Advisory Visit

River Mimram, Hertfordshire

April 2019

Key issues

- Road run-off presented a risk to the overall health of the river. It might be possible to establish buffer planting around the outfalls to mitigate the risk.
- Poorly sorted bedload (especially in the lower reaches of the Park) contained a high proportion of sand and silt. Much of the gravel bed was unsuitable for brown trout to spawn upon.
- The impact of dogs upon the banks was significant. Further control measures should be introduced to better manage how dogs use the site. It will be important to work with the public on this issue in order to avoid conflict.
- Much of the river was over-shaded, but the tree coverage is important for keeping water temperature cool (especially in low-flow rivers). A tree management plan should be agreed so that tree work retains important trees and allows light to the river where it is beneficial.
- Much of the river was over-wide, especially in the wooded reaches. The over-wide channel results in slower flow velocities which are less favourable to brown trout and reduce the river's ability to transport fine sediment.
- A simple habitat enhancement scheme could be worked-up between the Panshanger Angling Club and the Wild Trout Trust to address some of the pressures on that habitat. Techniques that would be effective include brushwood ledges, tree-hinging, fixing large woody material to the riverbed and flow defectors.

1.0 Introduction

This report is the output of a site visit undertaken by Rob Mungovan of the Wild Trout Trust to the River Mimram, Panshanger Park, at the request of the Panshanger Angling Club. Three club members were present for the duration of the visit which was undertaken on the 8th April 2019. Comments in this report are based on observations on the day of the visit and discussions with club members about the river's current management.

The purpose of the visit was to advise on the suitability of the river for wild brown trout, to consider measures that could be implemented to improve habitat for trout and other biodiversity (such as water voles) and how the club might manage the recreational pressures affecting the river.

Normal convention is applied throughout the report with respect to bank identification, i.e. the banks are designated left bank (LB) or right bank (RB) whilst looking downstream.

2.0 Catchment Overview

Table 1 summarises the Water Framework Directive (WFD) data for the River Mimram. The Mimram is classified as overall 'moderate' ecological status. Parameters that make up the overall classification include 'moderate' for fish and 'high' for invertebrates.

The Mimram is a small (~19km long) Hertfordshire chalk stream with a reputation for high water clarity and good fishing for both brown trout and grayling. The catchment has a chalk geology overlain with deposits of clay, sand and flint gravel. The main land use is one of intensive arable farmland yet many river valley meadows remain. The land use changes significantly in the lower reaches, with the catchment becoming urbanised as the river flows through Old Welwyn and the outskirts of Welwyn Garden City, before joining the River Lea at Hertford.

As with many chalkstreams in the region, over-abstraction for public water supply has had a significant impact on flow. The Mimram has been modified by humans for centuries, with records of milling within the catchment in the Domesday Book. In the 1950s, the rate of water abstraction increased significantly to supply the rapid growth of Welwyn Garden City. The majority

of water abstracted from the Mimram is not returned to the river and instead is returned to the River Lea as treated effluent. Hence, the river does not carry the same volume of water that it once did. However, the river does receive direct run-off from main roads including the A1(M) and the A414 which present a threat to water quality especially in low-flow periods.

	Waterbody details
River	River Mimram
WFD Waterbody Name	Mimram (Codicote Bottom to Lea)
Waterbody ID	GB106038033270
Management Catchment	Lea Upper
River Basin District	Thames
Current Ecological Quality	Overall classification of **Moderate** for 2016
U/S Grid Ref inspected	TL 14808 39432
D/S Grid Ref inspected	TL 18128 41498
Length of river inspected	~1.7km

Table 1 Data from https://environment.data.gov.uk/catchment-planning/WaterBody/GB106038033270

