters of base-rich streams and seepages; shallow silty peats and tufa deposits support an important assemblage of specialised invertebrates, including nationally scarce species. Parts of the SAC are associated with valley mires and fen meadows (species-rich purple moor grass, molinia meadow).	2005
Frome St Quintin*	SSSI	Frome	33	Dry and wet woodland of alder, ash and oak, tall herb fen and neutral grassland; the most extensive intact valley mire on Upper Greensand in Dorset	1991
Aunt Mary's Bottom*	SSSI	Wraxall	9	Wet woodland dominated by willow and alder, rich calcareous fen communities and a distinctive bryophyte flora	1991
Rampisham Down	SSSI	Wraxall/ Hooke	70	Unimproved acidic grassland and lowland heath	2014
Toller Porcorum*	SSSI	Hooke	178	Rich grassland communities are rare or absent elsewhere in Dorset; these include dry acidic grasses and herbs, grazed swards on damper soils, traditionally managed hay meadows and species-rich acidic, neutral, and base-rich flushes	1986
Woolcombe*	SSSI	Hooke	19	Wet woodland dominated by willow and alder, rich calcareous fen communities and small areas of unimproved dry acidic grassland on higher slopes; the fen is one of the most extensive of its kind in the county	1986
Kingcombe	NNR	Hooke	310	Encompasses most of Toller Porcorum SSSI as well as the organic farmland of Kingcombe Farm, comprising flower-rich grassland, ancient hedgerows, and rough pasture	2021

** Component of West Dorset Alder Woods SAC*

3. PRESSURES, IMPACTS AND ACTIONS

The ecological health of a chalk strea depends on three main things:

- Water quantity (the naturalness of the flow regime);
- Water quality (how clean the water is); and
- Physical habitat quality (the physical shape of the river but incorporating biological factors like invasive species which can degrade habitat directly and indirectly).

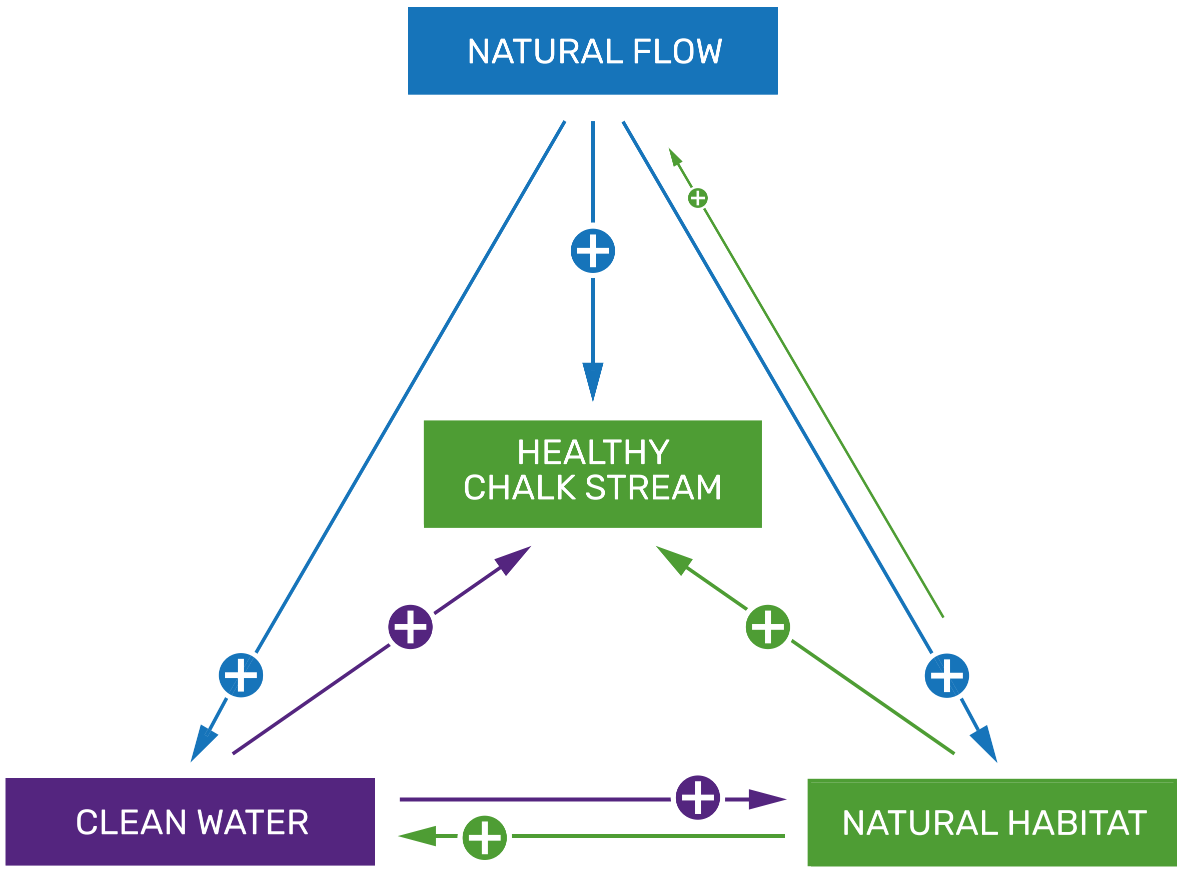


Figure 11. The three pillars of chalk stream health. CaBA, Chalk Stream Restoration Strategy, 2021

This strategy addresses each in turn and all three in combination: We look at these issues singly because it helps to focus, but together too, since it is important to remember how each one affects the others.

Improving the flow will improve river health by improving water quality and physical habitat. However, the benefit of improving flow is greatly increased if water quality and physical habitat are improved too. Improving water quality or physical habitat will likewise enhance the health of the chalk stream, although not as much as when the flow is also re-naturalised.

Within the catchment area, the fluvial audit assessment of hydro-morphological processes identified the following general processes operating in the catchment:

- Field sources where farming practice, drainage, and connectivity to flow pathways lead to significant sources of runoff and sediment from hillslopes that quickly reach the watercourse.
- Livestock access to the channel causing poaching and erosion of riverbanks.
- Land management which is accelerating natural processes.
- Connected spring headwater sources that deliver flow and sediment efficiently to the river along straight, incised channels that are not connected to the floodplain.
- Modified channel alignments that reduce flow and habitat variability, reduce channel length, and increase gradient to efficiently transport water out of the catchment.

In addition to the pressures on habitat and form of the river, other aspects of the catchments are also considered, including:

- Abstractions and discharges in the river.
- Impoundments including interactions with the road network in the catchment area.
- Invasive non-native species.
- Nutrient enrichment.
- Shade or tunnelling from dense tree-lined channel corridors.

The emergence of springs and groundwater in general means water is a valuable resource within the catchment and the catchment has been modified in many ways over time to make use of this valuable resource. Reasons for modification include improving drainage of land for agriculture, retaining water in pond features for various reasons or managing water flow as water meadows as previously described.

The opportunities for catchment improvements through working with natural processes and applying NFM and river restoration techniques are bespoke to each set of circumstances. However, when working with catchment users, some common pressures apply to the general use of the natural resource.

3.1 Water Quantity

Abstraction of water from the catchment's headwater springs is not common practice and only occurs at one location on the River Hooke. Wessex Water's investigations into the impact of abstraction from the springs in 2004 did not identify a significant reduction of available flow in the River Hooke due to abstraction (Wessex Water Investigation, 2004).

The pressures associated with water quantity in the catchment relate more to water feeding the river from slopes throughout the catchment rather than abstraction at the springs

The catchment's spring/groundwater-derived hydrology, along with a general tendency for incision within the stream network means that these slopes can become quickly saturated and generate runoff easily during significant rainstorm events. The incised nature of the tributary streams means that flow concentrated into the tributary streams flows away efficiently and land is easily drained. Slowing flow rather than maintaining downstream drainage should be a catchment-wide approach.

Whilst there are occasional reaches of naturally occurring woody debris in the channel, modification of the channel creating reaches of transfer tends to limit the frequency of in-channel woody material at a catchment scale. The addition of secured coarse woody material to the channel will help to address channel incision and introduce a flow variability that is lacking in transfer reaches. It is however important that the downstream passage of coarse bed material is maintained.

Historical river modifications have detached the river from its adjacent floodplain in several places. Where it no longer interacts with the floodplain, a vital function of the river is bypassed, meaning flow isn't slowed or stored as much within the catchment. Reconnecting the river to its floodplain has the potential benefits of storing water during floods, creating wetland habitat, and storing sediment from being delivered downstream.

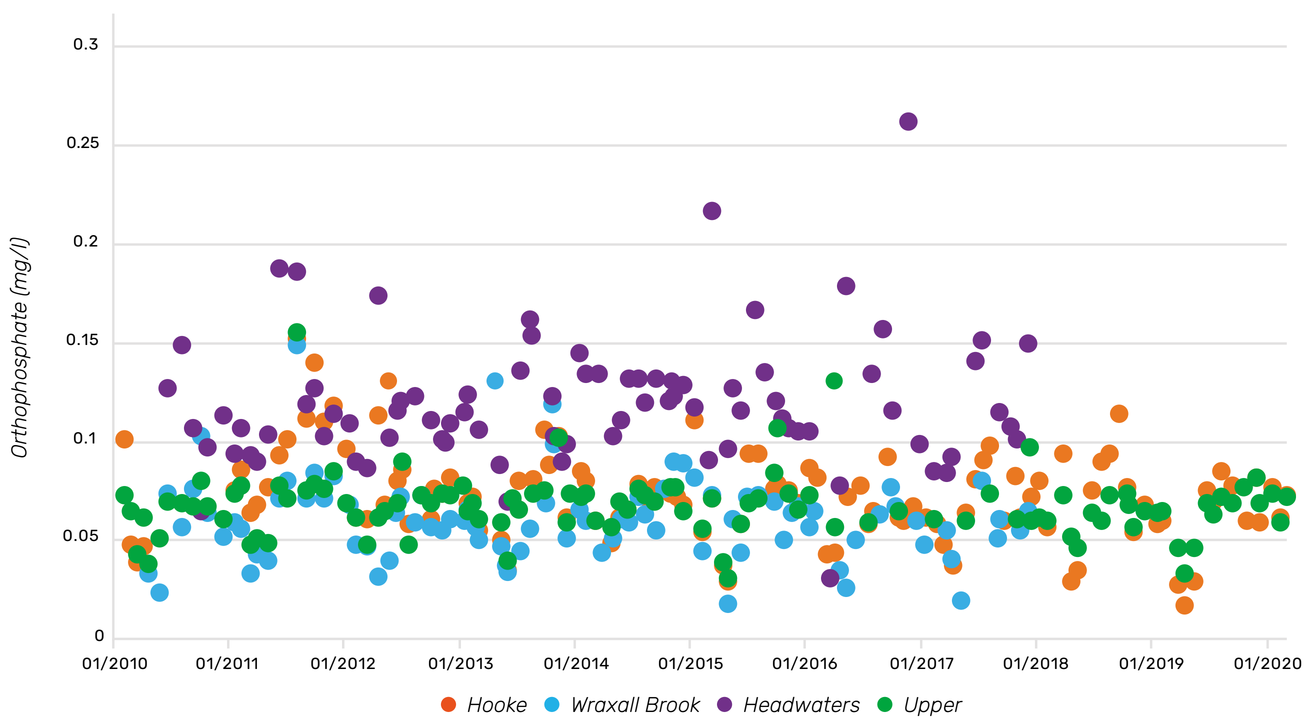
Reconnecting the river to its floodplain has the potential benefits of storing water during floods, creating wetland habitat, and storing sediment from being delivered downstream.

