WILD TROUT TRUST
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# Advisory Visit
# River Sid, Devon

April 19, 2021

*Figure 1 School Weir*

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# Key Findings

- The river observed is unnaturally straight and hence suffering from bed erosion and incision.
- Efforts have been made to arrest the erosion by utilising check weirs and artificial riffles/rubble weirs. This is contributing to reduced natural river function and habitat access.
- A greater range of lateral movement is needed in the channel to reduce the stream gradient and its energy.
- A rougher, more diverse channel is needed for trout habitat and the hydraulic roughness it provides to reduce conveyance.
- All old weirs should be investigated for possible removal.
- Should restoration of the reach upstream of School Weir be completed, the scope for reduction or even removal of School Weir will increase.

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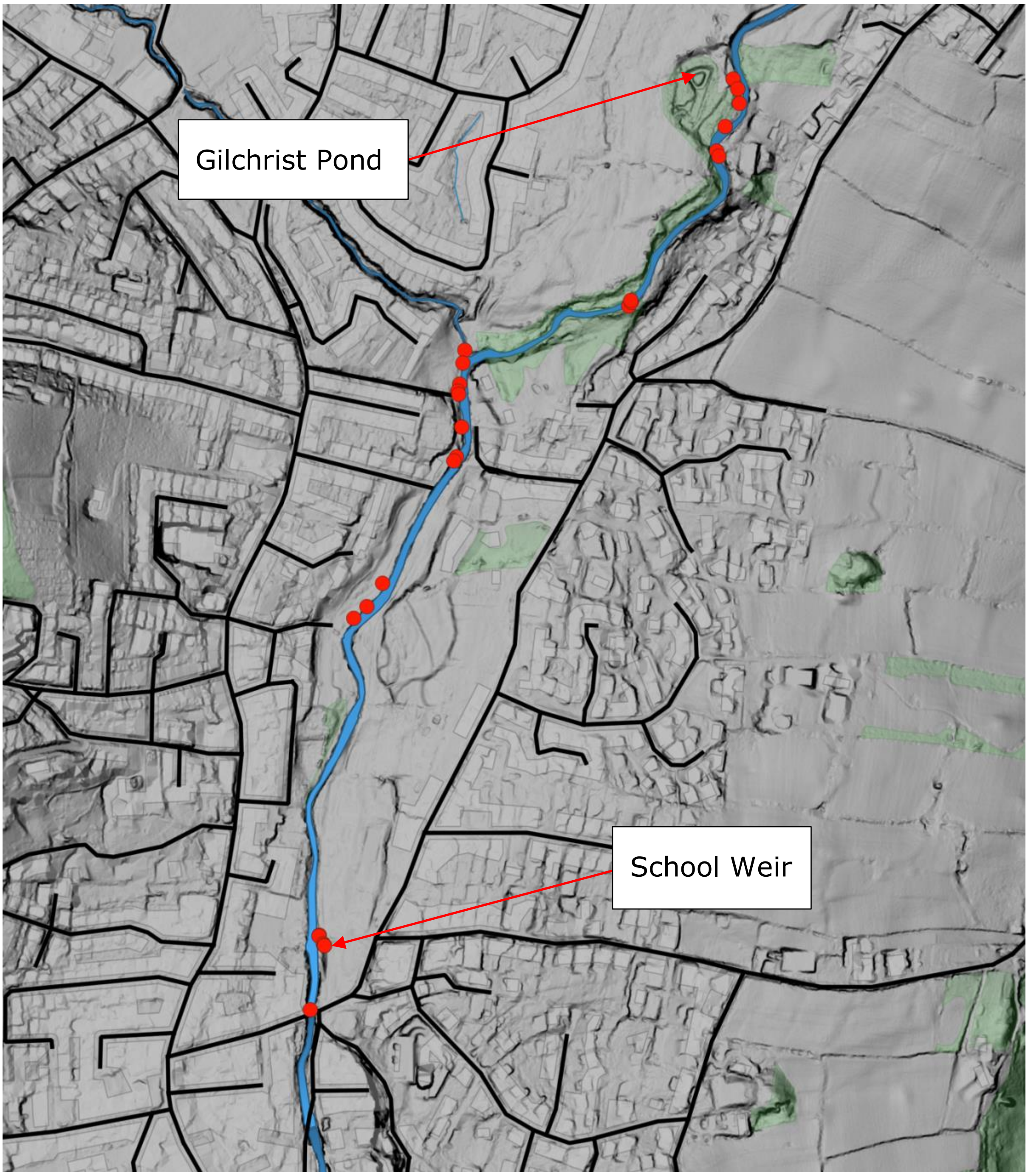
# Introduction