Cycle 2 classifications

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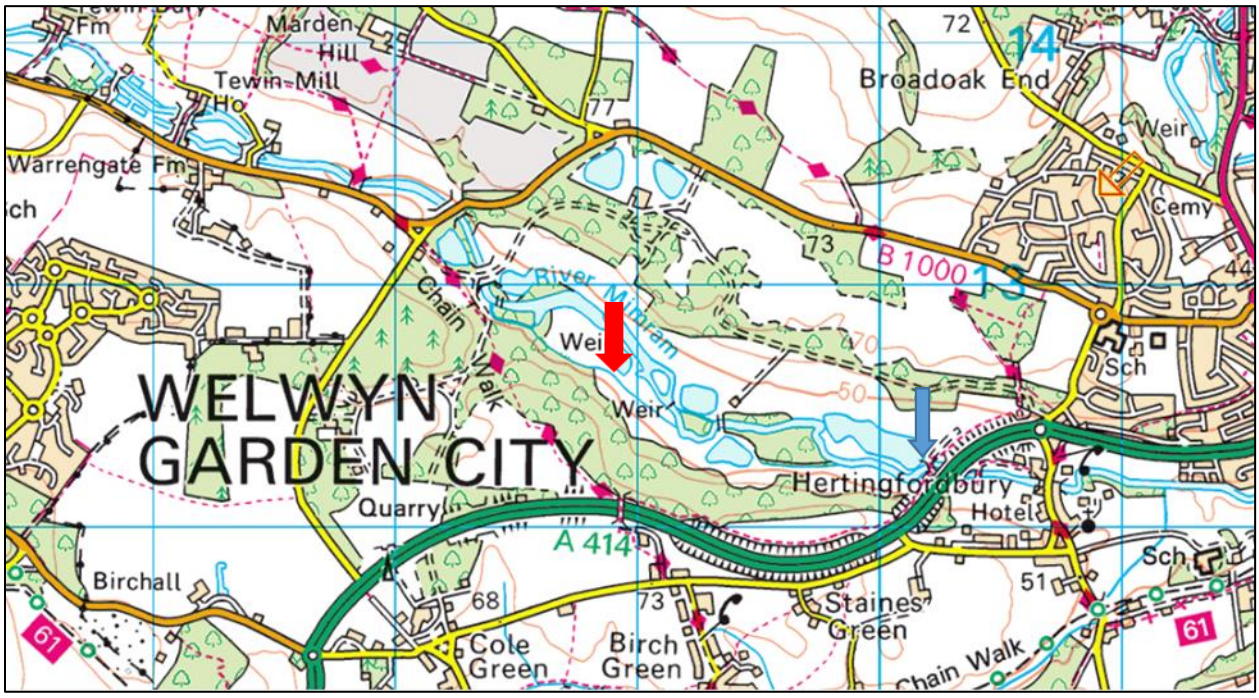
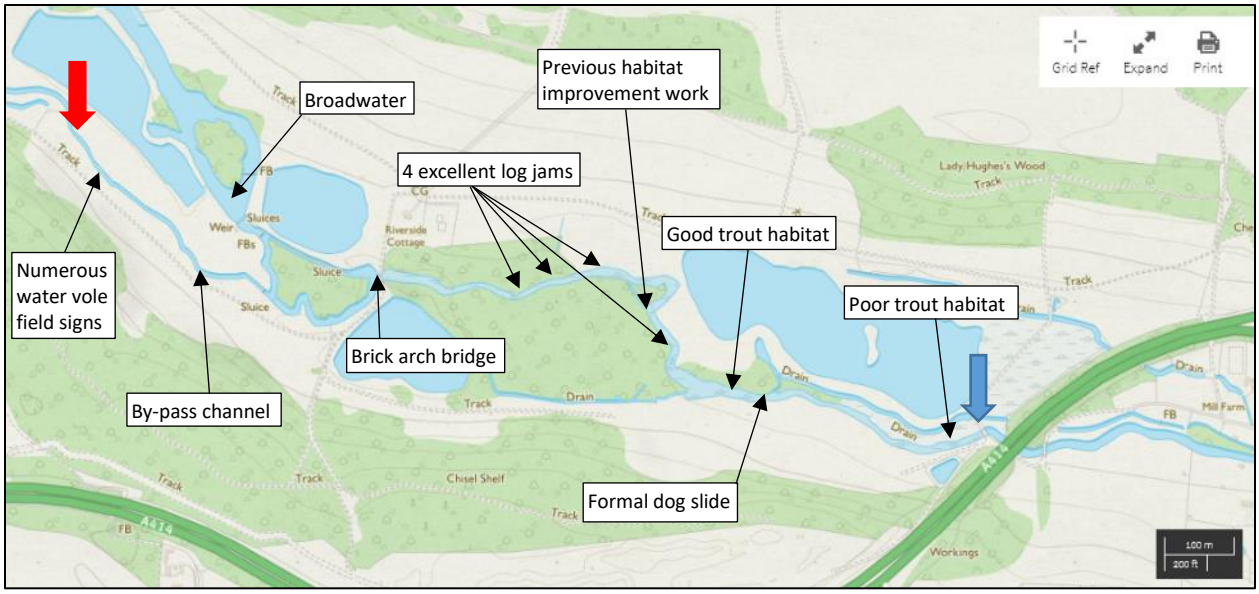
Classification Item	2013	2014	2015	2016
Overall Water Body	Poor	Poor	Moderate	Moderate
Ecological	Poor	Poor	Moderate	Moderate
Biological quality elements	Poor	Poor	Moderate	Moderate
Macrophytes and Phytobenthos Combined	Good	Good	Good	Good
Fish	Poor	Poor	Moderate	Moderate
Invertebrates	High	High	High	High
Hydromorphological Supporting Elements	Supports Good	Supports Good	Supports Good	Supports Good
Hydrological Regime	Does Not Support Good	Does Not Support Good	Does Not Support Good	Does Not Support Good
Morphology	Supports Good	Supports Good	Supports Good	Supports Good
Physico-chemical quality elements	-	-	Good	Good
Specific pollutants	Moderate	Moderate	High	High
Chemical	Good	Good	Good	Good

Table 2 Data from https://environment.data.gov.uk/catchment-planning/WaterBody/GB106038033270



Map 1 – The River Mimram at Panshanger Park. Red arrow is upper limit, blue arrow is downstream limit of visit © Ordnance Survey.