3.2 Water quality

Historical water quality data for the strategy area have been collected and assessed as part of the WFD status assessment. Ammonia concentrations have progressively improved in recent times at most assessment sites, with no major spikes captured on the Frome, Hooke or Wraxall Brook since 2008. A similar pattern is apparent in orthophosphate levels, with clear downward trends on the Wraxall Brook, Hooke and Frome (upper) waterbody since 2000 (Figure 12). However, there is no clear evidence of a post-2010 improvement in orthophosphate levels in the Frome (headwaters) to parallel those observed on the Hooke and the Frome further downstream. Addressing key nutrient sources all the way up to the river's source is therefore a key water quality priority. Elevated nutrients in the Frome headwaters come from two sources: agricultural activity and water company discharges.

Orthophosphate is regarded as the most important indicator of phosphorus within the watercourse and has become essential for the surveillance of wastewater. The UK government has shown the annual average orthophosphate concentration in rivers to range between 0.2 and 1.2 mg/l

Figure 12. Orthophosphate levels within the four waterbodies of the strategy area.



3.3 Agriculture

Arable land is largely cultivated in the headwaters of the Wraxall Brook catchment. Measures to improve soils and their capacity to retain water, combined with minimising runoff to the nearby watercourse are the first way to start to improve water delivery from the catchment.

Livestock farming is prevalent throughout the rest of the catchment. Management is important to reduce impacts from stock which include:

- Access to the channel.
- Eroding channel bank.
- Creation of localised sources of sediment.
- Compaction through trampling, increasing overland flow and runoff generation.
- Creation of crossings or gateways providing localised sediment sources.

Awareness-raising and a review of farming practices in the catchment is recommended concerning the Defra Farming Rules For Water, especially concerning the specific actions "Prevent erosion: manage livestock and soil" and "Manage livestock" within this legislation.

3.4. WRCs

The most significant point sources of nutrients in the strategy area are the WRCs at Evershot and Toller Porcorum (see Table 12), which discharge nutrient-loaded water into the adjacent river. Nutrient runoff from farmland is highly seasonal, peaking in winter when flows are high, whereas WRC discharges are a more constant source of phosphate and nitrate to rivers. WRC discharges will therefore coincide with both the growing season and low flow periods and can correspondingly have more marked local impacts on nutrient concentrations and instream plant growth. As with many small WRCs, the two works are not subject to phosphorus permits so phosphorus stripping is not currently part of the treatment process. The introduction of phosphorus stripping at small WRCs discharging to chalk stream headwaters was one of the recommendations made by the national, CaBA-led Chalk Stream Restoration Group (CSRG), which also proposed using integrated constructed wetlands (ICWs) as a more tractable, nature-based alternative to tertiary treatment.

In addition to the two WRCs operated by Wessex Water, there is a private sewage works at Chantmarle Manor, which appears to be disused, and a sludge storage site at Higher Wraxall. Much of the strategy area is unsewered, and a sizeable proportion of its population, including the inhabitants of Hooke, Rampisham, Lower Wraxall, Frome St Quintin and Chilfrome, use septic tanks for sewage treatment. Septic tanks are not routinely regulated or monitored but can, depending on their location, capacity, age, and state of repair, represent a significant source of nutrients to rivers and streams. This is likely to be the case in the headwaters of the Frome, where relatively impermeable, clay soils may be expected to reduce the efficiency of surface soakaways, causing runoff of septic tank effluent during storm events (Withers et al., 2011). The distribution of soil types suggests that Hooke village is likely to be the primary hotspot for this, followed by the smaller settlements of Toller Fratrum, Uphall (above Rampisham) and Chantmarle.

3.5 Physical habitat

From the assessment of the catchment function, actions can be identified which will make a positive impact. Measures must be bespoke to each location depending on the processes and pressures occurring. Measures at each location have specific roles in meeting the overall objectives but ultimately combine to improve the whole catchment. Lots of smaller actions will make a cumulative difference. To organise the action, the issues activities will address have been grouped below:

Contributory areas:

- Land use on catchment slopes is not always appropriate to the vulnerability of the soil and runoff-generating processes.
- Soils are not protected during key periods such as the winter when natural processes encourage runoff and soil loss.
- Flow pathways are uninterrupted and there is limited storage of water within the catchment.

Transfers:

- Channels are over-deep and have reduced connectivity to the floodplain, meaning they become efficient "canals" to deliver flow downstream.
- Channels are straightened and lack natural wiggle in the river pathway.
- The river cross section has become very uniform and has less interaction with fallen trees and resultant pools and shallows.

Floodplains:

- Channels have been modified and diverted outside of the natural low-lying floodplain.
- Flooding does not always occur in the right place at the right time using the natural floodplain.

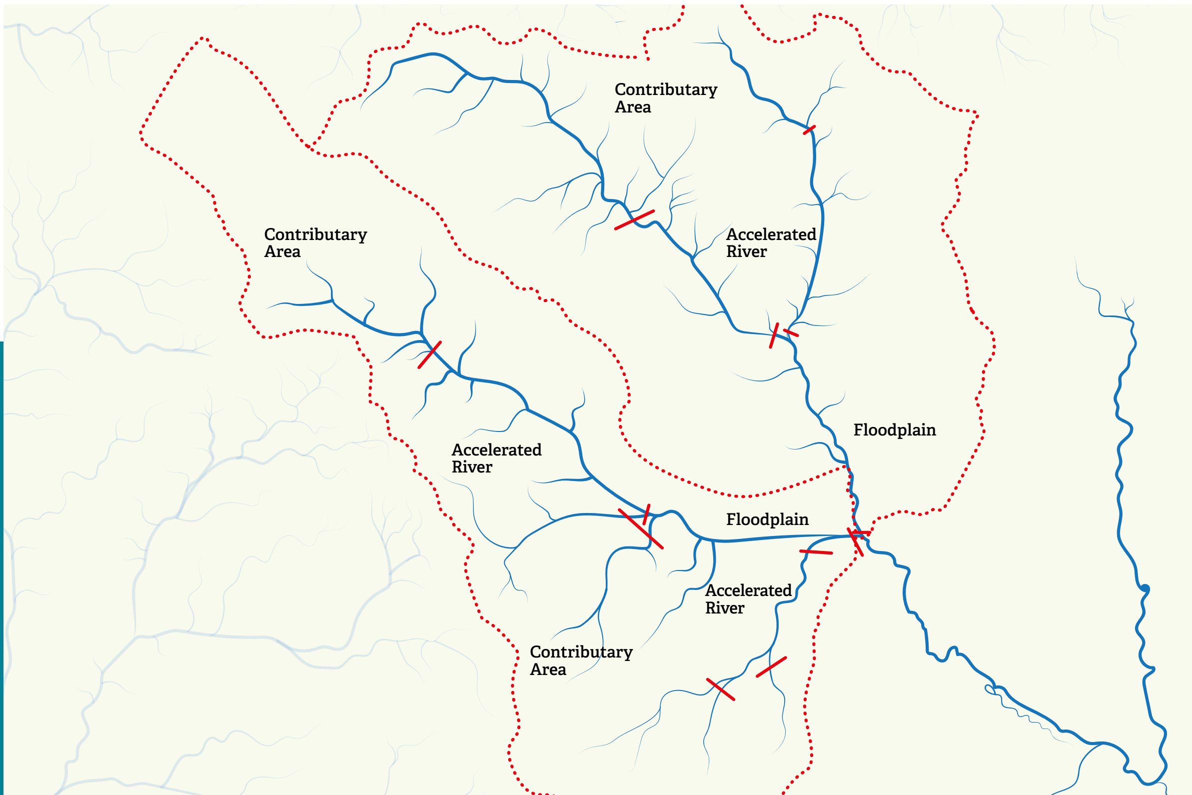


Figure 13. Primary roles of catchment reaches in issues to be solved.

At a catchment level, there is a general reduction in the size of bed material from the headwaters of the Hooke and Wraxall Brook moving downstream. Cumulatively within the catchment, there are several blockages including culverted crossing points which appear to be restricting the downstream delivery of coarse gravel-sized material in preference. Minimising obstacles to the delivery of coarse gravel, reducing inputs of fine sediment and creating flow variability to facilitate transport processes should be a catchment-wide approach to restoring the supply of coarse material to the river downstream.

4. RESTORATION ACTION IN DETAIL

4.1. Addressing diffuse pollution from agriculture

There are several ongoing initiatives within the catchment to work with and support landowners and farmers to reduce their contribution to diffuse pollution, particularly in reducing the washing of nutrients and sediment from the wider catchment area into the watercourses.

Key Issues for flow and sediment management:

- Downstream habitat quality reduction and effects on the river's ecological communities.
- Contribution of collective field runoff to the presence of fertilisers, pesticides, sediments, and faecal bacterial load in the river.
- Reduction of the recreational and cultural amenities of landscapes.