## Overview Map




*Map 1 An overview of the reach inspected, with Gilchrist Pond at the North and School Weir to the south with the flow North to South. Red dots indicate position of photos of note.*

This report is the output of a site visit undertaken by Bruno Vincent along the lower River Sid in Devon at the request of the Sid Vale Association. The group have been seine netting salmon and sea trout below a large Ogee-type weir for some years, transporting them above the obstruction in wheelie bins. They requested appraisal of options to improve fish passage through the weir (Figure 2).


*Figure 2 An Environment Agency officer loads a salmon into a wheelie bin as part of the Sid Vale Association's work to translocate migratory fish upstream of School Weir.*

The report covers a visit to the weir and approximately 1.4km of walkover of the Sid upstream.

Normal convention is applied with respect to bank identification, i.e. left bank (LB) or right bank (RB) whilst looking downstream. Upstream and downstream references are often abbreviated to u/s and d/s, respectively, for convenience. The Ordnance Survey National Grid Reference system is used for identifying locations.

| | |
|---|---|
| **River** | River Sid |
| **Waterbody Name** | Sid |
| **Waterbody ID** | GB108045009160 |
| **Management Catchment** | Sid and Otter |
| **River Basin District** | Sid |
| **Current Ecological Quality** | Overall status of **Moderate** ecological potential based upon an overall ecological potential of **Moderate** and a **Failing** chemical potential |
| **U/S Grid Ref inspected** | SY 13306 88994 |
| **D/S Grid Ref inspected** | SY 12794 87816 |
| **Length of river inspected** | ~1400m |

Table 1. Overview of the waterbody. Information sourced from: https://environment.data.gov.uk/catchment-planning/WaterBody/GB108045009160

Under the Water Framework Directive (WFD), the Environment Agency classify the Sid as Moderate with specific issues such failing levels of mercury and its compounds.

## Catchment / Fishery Overview

The Sid drains a catchment of around 3900ha over its 16km length. Rising around Burnt Common to the East of Ottery St Mary, it flows south, through the village of Sidbury, to the town of Sidmouth where it discharges into the English Channel. The Sid has three main tributaries, the Roncombe Stream, the Snod Brook and the Woolbrook.

Artificial straightening above Sidmouth has disconnected the river with its flood plain and energised the channel. Historic milling and land creation are the primary reasons for such straightening. Though milling has ceased, the densely populated town of Sidmouth has spread onto the floodplains.

In 2014, Fishtek were commissioned to suggest options for fish passage over School Weir. Their recommendation was an Alaskan A fish pass, owing to its ability to run at high gradients and the possibility of a single flight (though this would be at the outer limits for migratory salmonids).

There are downsides to such a design including lack of attraction flow and the disorientation or damage or smolts migrating downstream. Such a design also makes no improvement to the loss of natural river function.

## Habitat Assessment

Despite the conservation group looking after many more miles of river upstream, this report covers a reach from the old monastery Lake, Gilchrist Pond, downstream to Salcombe road bridge in the town of Sidmouth.

Primary concern for the group is the alteration of School Weir at the bottom of the reach. Reconstructed in 1977 to reduce flooding in the town downstream, it is a complete barrier to upstream migration. In mitigation for this, the group organises netting parties to collect sea trout and indeed salmon below the weir. They are then translocated above the weir in wheelie bins.

Increasing passibility is of the utmost importance; however, the human alteration of the preceding mile of river is also significant. As such, improvements upstream will likely have a bearing on successful intervention on the Weir.

This report will work downstream, focusing on the weir as a section of its own. An improved river course upstream will have an impact on possible weir alteration as peak energies and discharge could be reduced by restoration.