Map 2 – The length of River Mimram visited at Panshanger Park. Red arrow is upper limit, blue arrow is downstream limit of visit. © Ordnance Survey.

The Panshanger Anglers have access to the majority River Mimram through the Panshanger Park, but they do not fish the by-pass channel. They also have fishing in 3 lakes within the Park. The lakes are stocked with a mix of brown and rainbow trout. Occasionally, triploid brown trout are stocked into the river, although none were stocked in 2018. The club has 60 members, with the majority of members fishing the lakes.

EA fish surveys have shown the river to contain a population of wild brown trout and grayling. However, club members have not seen either species of fish spawning within their water. Contact with EA Fisheries Officer, George Horne, has confirmed that redd surveys have been conducted at the Park with evidence of trout spawning seen.

Water voles were present with many field signs observed on the by-pass channel where marginal vegetation was lush and fencing reduced disturbance by dogs. Water voles and their habitat receive full legal protection under the Wildlife and Countryside Act, 1981.

Otters are known to use the river occasionally. Otters are known to be widespread in the region, and their presence is not surprising. Otters and their habitat also receive full legal protection under the Wildlife and Countryside Act, 1981.

3.0 Habitat Assessment

The visit started upstream of A414, where the river was partially shaded with little marginal vegetation and no aquatic weed growth (pic 1). The channel width was ~8m with little flow diversity. The water depth was relatively uniform at ~0.75m. One brown trout of ~20cm was seen. Two outfalls, presumably road drainage from the A414, were noted and appeared to deliver run-off direct to the river, with an accumulation of tell-tale grey silt noted in the vicinity of the outfalls.

Pic 1 – Above the A414 the river was over-shaded, had little marginal cover and lacked flow diversity.

The riparian trees were dominated by common alder, various willow species and occasional sycamore. The tree roots, especially alder, were providing a degree of marginal habitat, bank strength and some localised channel narrowing. However, the impact of dogs was starting to affect the integrity of the roots with many breaking-down due to wear by dogs (pic 2). As banks become worn they act as sources of fine sediment input to the river and allow the channel to become wider. A widening of the channel results in a slowing of the flow and sedimentation of the riverbed.

Pic 2 – Dogs were causing bank erosion.

Tall and spreading riparian trees were casting excessive shade on the river leading to a suppression of marginal vegetation, resulting in degraded habitat and weakened banks. However, the occurrence of trees casting shade should not be seen as a problem to be totally eliminated. The cooling effect provided by the canopy may be important for retaining cool water temperatures throughout the summer especially in low-flow periods. Furthermore, large volumes of on-site woody material present opportunities for simple habitat enhancements to be undertaken at low cost. It was noted that coppicing work had resulted in piles of brash, that material could be used in-river to strengthen banks and to diversify the flow (see recommendation for examples of habitat enhancement techniques).

Picture 3 shows many low branches reaching out across the river, the club were minded to cut them to enable easier casting, with some high branches retained. However, a win-win situation could be achieved through the partial cutting of the low branches to allow them to trail into the water at the margins. This would provide some instant marginal cover, create flow diversity and allow light to the margins. The effect was already being achieved to a lesser extent by a partially collapsed elder. The slight flow deflection that it created was apparent by the differing deposits of silt.

A technique favoured by the Wild Trout Trust for delivering instant woody cover at water level is tree-hinging. Trees (large or small) are cut to produce an effect similar to hedge laying. Species such as willow and hazel respond particularly well. Laying retains a living hinge that secures the cut stem to the tree stump so structural strength is retained. With the tree-top laid at water level, it provides excellent over-head cover, flow deflection and, if beneath the surface, increased habitat for aquatic invertebrates and cover for fish against predators. The tall trees adjacent to the river present many opportunities for tree-hinging.

Pic 3 – The lower branches could be partially cut, pulled back to the margins and fixed in place at water level to increase marginal cover.