Catchment Sensitive Farming

Catchment Sensitive Farming (CSF) is a joint venture between Natural England (NE) and the EA to tackle sources of diffuse pollution in priority catchments across England. CSF encourages voluntary participation by offering free advice and some incentive payments. Agri-environment schemes (Entry Level Stewardship and Higher-Level Stewardship) have options that can be used to buffer watercourses and reduce the risk of sediment and nutrient loss on susceptible fields. CSF advises on making the best use of these options and includes a capital grant scheme which can provide up to 50% of the cost of installing selected items.

The Frome Headwaters is a CSF Priority Catchment due to the level of sediment, nutrients and some pesticides from agriculture that can be found in both the river and the groundwater.

In the catchment, the most appropriate options include:

- Track surfacing and drains.
- Gate relocation.
- Watercourse fencing.
- Sediment ponds and traps.
- Pesticide-handling facilities and yard works.

Wessex Water catchment management programme

The Wessex Water catchment delivery project commenced in 2005 and was initially targeted at water supply catchments where high or rising nitrate trends were seen. By working with landowners and using nature-based solutions, it was anticipated that the need for Wessex Water to build new treatment works with their associated high carbon and environmental footprints would be reduced.

Wessex Water's approach to bringing about change was to engage with land managers (and others) within the catchment on a voluntary basis and, where appropriate, provide financial support to encourage land managers to implement nitrate leaching reduction measures within specific target areas.

Drinking water safeguard zones - groundwater (SGZs)

SGZs are established around public water supply sources where additional pollution control measures are needed to alleviate the need for additional treatment. The Hooke public water supply source and its SGZ is within the Frome Headwaters catchment. Wessex Water used capture fraction modelling (based on the Wessex Basin groundwater model) to identify areas within the SGZ where 75% of the recharge and existing groundwater is abstracted from the source for public water supply. Within this SGZ target area, Wessex Water has actively engaged with farmers to achieve nitrogen efficiencies leading to reductions in leaching to groundwater.

Dorchester WRC nitrogen offsetting project

Wessex Water has a requirement to reduce the impact the company's WRC at Dorchester has on the level of nitrogen in the catchment. Rather than building carbon-intensive, single-outcome additional treatment at the WRC, Wessex Water is permitted to do this through catchment management similar to that described above. To deliver the N-offsetting project, Wessex Water advisers work with farmers to reduce agricultural nitrate losses from leaching. To achieve the required nitrate loss reductions for this scheme, Wessex Water targeted those areas from which the leaching or runoff of nitrates will reach Poole Harbour most rapidly (i.e., days/weeks/ months/years rather than decades). The area covered by this scheme comprised the Tertiary sediments and riparian areas extending out on the chalk geology where the unsaturated zone is thin so that the travel time of the nitrates to the Harbour is less than 5 years.

Case study: Wessex Water working with landowners (2021-2025).

Alongside the Dorchester WRC nitrogen offsetting project, Wessex Water has been implementing biodiversity improvements in the Poole Harbour catchment for a Water Industry National Environment Plan (WINEP) project. The WINEP project has delivered 70ha of new habitats that will also reduce nitrogen loss, by working with landowners and farmers across the Poole Harbour catchment.

The new habitats created through the project include 5ha of woodlands, 10km of hedgerows with 350 hedgerow trees, 27ha of wildflower margins and 28ha of species-rich grasslands.

One farm in the headwaters of the River Hooke has delivered significant land-use changes on sloped fields where soils are susceptible to runoff generation and erosion. More than 60ha of intensive arable land was reverted to grassland that will receive no nitrate inputs which will provide a reduction in nitrate contributions to the catchment. The biodiversity improvements comprise of over 2ha of woodland planted on the steepest slopes where the development of rills and gullies in fields is common in the winter. This woodland creation will help to block this sediment movement and increase the infiltration of water. The large fields have been split up into smaller parcels by planting 4km of hedges with 200 hedgerow trees, which intercept sediment pathways and have restored historic field patterns. A hectare of chalk grassland has also been restored and expanded. In addition to land use changes, further nature-based solutions have been installed to reduce runoff. Recognising that flow pathways will form, a series of nine scrapes have been dug across two significant pathways to trap sediment, and store and slow the flow of water.

All of the new habitats link up existing areas of biodiversity, by either expanding, improving, or connecting existing habitat fragments, to create ecological networks for wildlife. Monitoring of the new habitats is ongoing and will be summarised in a final report for the project in 2025.

The WINEP project has delivered 70ha of new habitats that will also reduce nitrogen loss, by working with landowners and farmers across the Poole Harbour catchment.

EA programme

The EA's work in the Frome catchment has centred around NFM, nutrient reduction and barrier removal or easement. In the Hooke catchment, the EA has worked with partners to improve floodplain connectivity and install NFM features. In 2023 and 2024 the EA has produced catchment strategies across the Wessex area, with the Frome Headwaters included within the wider Frome and Piddle strategy. These strategies provide a common understanding of issues within catchments and outline priorities and opportunities for integrated working. Nutrients, sediment management and flood risk reduction are all identified as key priorities within the Frome and Piddle strategy.

As part of the EA's contribution to the Catchment Based Approach (CaBA) chalk stream strategy, a locally specific chalk stream strategy has been written for the Wessex area. This highlights the importance of chalk streams and identifies priority areas such as headwater chalk streams, and issues including, diffuse agricultural pollution, artificial constraints on channel form and function. The strategy highlights the importance of partnership working.

The Frome Headwaters Flagship Chalk Stream Restoration Strategy is informed by this EA work. Although it focuses resources on the headwaters area including the source of the Frome, the work described will have beneficial effects throughout the downstream Frome catchment, including in its receiving waterbody, Poole Harbour.

Poole Harbour Nutrient Management Scheme

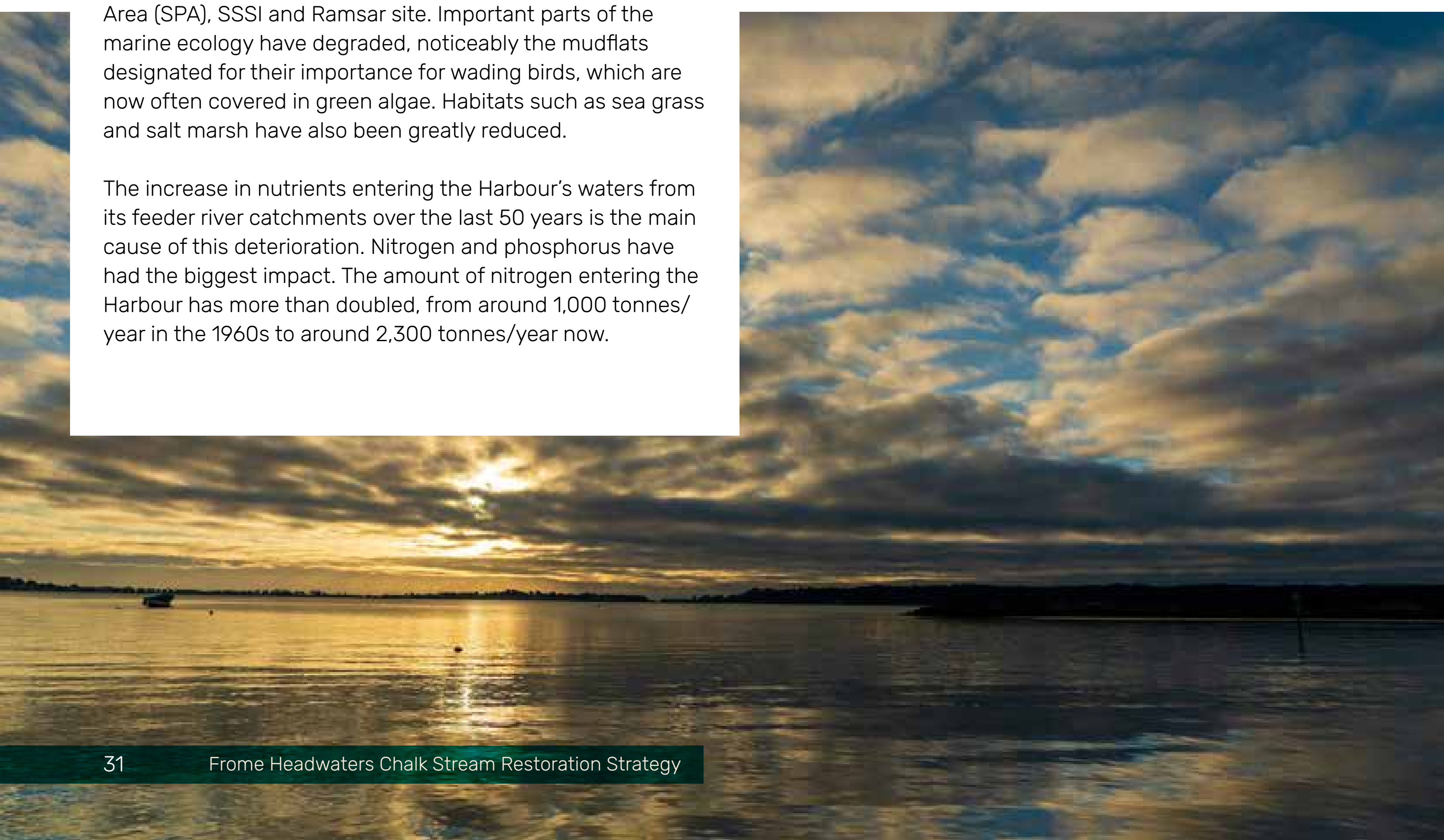
Poole Harbour is a site of international importance for nature conservation - the site is designated as a Special Protection Area (SPA), SSSI and Ramsar site. Important parts of the marine ecology have degraded, noticeably the mudflats designated for their importance for wading birds, which are now often covered in green algae. Habitats such as sea grass and salt marsh have also been greatly reduced.