The river exhibits a largely straightened planform, pushed to the side of the flood plain. The reduction in length straightening has caused has resulted in an increased gradient and contributed to significant incision. This is a vicious cycle, as the erosion disconnects the channel from its floodplain, the more erosion occurs. The greater part of the reach visited now sits deep within its own channel with little to no connection to the flood plain.

*Figure 3 The first boulder weir immediately upstream of another at Figure 4. This should be altered with an aim to provide general roughness, over the appearance of a weir. SY 13304 88965*

*Figure 4 Immediately downstream of Figure 3 (visible top left), a more sympathetic artificial riffle. Though better, it could still benefit from manipulation. SY 13307 88965*

A number of rubble weirs (coarse artificial riffles) have been introduced to arrest the artificially high energies by creating small sections of 'more natural' gradient. These are at least 100 years old, if not older. Though naturalistic in appearance they are man-made and are impediments to natural river function. Not a weir in the traditional sense, they still form impoundments of the river above and help maintain the artificially straight course of the channel. Such tumbling rock falls exist in moorland streams of similar gradient, though decreasing the gradient via a longer, more sinuous channel is preferable to man-made steps, however attractive they might be perceived.

*Figure 5 Another boulder weir. Simply encouraging low flows around the last boulder on the RB (nearest to camera) would begin a meander while still allowing high flows to pass over the top. SY 13307 88965*

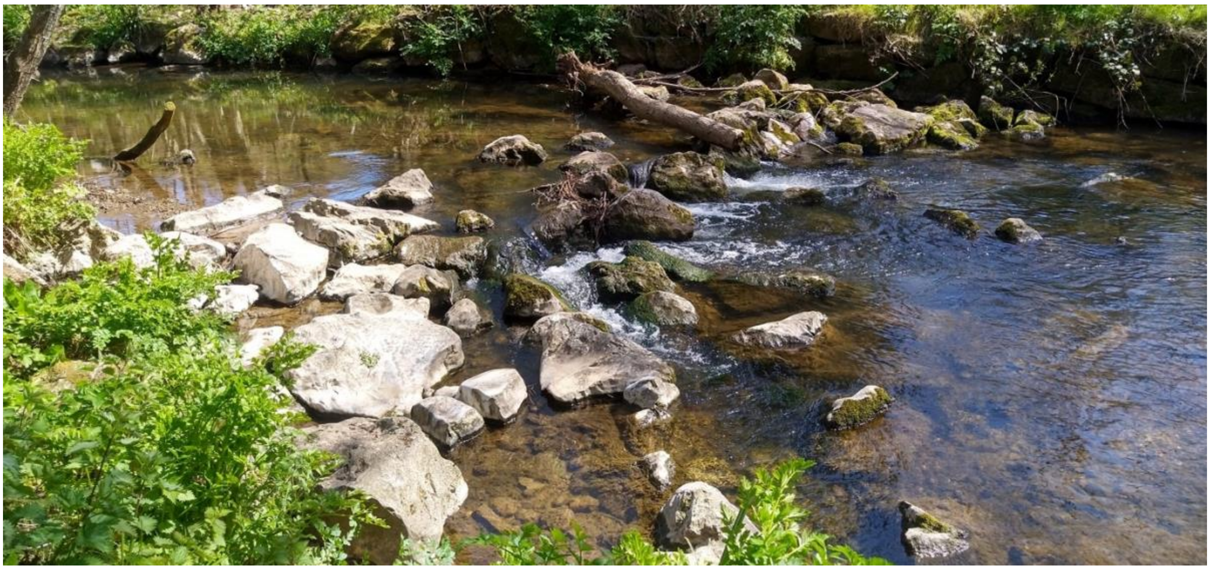


*Figure 6 Another boulder weir. Note the uniform depth and sediment upstream compared to the diverse depth and substrate downstream. Such uniformity increases the risk of smolt predation by piscivorous birds. SY 13289 88913*