Progressing upstream, the riverbed contained a high proportion of mobile sand which was smothering the gravel bed. Sand can be degrading to rivers when in excess, as it fills the interstitial spaces of the gravel reducing habitat for many aquatic invertebrates. Sand should normally settle in the margins of rivers, particularly on the inside of meanders. It was clear that the constant impact of a high numbers of dogs entering the water was the source of the mobile sand. Over a length of ~350m there were 6 significant dog slides in addition to the formal dog slide that had been recently created (the montage of pic 4 shows a selection of dog slides). All of the dog slides were a source of fine sediment and areas where sand was mobilised. Furthermore, the general

lack of aquatic plants will be due to dogs constantly moving through the water and dislodging them. At one location only a single plant of starwort was observed, normally the river would be expected to have a dense growth of the plant (pic 6). Dogs have also affected the growth of marginal plants, such as lesser pond sedge. Dog activity is negatively impacting upon the river's fish population, aquatic invertebrates, plants and water vole population.

Pic 4 – A montage of the numerous dog slides negatively impacting the river.

Pic 5 – Constant disturbance of the riverbed by dogs has resulted in a reduced number of aquatic plants, damage to marginal vegetation and mobilisation of fine sediment.

Where the river was screened from people and dog activity there was a greater amount of aquatic vegetation and marginal cover. This was aided by a lack of shade cast by trees. A dense fringe of common reed provided excellent marginal cover and was allowing the river to retain strong banks and naturally narrow itself (to about ~3m). The narrowed river had an increased water velocity which aided fine sediment transfer and produced flow diversity (pic 6).

Pic 6 – Unshaded reaches had dense fringes of marginal vegetation which allowed the channel to become naturally narrowed, leading to an increased water velocity and sediment transfer.

There were occasional accumulations of loose brushwood material in the margins. Whilst these small features can look insignificant, and to some unsightly, they are in fact very important cover for trout fry and parr particularly early season when there is minimal vegetation (pic 7). The accumulated material can provide cover from predators and reduces flow velocity through the matrix of material, and it increases the amount of lies available. Without such cover, juvenile trout are extremely vulnerable. As fry emerge in early spring their survival is density-dependant; the more available cover, the greater number of fry the river can support, greater numbers of fry surviving therefore potentially leads to more adult fish for the fishery.

Pic 7 – Accumulations of fine woody material at the margins should be valued as fry habitat. This type of material should not be removed. If necessary, it can be stabilised using posts, wire and battens.

Many areas lacked accumulations of wood and marginal cover (pic 8).

Pic 8 – The river was surprisingly clear of brushwood material given the large number of riparian trees. Many banks lack vegetation (as can be seen to the left of the picture).

The riverbed was disturbed by foot to assess the quality of the gravel. The disturbance revealed a very high component of fine sand and black sediment. The bed in the lower reaches of the Park was poorly sorted, degraded by fine sediment and unsuitable for brown trout to spawn upon (pic 9). Trout will spawn on well-sorted gravels (particularly in the range 15-40mm) with a swift flow moving over them.