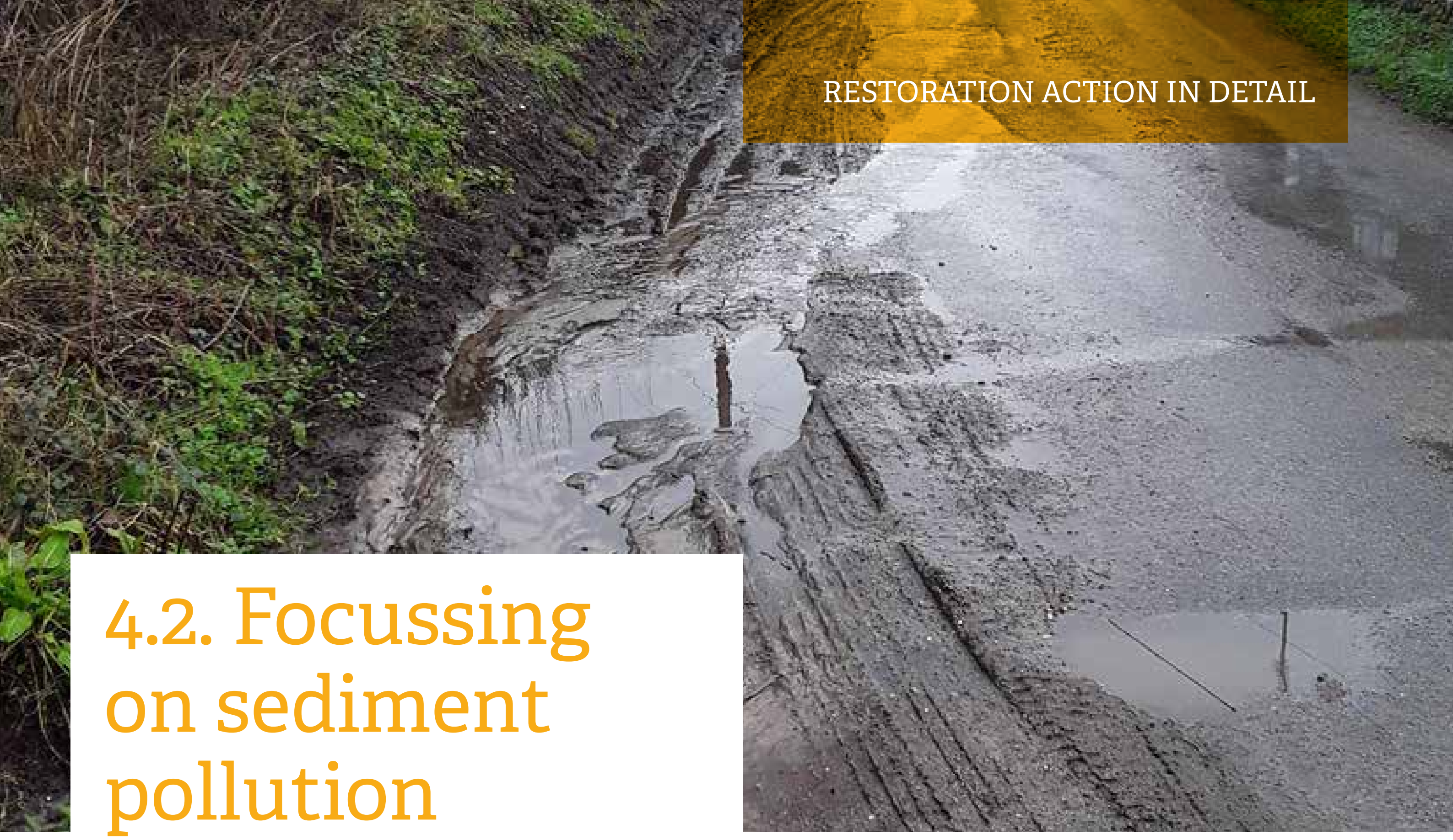
The increase in nutrients entering the Harbour's waters from its feeder river catchments over the last 50 years is the main cause of this deterioration. Nitrogen and phosphorus have had the biggest impact. The amount of nitrogen entering the Harbour has more than doubled, from around 1,000 tonnes/year in the 1960s to around 2,300 tonnes/year now.

In a 2015 Judicial Review brought by the Angling Trust, Fish Legal and WWF, the Government was found to be failing in its task of bringing the level of nutrients in Poole Harbour down to a level where the ecology could recover. As a result of the Judicial Review, the EA and NE implemented a Consent Order, and additional regulations putting emissions reduction requirements on three main sectors (the water industry, housing development and agriculture) at levels which would achieve the required reduction. If targets are not met by 2030, the EA has the power to implement a Water Protection Zone, the terms of which could be catastrophic for many farms in the catchment.

In response to the Consent Order, the agriculture sector, supported by the EA, NE, Dorset Council, Wessex Water, and the Dorset Catchment Partnership, developed a farmer-led scheme which allowed for collaboration within the sector to meet the Consent Order targets at an aggregated scale. Farmers within the scheme are permitted to work to an annually-tightening 'glide path' target for nitrate losses, accounted for through an approved tool and, if each year's target is reached, scheme members can then trade any overachievements with third parties as nitrate credits. Scheme members report their nutrient accounts to the scheme administration and are granted anonymity to the EA as a regulator in terms of declaring their nitrate losses, buying them time to transition to a sustainable, nitrate-efficient farming model. Farmers outside the scheme must report individually, directly to the regulator, and cannot trade additional reduction credits through the scheme.

More information about the Poole Harbour Nutrient Management Scheme can be found here: pooleharbournitrates.org.uk





4.2. Focussing on sediment pollution

Key Issues for flow and sediment management:

- **Raised levels of soil loss due to runoff from fields.**
- **Transport of nutrients including phosphates and nitrates are carried with the soil and water runoff, deteriorating the water quality in the river.**

Specific fields have been identified as active sources of runoff concentration and associated fine sediment loss from the fluvial audit. These fields deliver water flow with a high sediment load to the downstream river. The identified sources expected to deliver the greatest fine sediment load were from arable fields where drainage was connected to the adjacent watercourse.

The fields identified are especially vulnerable to runoff generation and soil loss at specific times of the year when the vegetation cover protecting soils from runoff is reduced. Compaction and poor soil structure also mean the capacity of soil to act as a sponge for water is reduced. Rainfall patterns mean initial loss may be associated with intense, short storms but ongoing runoff and soil loss also occur from prolonged, lower-intensity rainfall, especially where runoff pathways are established.

The fields identified during the survey are notably associated with factors including the emergence of groundwater, underlying bedrock geology or topography.

This strategy recommends addressing the excessive input of runoff and fine sediment from contributory areas by:

- **Reviewing land use appropriate to the risk of runoff and fine sediment generation.**
- **Breaking flow pathway connections from active field sources of runoff and sediment.**
- **Creating in-field buffers for runoff and sediment transport (headlands, hedges, bunds etc.).**
- **Slowing flow in established receiving pathways with leaky debris.**

Case study: Working with farmers to reduce runoff in the River Hooke's headwaters.

In the headwaters of the River Hooke, intensive arable land use on sloped fields, where soils are susceptible to runoff generation and erosion, flow pathways quickly establish, moving significant quantities of sediment. Development of rills and gullies in fields is common every year during the winter and sediment movement causes clear problems including deposits on adjacent roads, leading to increased flood risk and poor road drainage as gullies become blocked with silt.

Wessex Water's advisers have collaborated with farmers and landowners to increase ground cover over the winter period when the soil is most vulnerable either through winter cover crops or changes in land use.

In addition to attempting to stop the runoff and erosion developing advisers have supported farmers to install measures to attempt to slow runoff, reducing its erosive potential, and trap sediment using bunds in low-point field corners within the runoff pathway.

4.3. Focussing on accelerated flow pathways

Key issues for flow and sediment management:

- The loss of soil from fields is joined to the river along efficient tracks or transport routes which join the two.

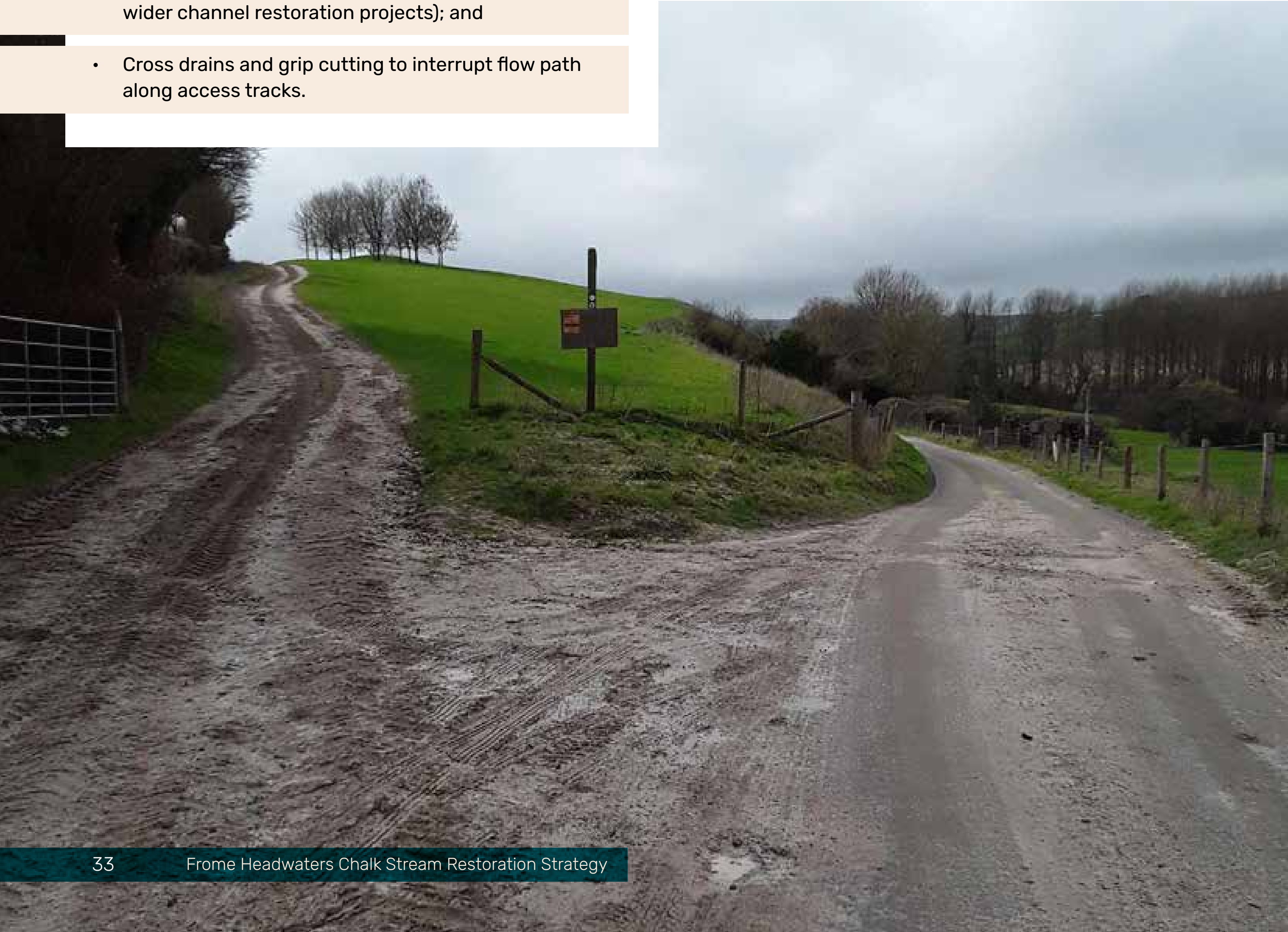
Once runoff has been generated, hard surfaces and defined tracks or transport routes can provide efficient pathways for the delivery of runoff and associated sediment to the water body. Hard surfaces can concentrate flow and increase velocity such that the competence of flow to transport sediment is increased. The pathways themselves may also become a source of eroded sediment. Pathways include:

It is recommended to address the excessive delivery of runoff and sediment in the Frome Headwaters by:

- Review of culvert capacity and management actions at road crossing points.
- Relocation of culvert crossing points (as part of wider channel restoration projects); and
- Cross drains and grip cutting to interrupt flow path along access tracks.