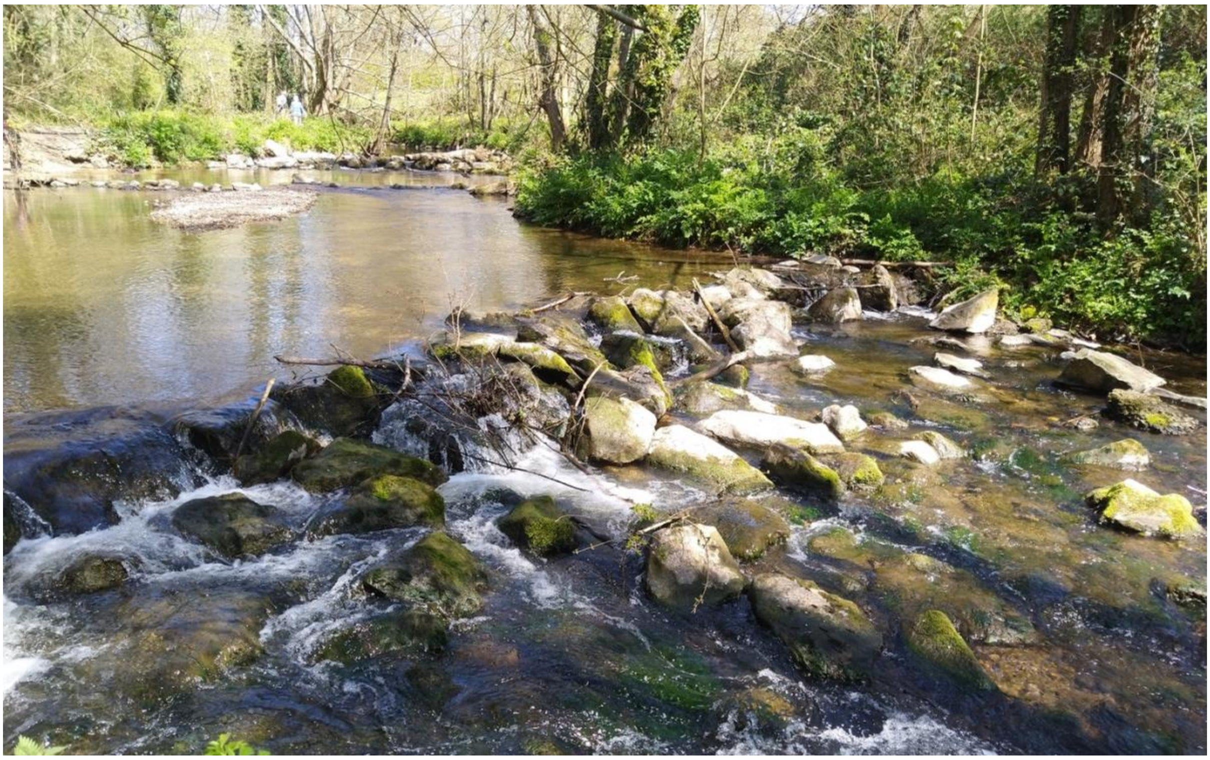


*Figure 7 A cascade of several boulder weirs. SY 13279 88875*

*Figure 8 Erosion is beginning to cut around the back of this tree. Considering the straightness of the channel downstream, this could be a place to encourage a bend by manipulating the boulder weir immediately upstream. Felling the tree across the channel could arrest flows and help with the diversion. SY 13279 88875*

Despite much of the reach having good density of riparian trees, there is a distinct lack of Large Woody Material (LWM) in the channel. Such LWM is a natural occurrence from windfall and washing downstream, lodging in the boughs of standing trees. Felling or hinging of bankside trees could replicate this process, bringing more channel diversity and a mechanism to encourage further lateral erosion where needed.