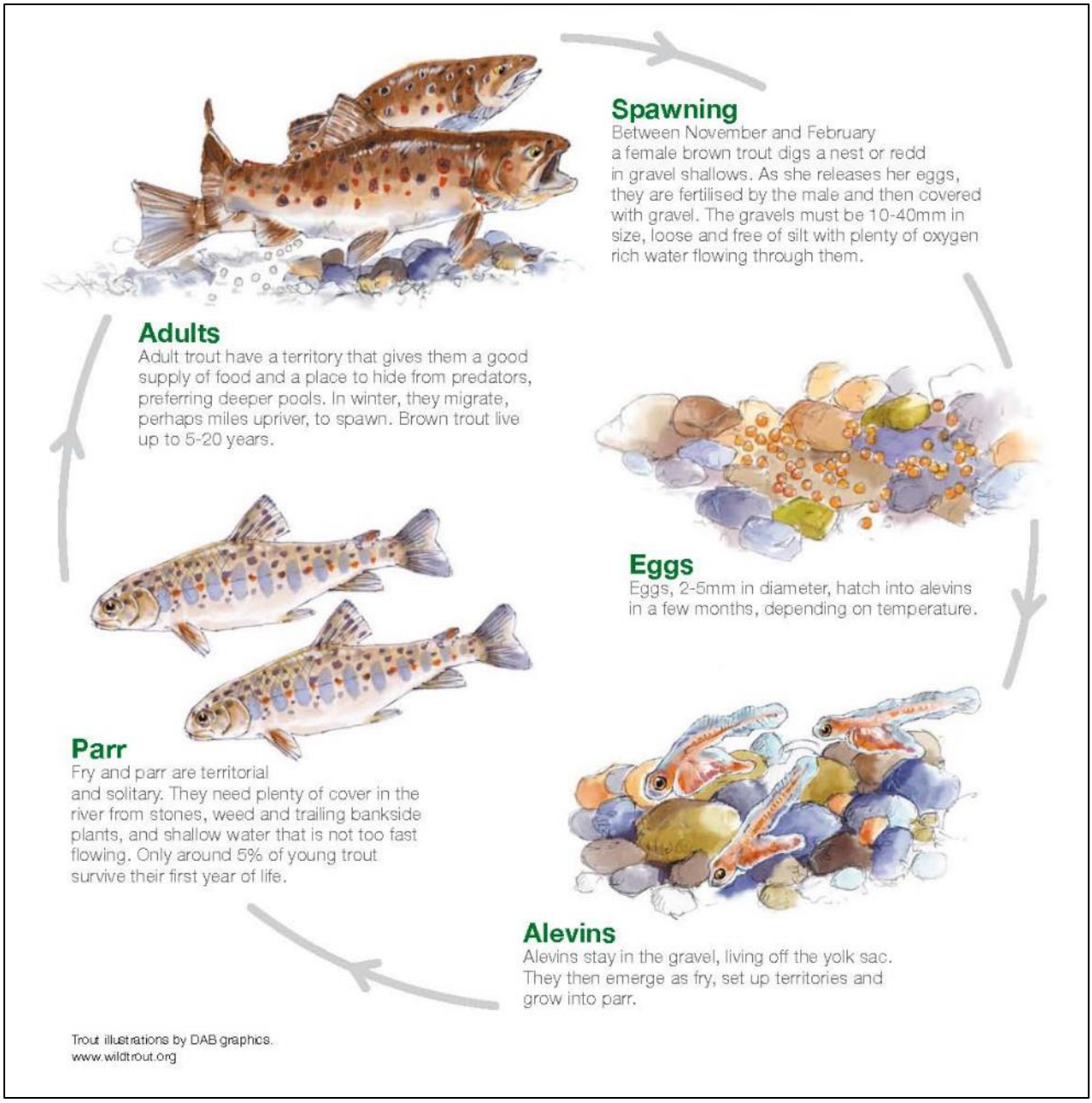


Illustration 1 – The life cycle of the brown trout.

Pic 9 – Disturbance of the riverbed revealed gravel unsuitable for brown trout to spawn upon.

Downstream of the formal dog slide there was an accumulation of marginal brushwood (quite possibly from numerous sticks thrown in for dogs) (pic 10). The material was narrowing the channel and increased flow diversity. However, as it was not fixed it would be prone to wash-out in high flows, thus removing any habitat benefit that it provided. One small run near to the bank had relatively protected conditions from dogs, together with a swift flow, and was sustaining water crowfoot (pic 11). Water crowfoot is important for naturally retaining a head of water, for increasing in-channel cover for fish, for providing shade, and it hugely increases the aquatic habitat available for invertebrates. The plant is typical of clean swift-flowing rivers.

Pic 10 – Small pieces of loose brushwood provided some marginal cover and flow diversity, but they are prone to wash-out.

Pic 11 – Where flow conditions were suitable, and the bed undisturbed, water crowfoot was present.

The formal dog slide clearly provides a valued feature for visitors to the Park, but it appears to have created some problems too. The stones put down to reinforce the slope have been kicked (or thrown) into the river resulting in a localised shallowing of the bed and an aggregation of uniform particles sizes (~20mm) (pic 12). In the low-flow the shallow conditions potentially presented a minor obstruction to the movement of fish. Whilst the slide is fenced, it is no barrier to dogs using the banks either side of it. Erosion of the banks both upstream and downstream was significant and represented further significant sources of fine sediment input (see inset pic 12).

Pic 12 – The formal dog slide has not taken pressure off other parts of the river as 6 further slides were observed over a relatively short distance. Dogs are accessing the banks either side of the slide causing bank erosion.

A short distance upstream of the formal dog slide public access was limited and habitat quality improved. There were shrubs trailing down to water level providing important overhead cover, there was water crowfoot, a marginal growth of sedge, depth cover and the gravel was not smothered by sand (pic 13). The habitat value of this reach for brown trout was much greater than the reach downstream of it, demonstrating the potential of the river for wild brown trout. Trout require habitat diversity for feeding, spawning and nursery areas, in addition to good water quality. The reach was generally unshaded which allowed the sedge beds to naturally narrow the river's width. As the

river was walked a number of deeper holes were observed. In one hole a small shoal of grayling was seen.

Pic 13 – Good trout habitat was found above the formal dog slide.

The river then became more wooded, with tall trees on both banks. It was reported that in summer this reach is significantly shaded. However, and very importantly, where trees had fallen, they had created natural gaps in the canopy allowing light to the river, this enabled sedge to grow which provided cover, localised channel narrowing and bank stability (pic 14).

Pic 14 - Note how the sedge has grown out into the river to colonise sediment that had accumulated around the fallen tree. This feature is effectively a natural A-wing flow deflector.