The accelerated delivery of runoff and sediment downslope along farm tracks can have local consequences as well as wider impacts on the receiving river. Where tracks lead to farmyards or join onto roads, problems with flooding and sediment accumulation cause nuisance, especially during intense rainfall.

Collaborating with farmers and landowners we have looked to manage the pathways by disrupting the development of the runoff by diverting through grips or introducing “speed bumps” to help control the pathway and generation of downslope force.



4.4. Restoring connectivity in the upper river channel

Key issues for flow and sediment management:

- Over-efficient flow contained within the channel rapidly delivering water and sediment downstream.
- Reduction of storage of water within the river channel.
- Lack of habitat variation.

Undisturbed natural channels are characterised by the presence of fallen trees which interact with the flow in the river channel to create a diverse habitat. With historical tree clearance limiting the supply of bankside wood, and an over-deepening of channel shape meaning any falling trees often span the width of headwater streams, there is a need to introduce large woody debris into the channel. The over-deepening of the river channel also means banks tend to be more stable, and a lack of lateral channel movement in the floodplain means tree fall is less common.

Fallen trees interacting with the river, causing channel evolution, is a natural process. Introducing wood into the channel can help trap sediment moving downstream and hold back water, slowing the passage of flow through the catchment. By holding back water and increasing deposits, the channel will start to interact more with the adjacent floodplain rather than eroding downwards.

Leaky woody debris dams can be introduced in several ways including:

- Hinging bankside trees.
- X-shaped structures pinned into the channel as leaky dams; and
- Placing trunks longitudinally into the river.

Case study: using leaky woody debris to reconnect the river with its floodplain.

The River Hooke through Kingcombe Meadows nature reserve has historically been modified partially through an upstream realignment of the channel entering the reserve but also through drainage management of the floodplain. The channel flows through a wooded corridor with available adjacent floodplains which could create wet woodland habitat, but an over-deepening of the channel means flow connects less frequently.

The addition of leaky woody debris to the channel by felling selected bankside trees at chosen locations where the bank height is lower is encouraging water levels to rise more when the river is swollen. When the water level backs up, the river is trying to find a new path onto the adjacent floodplain, cutting new channels and creating a more natural, multi-thread channel system in a wet woodland area.

The River Hooke through Kingcombe Meadows nature reserve has historically been modified partially through an upstream realignment of the channel entering the reserve but also through drainage management of the floodplain.

4.5. Reversing canalisation and increasing connectivity

Key issues for flow and sediment management:

- Historical modification to make use of the river's power and water has resulted in the channel being straightened and moved, and water level controls being introduced, reducing the natural form and function of the river.

- Modified rivers can increase the deposition of fine sediment in the river and at the same time prevent valuable coarse gravel from being transported downstream.

Significant reaches of river within the catchment have been modified through realignment, resulting in confined channels that are straightened or in some cases perched outside of the natural floodplain. Incision (downcutting) and entrenchment (bank raising) of channels also occur, resulting in reduced flow variability and associated morphological processes. Channels have become carriers of sediment with little in-channel variability in bed form.

Reaches where the planform of the channel has been straightened or constrained tend to have deeper, smooth-type flow with little flow variability. Where the supply of coarse material has been reduced or where sources of fine sediment join the channel, the coarse gravel bed of the river is smothered with smaller-sized material of fine gravel or smaller. The reduction in flow variability is associated with a reduction in fine sediment mobilisation processes leading to a muddy channel of poor habitat quality.

This strategy recommends that the reduced flow variability of the modified channels is addressed by:

- Creation of flow deflectors and berm features in downstream evolved channels to improve flow variability and in-channel morphological processes.

- The addition of woody debris within the channel, or as berms in reaches designated as sinks, to promote sediment mobilisation.

Case study: adding woody debris to restore natural river processes.

Woody debris has been added into the channel of the Toller Brook at Powerstock Common in carefully selected locations where the channel has been straightened. The woody debris holds back water but also helps to trap gravel and sediment transported by the river. By raising levels and identifying locations where there are adjacent terraces to the river, water is encouraged to spill onto the available floodplain more frequently creating flood storage and morphological diversity. Whilst overtopping banks, the stream is also cutting channels to join flow onto the adjacent land and creating a multi-channel river system.

4.6. Restoring connectivity in the lower river

Key issues for flow and sediment management:

- Modified, straightened channels for drainage have diverted the river outside of its floodplain so the river can't spill its excess water, and more flows downstream.
- Over-deep channels mean connections to the floodplain such as secondary channels do not receive flow as frequently when the river is swollen.
- Modified, straightened channels for railway development have realigned and constrained the river channel from spilling onto the adjacent floodplain.
- The floodplain no longer functions to reduce flood risk.
- Habitat diversity is reduced.

The detachment of the river channel from the floodplain means the flow is contained within the channel and efficiently delivered downstream. The energy-reducing function of the floodplain is decreased. The lack of connectivity with the floodplain means there is no storage of flow or associated sediment during critical spate events when the river is swollen. Floodplain habitats can provide a vital catchment-wide reduction in flood risk and storage of fine sediment load.

Floodplain habitats can provide a vital catchment-wide reduction in flood risk and storage of fine sediment load.

This strategy recommends investigating reconnecting the floodplain of the Wraxall Brook and Upper Frome by:

- Introducing woody debris into the channel to raise water levels within incised channels and encourage the accumulation of coarse material/bedform variability to raise the bed of the channel.
- Re-aligning the channel of the river back into the low point of the floodplain and allowing the river to flow across the floodplain in an unconstrained flow.
- Reducing bank height to allow flow to spill onto the floodplain area.
- Allowing the channel to evolve in an unconstrained flow within the floodplain as space allows.
- Facilitating the development of wetland/fen-type features.

Case study: historical realignment for now-disused water meadows prevents natural river function.

Water meadows created a head of water by realigning channels out of the valley floor to irrigate the floodplain, meaning detaching the river from the natural floodplain. Now the water meadows are no longer operated, the river has been left high above its natural valley floor and is disconnected from the functioning floodplain. Flow in the river therefore no longer interacts with the natural overbank flooding mechanism onto the floodplain for dealing with excess flow in the channel.

4.7. Managing abstraction and water resources

Key issues for flow and sediment management:

- Groundwater abstraction can reduce the amount of water in the river, especially at low flows.
- Low flow stress causes potential habitat disruption.

Chalk stream ecosystems are adapted to relatively stable flows and are therefore sensitive to the impacts of both groundwater abstraction and meteorological drought. The headwaters of the Frome are nonetheless significantly less affected by abstraction than most UK chalk streams. As part of its national strategy, the CSRG summarised abstraction data from chalk stream catchments across the country and reported that recent actual abstraction on the Hooke and the Frome (downstream to Dorchester) was 0% and 0.5% of average recharge respectively (full licence = 0.2% and 0.8%). These figures compare favourably to most chalk streams and fall well within the CSRG target of 10%.

The only abstraction source that has been the subject of detailed environmental investigation is Hooke Springs, the impact of which on the flow and invertebrate fauna of the River Hooke was examined by Wessex Water in 2003-2004 (Wessex Water Investigation, 2004). The report concluded that the abstraction regime at Hooke Springs caused wide diurnal fluctuations in discharge downstream, but these were not sufficient to trigger either low flow stress or high flows associated with bed scour and, even in dry years, discharge exceeded the minimum prescribed flow (MPF) of 3.41 Ml/d. It should however be noted that the current licence conditions stipulate an MPF of 2.27 Ml/d during dry periods.

The 2003-04 investigation estimated that during low flow conditions abstraction accounts for approximately 25% of the river flow at Hooke village, decreasing to 20% at Toller Porcorum. However, the adjacent Hooke Springs Trout Farm, located on a small tributary of the Hooke and partly fed by overflow from the supply source, was found to trigger fluctuations in downstream discharge of up to 80% 3-4 times per day, largely obscuring the signal of abstraction. The invertebrate communities of the River Hooke did not show any clear indication of flow-related stress, although the report noted the potential confounding impact of water quality issues associated with local industries.

The Cattistock source is located in Lankham Bottom, a 46ha nature reserve protected from agricultural improvement and noted for its natural grassland and assemblage of downland butterflies. The catchment of the Maiden Newton source is, in contrast to the other two sources, predominantly arable, and there is a correspondingly greater risk of groundwater contamination from herbicides, fungicides and insecticides and nitrate leaching from fertiliser application. Wessex Water has been collaborating with farmers near the source to encourage responsible herbicide (Bentazone) use, including guidance on areas where the application is to be avoided (shallow and freely draining soils).

4.8. Resolving or mitigating impoundments

Key issues for flow and sediment management:

- Modification to the natural downstream passage of flow and sediment causes an increase in the supply of sediment from headwater sources.
- The analysis of bed composition identified a general downstream reduction in coarse gravel with an associated increase in fine gravel and fine sediment deposits downstream.
- Habitat diversity is reduced.