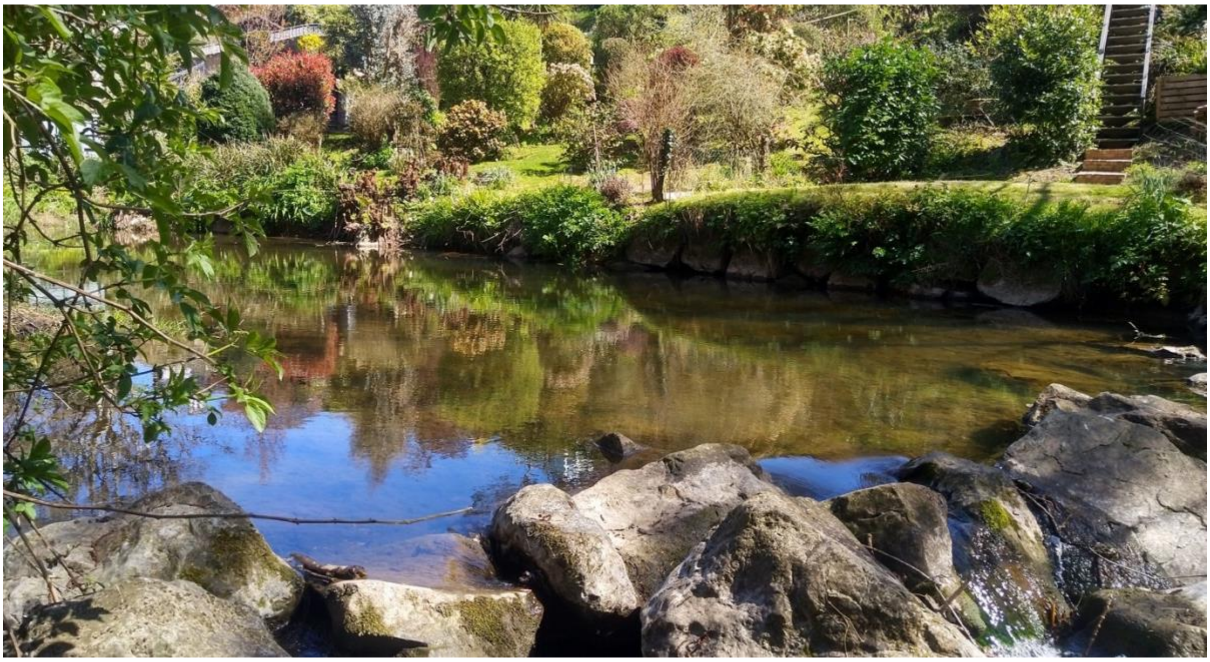


*Figure 9 Another boulder weir. Note the impoundment of the river above and the stone revetment of the garden banks. This calm water may be seen as desirable for the bankside gardens but is detrimental for the habitat. SY 13171 88701*

*Figure 10 Easing of this boulder weir will increase the pace of flow in the impoundment by the gardens (as seen in Figure 9). Work will be needed to prevent erosion of their banks, but the river course could be encouraged toward the RB. SY 13171 88701*

*Figure 11 A more natural looking, yet man made, boulder weir. Better placement of rocks could allow the river to traverse across its width. SY 13171 88701*

*Figure 12 The largest of the rubble weirs visited. Note the natural riffle in the bottom of shot. Such habitat is rare on the reach, being drowned out by the artificial weirs. As juvenile habitat, it is important to allow such habitat to exist. SY 12992 88628*

*Figure 13 Hard sheet piling revetment prevents the footpath from eroding. Reducing stream energies upstream will allow for a softer, greener bank to be installed. Note the smothered gravels caused by the impoundment of the old weir downstream. SY 12963 88595*

*Figure 14 The remains of an old weir structure. Despite the breach, it is impounding the reach above and could be entirely removed. SY 12956 88575*

*Figure 15 Sewer Storm Overflow Permit No: 201828 no spill duration monitoring available. Algal growth suggesting excessive nutrients in this area. SY 12956 88575*

*Figure 16 A sewerage pipe crosses the river. With high flow velocities common, this is vulnerable to fracture by passing debris. The asset owner is liable for the environmental damage such a fracture will undoubtably cause downstream. Liaison with the owner to find a re-routing solution is advised. SY 12977 88539*

*Figure 17 Another old weir that has had a section removed. Despite this improvement for fish passage, the three shallow steps downstream are a significant impediment to fish passage. Total removal would be the best course of action. SY 12969 88498*

*Figure 18 The three shallow steps downstream of the weir in Figure 17. In low to medium flows, there isn't enough water for fish to swim upstream. SY 12969 88498*

*Figure 19 Looking upstream to the weir in Figures 17 & 18. A notional jumping pool has been created to ease the first step (red circle), but overall insufficient to allow good upstream fish passage. SY 12969 88498*