Of most importance was the presence of large fallen timber (pic 15). Fallen trees within a river would have once been a regular occurrence, before deforestation and regular channel maintenance. The random event of a tree falling would have initiated the natural geomorphic processes of bed scour, sediment sorting and transfer, followed by deposition according to particle mass. This often enables the development of riffles (shallow, gravel-rich runs with broken surface water) which are extremely important as spawning areas. Shallow riffles and glides, especially those with water crowfoot, provide valuable parr habitat. Furthermore, the sorting of bedload material encourages the marginal deposition of fine sediment or may enable it to be deposited upon the floodplain when out-of-channel flow is experienced.

These natural processes of scour and deposition create a wonderful array of habitats (pic 16). Walking amongst the fallen timber the bed depth variation was immediately apparent, with small scour pools forming amongst the mass of branches. The branches had collected organic material, that material is an important food source for invertebrates such as freshwater shrimp, which in turn may be eaten by fish. The impounded water held by timber and organic matter had increased the upstream water depth. Club members reported that

the deeper water areas provided some of the better fishing through the reach. Certainly, the broader and deeper water would be attractive to grayling in addition to large dominant trout. The key to a successful and sustainable wild brown trout fishery is habitat diversity which is able to support all of the different life stage (refer to illustration 1). The fallen timber combined within other woody debris is collectively referred to as large woody material (LWM).

Pic 15 – Fallen trees provided excellent natural habitat enhancement and should not be cleared unless they pose a significant flood risk to property.

The presence of LWM is extremely important in a river. It increases the available surface area on to which a biofilm (algae, bacteria and other microbes) can grow. In turn, the biofilm is a source of food for invertebrates, thus increasing the total biomass that a river can support. LWM also provides underwater cover, offering refuge for fish from high flows, otters and fish-eating birds.

Pic 16 – The range of micro-habitat presented by large fallen timber is extremely important.

Walking through the wooded reach it was apparent that the river had been subject to a habitat enhancement scheme in the past. A number of large tree trunks had been positioned to provide bank cover and to create scour pools (pic 17). The club did not know when the work had been carried out but much of it was still giving benefit to the river.

Pic 17 – A long-established scour pool as a result of habitat enhancement work several years earlier.

Without the impact of the fallen trees and the scour pools, much of the wooded reach would be shallow and wide, and consequently unfavourable for trout (pic 18). At some locations the water level was so shallow that mid-channel gravel bars were exposed (pic 19). This should not be viewed as problematic (other than showing how low the flow was) as exposed riverine sediments are very important for a wide variety of invertebrates. Furthermore, if light were allowed to reach the channel the bars may become vegetated which, in time, would lead to the natural evolution of vegetated mid-channel islands. Mid-channel islands create important habitat as they double the length of marginal habitat and may provide secure nest sites for wildfowl.

Pic 18 – Without the flow and depth variation created by fallen LWM much of the wooded reach would be wide and shallow, and unsuitable for trout (as shown).

Pic 19 – The low-flow conditions had revealed mid-channel gravel bars. This location would benefit from tree thinning to allow light to reach the exposed gravel bars.

Through the wooded reach LWM had accumulated in the margins. The LWM aided the retention of vegetation such as watercress, water forget-me-not and brooklime. Shallow vegetated marginal habitats will be used by trout fry and also parr when depth and flow is suitable (pic 20).

The impoundment of one log jam extended upstream for ~70m. The water level, even in the low-flow conditions, was just below the level of the adjacent woodland. This is beneficial to the adjacent woodland which could be described as "wet woodland". Wet woodland is a nationally declining habitat due to the disconnection of rivers from their floodplains. If the river floods out into the adjacent woodland it poses no risk to property, the woodland absorbs the flood water, and then releases it slowly back to the channel after having absorbed nutrients and fine sediment.

Woodlands provide excellent natural flood management. The situation found adjacent to this reach of the Mimram is very special and is what many river conservationists are trying to re-create across the country. The club should be very protective of this scarce habitat and grateful that it has been created naturally at no cost and free of red tape. The scouring effect of water funnelled through the LWM had produced clean and well-sorted gravel. Consequently, gravels in the vicinity of the fallen timber contained less fine sediment and were suitable for trout to spawn upon. However, it was surprising not to find any redds (the gravel "nest" into which eggs are laid), but personal observation of the Mimram upstream at Tewin had shown winter 2018/19 to be a particularly poor spawning season, most probably due to diminished winter flow.

Pic 20 – Slower pockets of water created by fallen LWM provided habitat for trout fry in the margins, and act as anchor point for plants to take root.