The fluvial audit has identified several structures which regulate the downstream passage of flow from the Frome headwaters. The structures can be grouped into two types:

- Sluices and water level controls to redistribute flow from the river.
- Crossings where the watercourse is culverted in pipes under roads or tracks. The crossing points can prevent the downstream passage of bed sediment but also the upstream passage of fish.

This strategy recommends rectifying the constrictions of downstream passage by:

- Re-aligning the channel of the river back into the expected natural pathway through the floodplain.
- Modifying any existing overflow pipe connections to connect flow more frequently to the floodplain.
- Reducing bank height to allow flow to spill onto the floodplain area.
- Allowing an unconstrained flow within the floodplain as space allows.
- Allowing wetland/fen-type features to develop.

Case study: modifications and impoundments in the Upper Frome and Hooke catchments

Water level management structures can be identified throughout the catchment area. The majority manage side channels and off-takes from the main channel for various water-dependent activities and, as such, have a localised impact. However, two significant structures can be considered to have wider catchment impacts due to their size. The structures and re-alignment are significant, catchment-wide issues for both downstream sediment supply and upstream fish passage:

1 The reach of the River Hooke in the vicinity of Toller Fratrum extending approximately 1,250m has been re-aligned and impounded. The channel has been disconnected from the floodplain and is divided to create a mill stream and diversion channel on either side of the floodplain with joining transverse water meadow drainage channels on the floodplain. Water levels in the reach are managed by a flow-splitting weir and structure at the upstream end. Both channels are perched above the level of the floodplain, reducing channel gradient such that when the channels re-join at the downstream end of the reach, there is a weir with a drop of approximately 2m. The weir at the downstream end of the reach is the furthest downstream impoundment on the River Hooke and prevents fish passage further up the river.

2 The most significant structure is at the confluence of the Wraxall Brook and the headwaters of the Upper Frome. At this location, a ford is a significant obstruction but, as part of wider flow management at the location, both the Wraxall Brook and Upper Frome have been re-aligned outside of their natural course within the floodplain. Flood relief pipe structures also manage flow at the site.

The catchment-significant re-aligned channel at the confluence of the Frome and Wraxall Brook flows around the outside of the floodplain passing through a ford that is constructed with a series of pipes covered in a concrete crossing. Sediment that accumulates at the ford is of fine gravel or smaller size in contrast to the coarse gravels observed in source channels.

The Wraxall Brook joins the Upper Frome and flows southwards along the margin of the floodplain. The channel is incised and laterally disconnected from the adjacent lower topography of the floodplain. Embankments further downstream also reduce the connectivity of channel flow to the floodplain.

A detailed inspection of the topography of the area using the EA 1m LiDAR Digital Terrain Model shows how the channel has been detached from the local topography. By looking at the relative topography it is possible to visualise the former course of the river and where the floodplain may have been connected.

4.9. Reducing nutrient enrichment

Key issues for flow and sediment management:

- The public perceives the river as polluted.
- Downstream habitat quality reduction and effects on the river ecological communities.
- Reduction of the recreational and cultural amenities of landscapes.

Discharges from WRCs are recognised to increase nutrient levels in their receiving watercourse. Wessex Water and EA records reveal few documented sewage pollution incidents within the strategy area over the last 20 years. With a single exception, namely a sewer blockage in Cattistock in 2005, these have occurred on the sewerage network in Evershot.

Impact assessments have been conducted for Evershot Common and Evershot WRC overflows using the EA's Storm Overflow Assessment Framework (SOAF). The assessment for Evershot Common used aesthetic and invertebrate impacts, which were classified as High and Severe, respectively. The Evershot WRC assessment yielded a High aesthetic impact but no modelled water quality impact (a water quality assessment was conducted instead of an invertebrate assessment due to the confounding upstream impact of the Evershot Common overflow). The Evershot WRC overflow has been subject to public complaints, which concerned 'murky' water being seen downstream of the outfall and sewage overflowing from the storm tanks.

As part of Stage 3 of the SOAF process, 'grey' and 'green' options are being assessed by Wessex Water, both of which address the two sites together, reflecting their proximity to one another. The 'grey' option consists of the construction of a 100 m3 offline storage tank at Evershot Common and increased treatment capacity (FFT) at Evershot WRC. The 'green' option comprises in-catchment surface water separation through Sustainable Drainage Systems (SuDS) (across approximately 4.3 ha of paved and roofed areas).

Stage 4 of the SOAF will yield a decision on the prospective improvement options at Evershot, based on criteria including estimated reductions in spill frequency, financial costs, and wider considerations (carbon impact, disruption due to construction, biodiversity, health, and education benefits). Stage 4 is expected to be completed by 2025, with Stage 5– delivery of the most suitable option– planned for 2025-2035, depending on Defra policy.

It is important to note that the conclusions of the FSO (Frequently Spilling Overflow) assessment of Evershot are independent of the Frome Headwaters Flagship Chalk Stream Restoration Strategy, and Wessex Water does not consider that these wastewater assets will fall under the remit of this strategy from 2025. This flagship strategy considers the improvement of the SOs and WRC at Evershot to be a priority, particularly given their proximity to both the source of the Frome and Frome St Quintin SSSI. Additionally, stormwater storage improvements are being made at Toller Porcorum WRC to improve capacity by 2025.

Although Wessex Water already has planned improvements to their WRCs, Table 4-1 below outlines some potential restoration measures to address water quality pressures in the area.

Water quality pressure	Objective(s)	Possible action(s)
Septic tanks	Understand the impacts of septic tank discharges on river water quality	Identify septic tank runoff and water quality impact hotspots
Aquaculture	Understand the impacts of fish farm effluent on river water quality	Water quality and ecological monitoring upstream and downstream of discharge(s)
Sediment and nutrient runoff	Reduce soil erosion and runoff of sediment and nutrients from farmland. Quantify the relative significance of sediment sources	Work with farmers to increase the uptake of responsible farming practices (ploughing approach, harvest timing, planting of winter cover crops, secure slurry storage) Improve sediment interception across the landscape (drainage grips, bunds) Undertake sediment fingerprinting analyses

Table 4-1 List of potential actions to address water quality pressures in the headwaters of the Frome.

4.10. Reducing overshading to improve fish passage

Key issues for flow and sediment management:

- Excessive shading creates uniform habitats devoid of macrophytes.
- Overshading often accompanies channel modification which deprives the river of its ability to rework bed and bank material and creates artificially stable bankside habitats where mature trees can grow unimpeded.

Unmodified, spring-fed headwaters support wet woodland habitats due to a high-water table. This woodland, comprising trees of varying ages and heights, will naturally create a patchwork of light and shade. This, in turn, increases instream habitat diversity, allowing macrophytes to colonise sunlit areas, improving habitat suitability for salmonid fry and creating important morphological features when woody debris falls into the channel.

However, excessive shading, typically associated with 'tunnelled' vegetation cover (when dense tree cover is present on both banks and overhangs the channel), can give rise to homogeneous habitats devoid of macrophytes. Such overshading often accompanies channel modification, such as diversions, impoundments, straightening and embankments, which deprive the river of its ability to rework bed and bank material, and create artificially stable bankside habitats where mature trees can grow unimpeded.

Notably, the reaches with relatively natural, meandering planforms on the Wraxall Brook (downstream of Rampisham and Lower Wraxall), River Frome (downstream of Chilfrome) and River Hooke (downstream of Toller Porcorum) all exhibit relatively natural levels of streamside tree cover.

Case study: identified tunnelled reaches of the strategy area.

A 2016 Westcountry Rivers Trust (WRT) survey identified sections of tunnelled vegetation on the Frome at Cattistock and upstream of Maiden Newton, and on the Hooke between Hooke village and Higher Kingcombe. Tunnelled stretches are also apparent on the Wraxall Brook immediately upstream of Rampisham village and on the Frome from Chantmarle to Sandhills (sections of the river outside the geographical scope of the WRT report).

Reconnecting the river to the floodplain encourages flow diversity and encourages the interaction of wood with the river.

4.11. Invasive species

Key issues for flow and sediment management:

- Invasive species can negatively alter the ecology of our waters, affect factors such as nutrients and sedimentation and change the physical characteristics of an ecosystem.
- Threats to native species including predation, competition for food and habitat, and spread of disease.
- Potential loss of biodiversity, and extinction of native species.

Non-native invasive species (INNS) can have significant ecosystem-wide impacts through consumptive and non-consumptive effects on native flora and fauna, and habitat engineering. In the headwaters of the Frome, two invasive species are prolific, namely signal crayfish (Pacifastacus leniusculus) and Himalayan balsam (Impatiens glandulifera). These species both appear to be more successful here than on many other chalk streams, likely because the relatively deeply incised river channels provide plentiful burrowing habitat for crayfish and suit the invasive plant's tolerance of steep bank slopes (Faller, 2018).

The morphological impacts of the two species are broadly similar. Signal crayfish destabilise riverbanks through burrowing while Himalayan balsam outcompetes other plants to form monospecific stands that die off in winter, leaving banks bare. Bank erosion and associated issues (loss of marginal habitat, increased fine sediment loads) are therefore common on invaded reaches. Himalayan balsam is widespread throughout the strategy area, with a particular stronghold on the Frome between Chilfrome and Maiden Newton.

Non-native invasive species (INNS) can have significant ecosystem-wide impacts through consumptive and non-consumptive effects on native flora and fauna, and habitat engineering.

5. MONITORING

The measurable intended outcomes of the interventions described in this strategy, for all targeted waterbodies are:

- Reduced suspended sediment levels.
- Reduced nutrient levels.
- Reduced maximum river flows during rainfall events.
- Increased depth and volume of river flows during dry, summer periods.
- Improved distribution, age range (size) and number of species of aquatic invertebrates and fish.
- Improved habitat and biodiversity instream and in the associated floodplains and margins.

A monitoring programme is already in place, but this will be expanded to assess the actions' impact and help target where and how many interventions are most effective.

A monitoring programme is already in place, but this will be expanded to assess the actions' impact and help target where and how many interventions are most effective. A proposed monitoring approach is shown in Table 5-1 below.

Table 5-1 Proposed monitoring approach.