Above the impoundment of the last log jam the river became shallower with a depth of ~0.4m and a width ~4m. There were shrubs trailing down to the water which provided excellent cover for trout (pic 21). Trailing branches are particularly important as overhead cover for a wide range of fish, especially brown trout, they create small areas of shelter and increase the available number of lies within a river. The branches also present opportunities for invertebrates to fall into the channel where they become food for fish. Branches that extend into the water may provide a means for some aquatic invertebrates to emerge from the river and to return beneath the water to lay their eggs.

The tree canopy became less dense, and light was able to penetrate to the river. There was some water crowfoot growing but it appeared to have been grazed by wildfowl (swans or geese). Towards a low brick arch bridge, the water velocity increased due to a change of gradient. The grazing pressure was reduced (due to the increased water velocity) and the water crowfoot growth was more extensive.

Pic 21 – Trailing shrubs provided important cover above shallow water.

Above the brick-arch bridge the Herts and Middlesex Wildlife Trust had erected a number of signs drawing visitors' attention to the presence of water vole and the importance of chalk rivers as a globally threatened habitat. Sadly, the simple rope barrier is not an effective barrier to dogs which continue to damage the river bank with a negative impact upon the water vole habitat (pic 22). A simple means of controlling people and dogs is the use of dead-hedging (simple stacks of cut material held by posts and wire), or through tree layering, where the limbs of willow or hazel are pinned down to the ground to encourage them the take root. These measures create physical barriers but still looks natural.

Pic 22 – A simple rope barrier is ineffective at deterring dogs from entering the river.

Approximately 220m above the brick-arch bridge the river split into 2 channels. One channel was the historic path of the river which was dammed to form a Broadwater (by Humprey Repton, pic 23). The other channel is a recent construction by Tarmac in 2003 to allow further gravel extraction from the Park, and subsequently had to provide the by-pass channel around the Broadwater.

The by-pass channel had much potential for wild brown trout. The gravels were well-sorted and generally clean of excessive sand and silt (pic 24). Not all of the channel could be walked, but it was apparent that water voles were very numerous in the well-vegetated banks. Some recent coppicing of sallows had taken place to prevent water vole habitat from being shaded. Fortunately, some trailing branches had been retained and provided good overhead cover for any fish moving through the reach (pic 25). There were occasional plants of starwort and lesser water parsnip but the by-pass channel (surprisingly) lacked significant in-channel vegetation. Much of the channel lacked depth cover and sinuosity. In the current low-flow conditions, the by-pass channel was unsuitable for adult trout but did provide habitat for trout fry and parr. It was surprising not to find any trout redds in the by-pass channel.

Pic 23 – The main course of the River Mimram was dammed by a weir to form one of the Park's Broadwater lakes. However, the by-pass channel provides a route around the lake.

Pic 24 – The gravel bed of the by-pass channel was suitable for brown trout to spawn upon.

Pic 25 – Trailing sallow branches provided important cover at water level.

Increasing in-channel sinuosity through the use of flow deflectors would assist the evolution of a sinuous channel together with sediment transfer. Fine material (especially sand) could then become deposited in the margins, thus aiding the development of marginal habitats through sediment entrainment. Furthermore, the creation of some deeper pool habitat (through the use of flow deflectors) within what it's a relatively shallow glide could provide resting habitat for pre and post-spawning fish.

The presence of a newly erected fence to prevent people and dogs from entering the channel will do much to aid plant growth, and to protect the water voles from dogs. Simple habitat enhancement measures such as brushwood ledges, flow deflectors and pieces of timber tethered to the bed would bring about further habitat gain to the channel and could benefit water voles and invertebrates by increasing overall habitat complexity.

Pic 26 – The coppicing of sallows has retained a number of shrubs that provide important overhead cover. A balance is being struck between cover for fish and open habitat for water voles.

4.0 Recommendations

The out-falls from the A414 presented a threat to water quality. Measures should be investigated as to whether it is possible to establish any buffer planting in front of them. The local Highways Authority should be consulted to see if there are any oil/sediment traps that should be cleaned and /or maintained.

The formal dog slide has resulted in stones being added to the river, this has shallowed the bed of that area. The shallow bed could hinder the movement of fish in certain flows. A slightly deeper "trench" could be raked through the area to aid fish movement. Ideally the stones should be put back on to the dog slide to provide bank protection again.

The Panshanger Angling Club have provided the document, "Management Plan for the River Mimram through Panshanger Park". The plan does not state when it was written nor by whom (however it is believed to be the Herts and

Middlesex Wildlife Trust). The plan contains a number of objectives which are worthy of repetition in this report, namely:

- Strategic removal/felling/crown raising of trees at intervals along more shaded parts of the river channel to enable more light to reach river. Removal to be agreed with advice from HMWT. Trees should be checked for bat usage prior to works.
- Work with angling club to manage riverine habitats.
- Selectively remove non-native tree species along river margins.
- Minimal-intervention in majority of wet woodland areas, but monitor substantial changes.
- Maintain managed access to river e.g. via fencing or viewing platform.
- Provide east-west riverside walk, but ensuring that the River Mimram, the diversion and the wildlife it supports is protected from damage and disturbance.
- Strategic felling of specific trees at intervals along river in order to let in more light and create woody habitat within the river.
- Hinge or fix felled trees into river channel at intervals to create scouring action through speeding up flow rate around woody debris.
- Addition of some woody debris in specific areas to help scouring action and create areas of different flow rate.
- Conduct redd survey to identify trout spawning areas.

There is clearly a lot of over-lap between the site's management plan and issues contained within this document. This report should be used as a catalyst to take forward the riverine objectives contained within the management plan.

There is clearly a need for tree management to take place. A tree management plan should be agreed so that tree work can retain important trees and allow light to the river where beneficial. The presence of large amounts of on-site timber and brash is advantageous and could be used in many different ways:

- Tree-hinging would be a simple first approach to managing the tree stock whilst providing cover at water level (pic 27). The process and benefits of tree-hinging has already been discussed on page 7.

Pic 27 - An example of tree hinging, a simple and effective technique for increasing cover in a river

- Brushwood ledges: these features can be created following tree works. A brushwood ledge provides complex cover at, and below, water level. Brash from tree thinning is pinned against the bank in alternating directions or increasing stem thickness, and is securely wired down or held with battens. The brushwood lattice provides niches for invertebrates and small fish, aids silt entrainment and provides a rooting substrate for plants to establish. In time (~3yrs) the brushwood ledge will become a vegetated berm if exposed to full sunlight.

Pic 28 – A low-level brushwood ledge created on the River Misbourne following tree thinning work. Brushwood can be used to protect banks from erosion, to create in-channel sinuosity and to entrain silt and sand. They are particularly effective for enhancing low flow rivers.

- Flow deflectors: these features can be used to increase flow diversity and bed scour. They can be simple log deflectors or tethered tree stems. The complex flow that arises results in depth cover and sediment sorting and transport.

Pic 29 - A flow deflector used to focus flow and scour into the centre of the channel.

- Fixing LWM to the riverbed: this is a means of increasing flow diversity and in-channel cover. In gravel-rich rivers such as the Mimram, the positioning of LWM mid-channel is likely to increase bedform diversity, through scour and deposition of gravel. This could result in a highly diversified channel with complex flow patterns and a greater level of habitat diversity.

Pic 30 – LWM fixed to the bed on the Wylye. Large pieces of timber create both underwater scour to sort sediments and a broken water surface providing cover and oxygenation.

The River Mimram through Panshanger Park is an attractive river which retains a population of wild brown trout (and grayling). It would not take too much effort to better manage the undisturbed areas of river and to greatly increase their capacity to retain fish. Whilst much of the river is facing negative impacts as a result of dog disturbance, over a period of years a number of subtle measures could be introduced to direct people, and their dogs, to less-sensitive areas, whilst ensuring the best parts are protected and further enhanced. If no measures are implemented the river and its biodiversity will decline.

5.0 Making it Happen

It is a legal requirement that (most) works to 'Main River' sites like the River Mimram require written EA consent prior to their implementation, either in-channel or within 8 metres of the bank.

The Wild Trout Trust can provide further assistance in the following ways:

- Assisting with the preparation and submission of an Environmental Permit to the EA (formerly referred to as Land Drainage or Flood Defence consents), or by identify appropriate exemptions to take forward small-scale habitat improvement works.
- Running training days to demonstrate the techniques described in this proposal.

We have produced a 70 minute DVD called 'Rivers: Working for Wild Trout' which graphically illustrates the challenges of managing river habitat for wild trout, with examples of good and poor habitat and practical demonstrations of habitat improvement. Additional sections of film cover key topics in greater depth, such as woody material, enhancing fish stocks and managing invasive species.
The DVD is available to buy for £10.00 from our website shop www.wildtrout.org/shop/products/rivers-working-for-wild-trout-dvd or by calling the WTT office on 02392 570985.

The WTT website library has a wide range of materials in video and PDF format on habitat management and improvement:
www.wildtrout.org/content/library

6.0 Acknowledgement

The WTT would like to thank the Environment Agency for supporting the advisory and practical visit programme in England, through a partnership funded using rod licence income.

7.0 Disclaimer

This report is produced for guidance; no liability or responsibility for any loss or damage can be accepted by the Wild Trout Trust as a result of any other person, company or organisation acting, or refraining from acting, upon guidance made in this report. Accordingly, no liability or responsibility for any loss or damage can be accepted by the Wild Trout Trust as a result of any other person, company or organisation acting, or refraining from acting, upon comments made in this report.