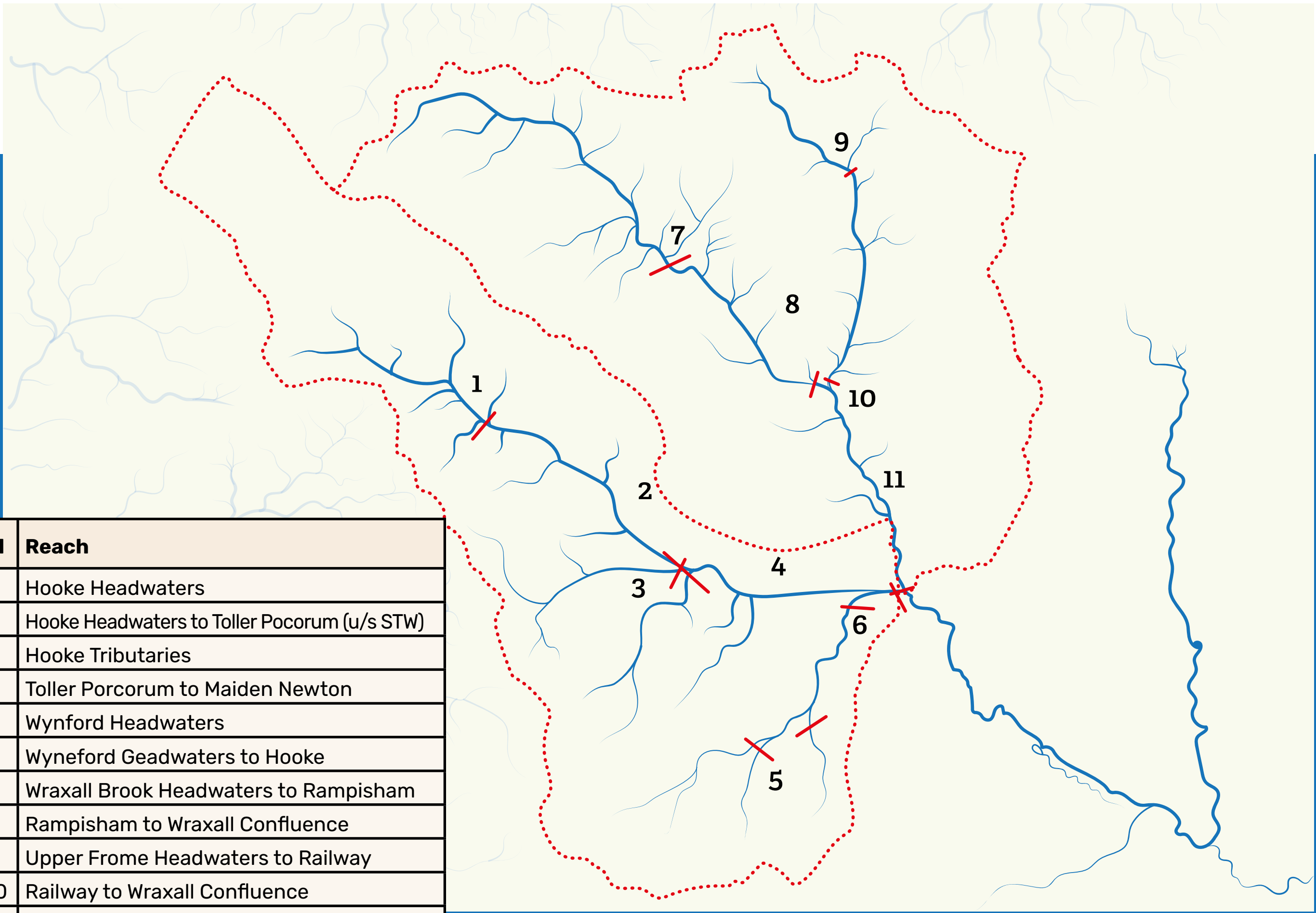
Indicator	Measurable outcome	Monitoring	Sampling Frequency
Sediment mobilisation within the catchment	Increased storage of sediment on catchment hillslopes.	Measurement of depth of sediment trapped at a fixed point within in-field storage.	Seasonal measurement
In-stream invertebrate communities	Increased diversity and abundance at the local scale related to measure. Increased diversity and abundance at the landscape scale.	Anglers' Riverfly Monitoring Initiative (ARMI) scores from repeated point survey. Additional kick samples at points along a reach, identified to species level, to verify and provide context to Riverfly data.	Monthly sampling from year zero Bi-annual (late spring and early autumn)
Water chemistry	Reduction in nutrient loads (nitrate (NO3) and phosphate (TP)) Reduction in total suspended solid loads (TSS) Increased or stable dissolved oxygen (DO).	Repeated point sampling and laboratory water analysis for NO3 and TP. Continuous-sampling turbidity probes, repeated point-sampling, and laboratory water analysis for TSS. Continuous sampling DO probes.	Monthly sampling from year zero Continuous from year zero
Stream flow regime	Stream flow regime becomes shows slower, smaller reactions to rainfall events.	Fixed point photography at in-channel structures. Continuous sampling of water depth via in-stream depth loggers e.g., pressure transducers (water depth to be used as a proxy for flow, with caveats). Reference to EA Flow Gauging.	Continuous from year zero
Stream geomorphology	Stream geomorphology of rivers becomes more heterogeneous with natural processes.	Repeated fluvial audit (or similar approach) surveys in sub-catchments/ reaches.	Years zero and 3
Riparian vegetation	Increased area of wetland-associated habitat types/plant communities.	Mapping of vegetation communities using the UKHab system (in combination with water levels above to indicate greater connectivity of water table with riparian zone).	Years zero and 3
Invertebrate abundance in terrestrial environment	Increased abundance and biomass of flying insects of aquatic origin versus terrestrial origin.	Window trap and/or sticky trap data from grids of traps along stream corridors, with identification to order and biomass estimation from existing length-mass regression data.	Repeated deployment periods from year zero
Fish	Increased fish population and habitat availability.	Walkover survey for habitat assessment to include redd counts. Electrofishing.	Year zero and 3

6. RESTORATION ACTION PLAN

6.1. Restoration units

The catchment has been segmented according to the different pressures and processes occurring (Figure 14). Based on the comprehensive assessment of the catchments, a suite of small-scale actions has been identified within each reach which, if carried out, provide cumulative benefits within each reach, and together across all three headwater catchments. This provides resilience in the event that not all the requisite landowners choose to participate in the project, in that considerable benefits would still be achieved, but offers a comprehensive restoration opportunity if all the actions are completed.

Figure 14 The Frome Headwaters strategy catchment is divided into 11 reaches.



id	Reach
1	Hooke Headwaters
2	Hooke Headwaters to Toller Pocorum (u/s STW)
3	Hooke Tributaries
4	Toller Porcorum to Maiden Newton
5	Wynford Headwaters
6	Wyneford Geadwaters to Hooke
7	Wraxall Brook Headwaters to Rampisham
8	Rampisham to Wraxall Confluence
9	Upper Frome Headwaters to Railway
10	Railway to Wraxall Confluence
11	Wraxall Confluence to Maiden Newton

Table 6-1 The Frome Headwaters Strategy catchment is divided into different areas for pressures and processes.

ID	Reach	Issues	Restoration Measures
1	Hooke Headwaters to Hooke Village (to (1) SY5387 9992)	• Runoff pathways. • Runoff and soil loss from high-risk arable fields. • Accelerated tributary flows. • Disconnected wet woodland. • Road flooding; and • EA gauging weir impoundment.	• Land use change and hedge planting. • Field measures to bund/retain runoff. • Woody debris in the channel to improve river habitat variability. • Beaver introduction. • Wet woodland enhancement. • Channel restoration/wetland. • Road drainage at Knights in the Bottom and Rampisham Hill • Abstraction
2	Hooke Village to Toller Porcorum ((1) SY5387 9992 to (2) SY 5654 9792)	• Disconnected wet wood. • Track Pathway. • Embanked channel reaches. • Modified channel for mill activity. • Shading/tunnelling. • Invasives.	• Wet woodland enhancement with woody debris. • Track management. • Lowering embankments to allow floodplain connection. • Floodplain reconnection by channel restoration.
3	Tributary headwaters to Toller Porcorum (to (2) SY 5654 9792)	• Straight efficient channels. • Road flooding. • Disconnected wet woodland. • Disconnected floodplain. • Ponded storage management.	• Woody debris in-channel. • Wet woodland enhancement with woody debris. • Channel restoration to the natural floodplain. • Creation of bunded storage. • Road drainage at Powerstock Common.
4	Toller Porcorum to Maiden Newton ((2) SY 5654 9792 (3) SY 5963 9765)	• STW discharges. • Road flooding. • Impoundments. • Disconnected floodplain.	• Treatment works infrastructure upgrades. • Road drainage for Toller road. • Impoundment removal/bypass. • Floodplain reconnection.
5	Wynford Headwaters (to (5) SY 5763 9549/ SY 5838 9581)	• Runoff and soil loss from high-risk arable fields. • Runoff pathways. • Accelerated tributary flows. • Disconnected wet woodland.	• Land use. • In-field retention. • Wet woodland. • Track drainage management. • Leaky woody debris (dams).
6	Wynford Eagle to Maiden Newton ((5) SY 5763 9549/ SY 5838 958 to (6) SY 5904 9752)	• Impoundment. • Disconnected floodplain.	• Floodplain connection by channel restoration. • Impoundment removal.
7	Wraxall Headwaters to Rampisham (to (7) ST 5642 0211)	• Runoff and soil loss from high-risk arable fields. • Livestock access to the channel. • Runoff pathways. • Accelerated tributary flows. • Disconnected floodplain. • Disconnected wet woodland. • Road flooding. • Road culvert impoundments.	• Land use change and hedge planting. • Field measures to bund/retain runoff. • Woody debris in the channel to improve river habitat variability. • Wet woodland enhancement. • Channel restoration to floodplain. • Road drainage at Evershot-Rampisham road. • Fencing to prevent livestock access. • Road crossing impoundment assessment.
8	Rampisham to Wraxall Confluence ((7) ST 5642 0211 to (8) ST 5840 0039)	• High-risk fields. • Lack of channel habitat diversity. • Impoundment. • Disconnected floodplain/wet woodland. • Road flooding/road culvert impoundments.	• Land use change. • Field measures to bund/retain runoff. • Woody debris in the channel to improve river habitat variability. • Wet woodland enhancement. • Channel restoration to floodplain.
9	Frome Headwaters to the railway (to (9) ST 5887 0333)	• WRC discharge. • Accelerated flow.	• Treatment works infrastructure upgrade. • Leaky dams to slow flow and enhance wet woodland in SSSI.
10	Railway to Wraxall confluence ((9) ST 5887 0333 to (10) ST 5862 0046)	• Extremely modified channel – straight and constrained by the railway. • Field source. • Livestock access to the channel. • Road flooding.	• Addition of woody material to channel for berms and general bed raising. • Land use change/bunding. • Fencing to restrict livestock. • Road culvert review.
11	Wraxall Confluence to Maiden Newton ((8) ST 5840 0039 / (10) ST 5862 0046 to (11) SY 5963 9766)	• Disconnected floodplain. • Impoundments. • Accelerated runoff along tracks. • Shading/tunnelling. • Reduced in-channel flow habitat.	• Channel restoration to the natural floodplain. • Impoundment removal/bypass. • Track grips and drainage management. • Tree felling and addition of woody debris to the channel.

7. SUMMARY

The Frome Headwaters Flagship Chalk Stream Restoration Strategy has been prepared by Wessex Water in partnership with the project's steering group, including the Environment Agency, Natural England, Dorset Wildlife Trust, Catchment Sensitive Farming, and the Dorset Catchment Partnership. Its findings are based on surveys, historical research, previous publications (see references section) and specialist knowledge of the catchment and chalk streams.

This restoration strategy will help deliver the partnership vision:

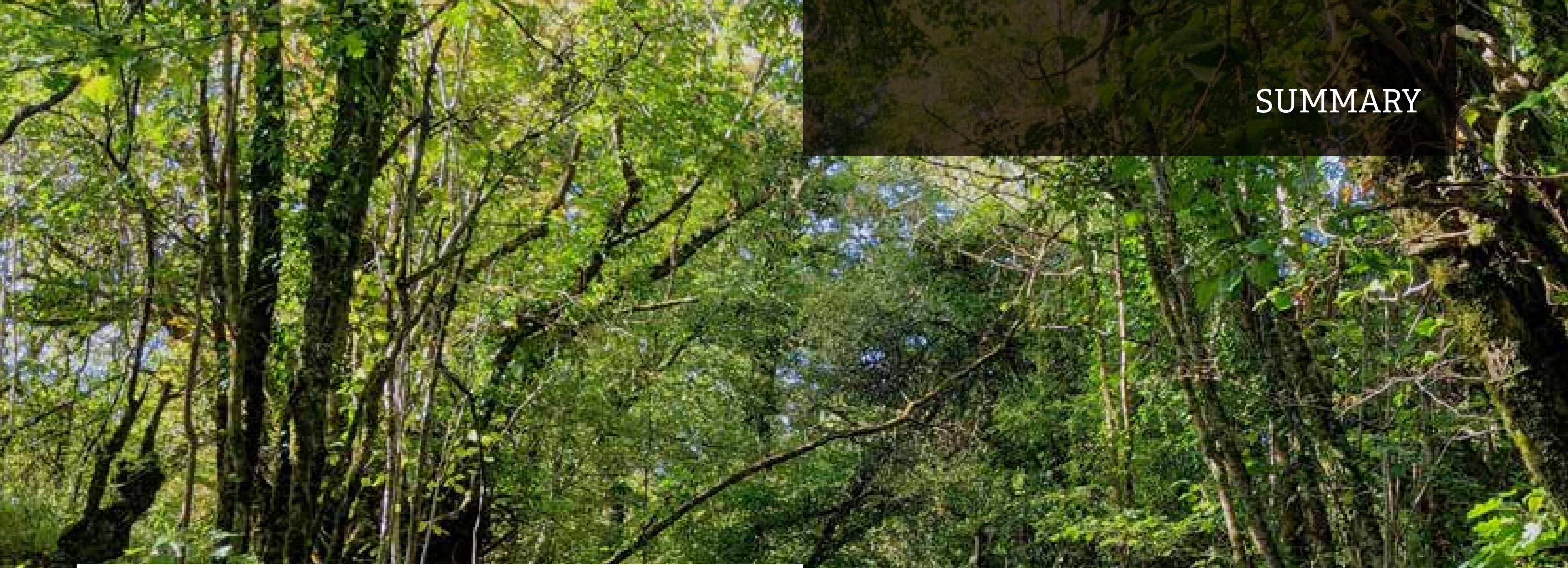
The Frome Headwater catchments will support thriving, clean rivers, which provide high-quality chalk stream habitats for a wide variety of fish and other wildlife. Local communities feel strongly connected to their river, valuing its health, wellbeing, and recreational benefits, and reaping economic benefits attached to sustaining the river's natural function, water quality and habitats.

The strategy is comprehensive and detailed, highlighting the challenges facing the River Frome headwaters and the surrounding catchment area. It provides a vision to guide the recovery and enhancement of the chalk stream's rich and diverse ecology and to achieve "Good Ecological Status or Potential" under the WFD as assimilated into UK law. The strategy provides a blueprint for the restoration of the wider catchment, to be reviewed in line with the Catchment Based Approach and demonstrates the project's delivery partnership's commitment to restoring, conserving, and enhancing the natural environment, recognising the value of the river ecologically, hydrologically, and to local communities.

Interventions have been targeted by dividing the catchment into three fundamental areas: the Contributory Area, the River, and the Floodplain. In a joined-up approach, the interconnectedness of upstream and downstream elements of natural processes in terms of water company assets, flow, and sediment factors are all considered. Historical modifications in the catchment such as water meadows are also considered. Their importance for agricultural activities in the seventeenth century is highlighted, especially on the River Hooke floodplain. Historical use of the catchment is an important context for any restoration considered.

The restoration action plan outlines existing initiatives to tackle diffuse pollution in the River Frome's headwaters, including Catchment Sensitive Farming and Wessex Water's Catchment Management Program. These projects focus on nature-based solutions to improve and create habitats, and to reduce in-river nitrate levels. Case studies show that successful outcomes such as land-use changes and biodiversity enhancements have positive, holistic outcomes.

The strategy builds on existing work to address specific additional challenges like restoring natural morphology, addressing sediment pollution, and reducing the spread of invasive species, and concludes with a thorough assessment of potential restoration measures and plans. In partnership with appropriate organisations and key stakeholders in the catchment, Wessex Water intends to implement ambitious restoration actions as funding becomes available.



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James Burland, Steve Davis, Ken Dolbear, Guy Edwards, Jon Hawkins, Jim Higham, Delphin Jones, Steve Kinnershy, Ashlea Kirk, Hamish Murray, Steve Oliver, Hazel Ormrod, Jeremy Powne, Peter Stone, Christian Steele, Dani Wilson and Wessex Water image library

7.2. References

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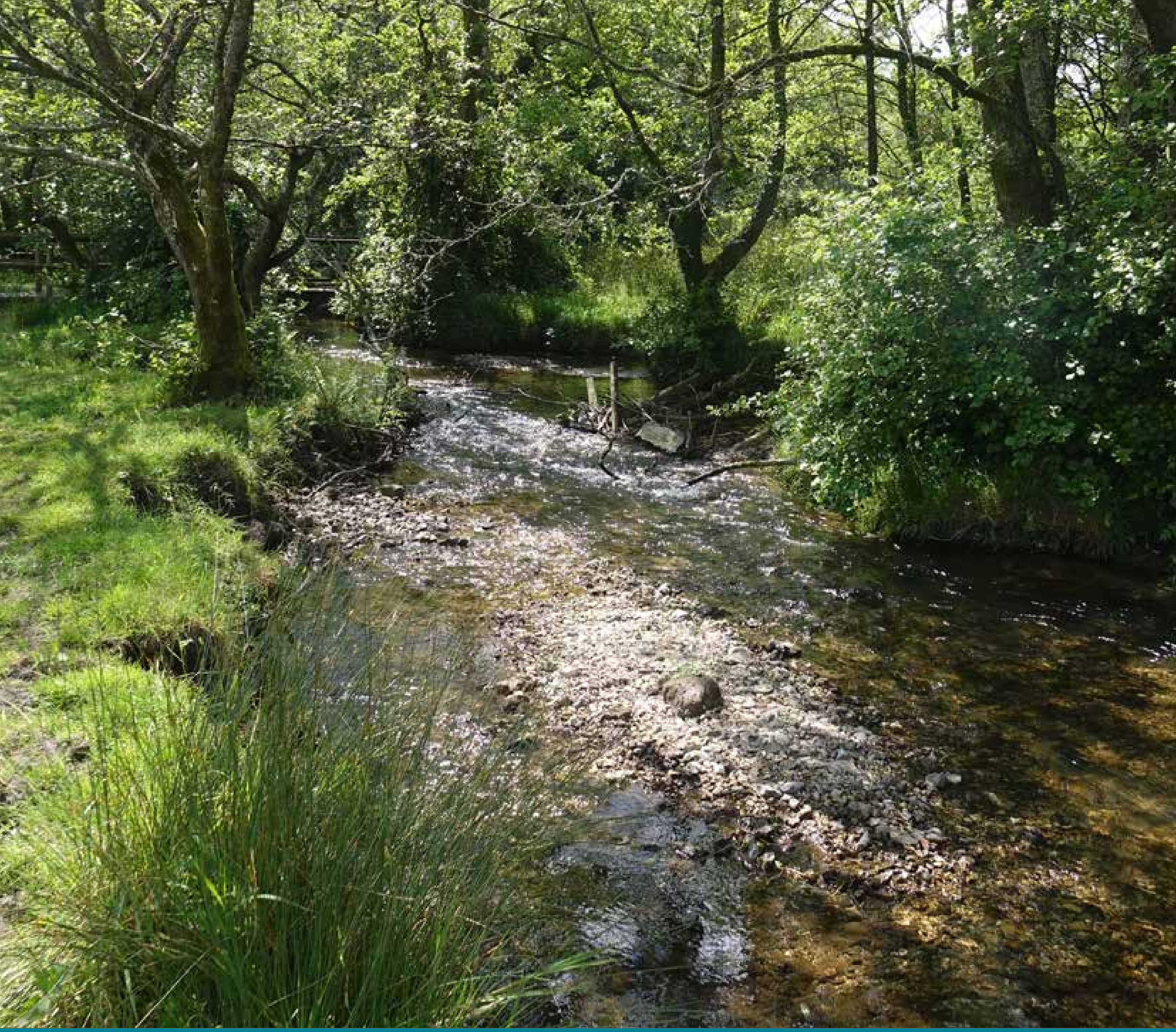

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