*Figure 20 A slightly more conventional Check Weir. Though not impassable, it still presents an unnecessary stress and delay to upstream and downstream migration. The impounded reach above is also severely lacking habitat diversity caused by the impoundment. Removal or significant alteration is recommended. Adding large woody material (LWM) would also be beneficial. SY 12880 88343*

*Figure 21 A better looking rubble weir, though still an unnecessary impediment to natural river function and fish migration. With room on both banks, the gradient could be reduced through meandering rather than an unnatural step. This would restore a lateral scour pool and riffle sequence, good for all salmonid life stages. SY 12863 88312*

*Figure 22 Directly downstream of Figure 20, another reasonable rubble weir. Again, this could be made redundant (at least partially) through meandering. SY 12852 88305*

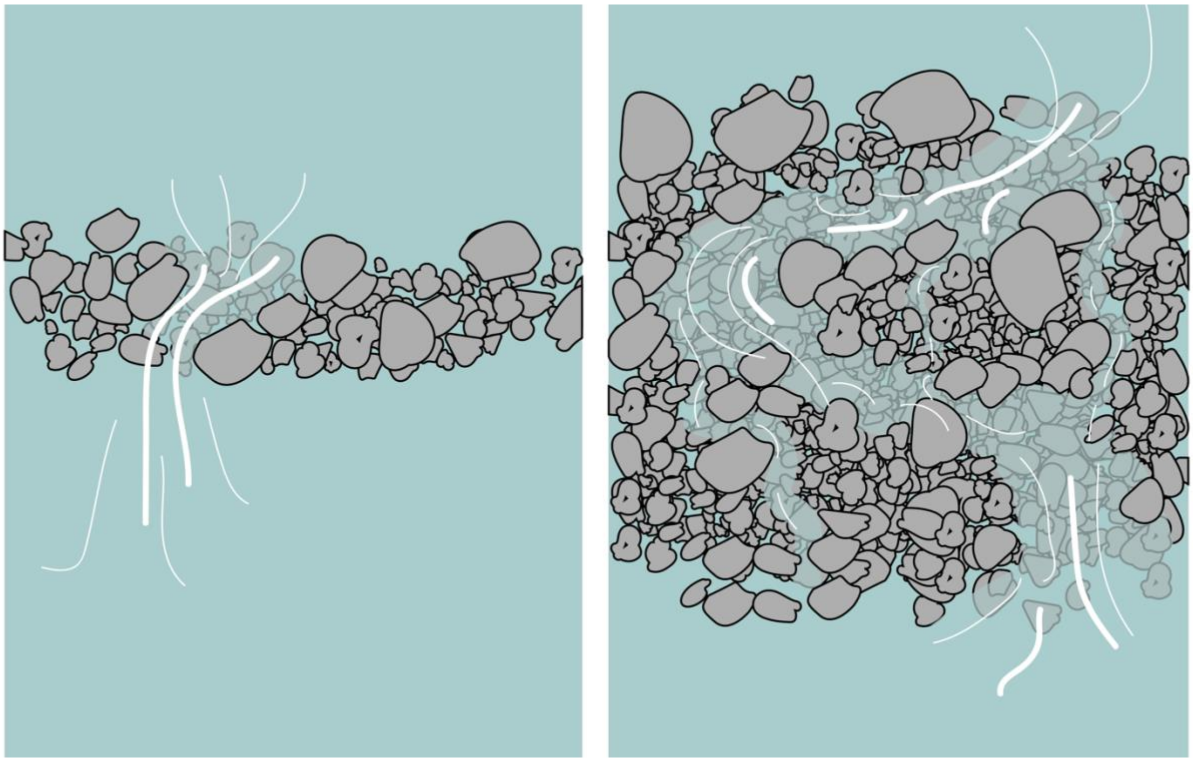


*Figure 23 A rough illustration of an existing boulder weir on the left, and a better design on the right with enforced lateral movement and a greater range of low flow pathways. Winching larger boulders (see appendix) up and downstream, in combination with lifting medium sized rocks will begin the process. High flows will move the smaller sized gravels and cobbles into the interstices completing the structure.*

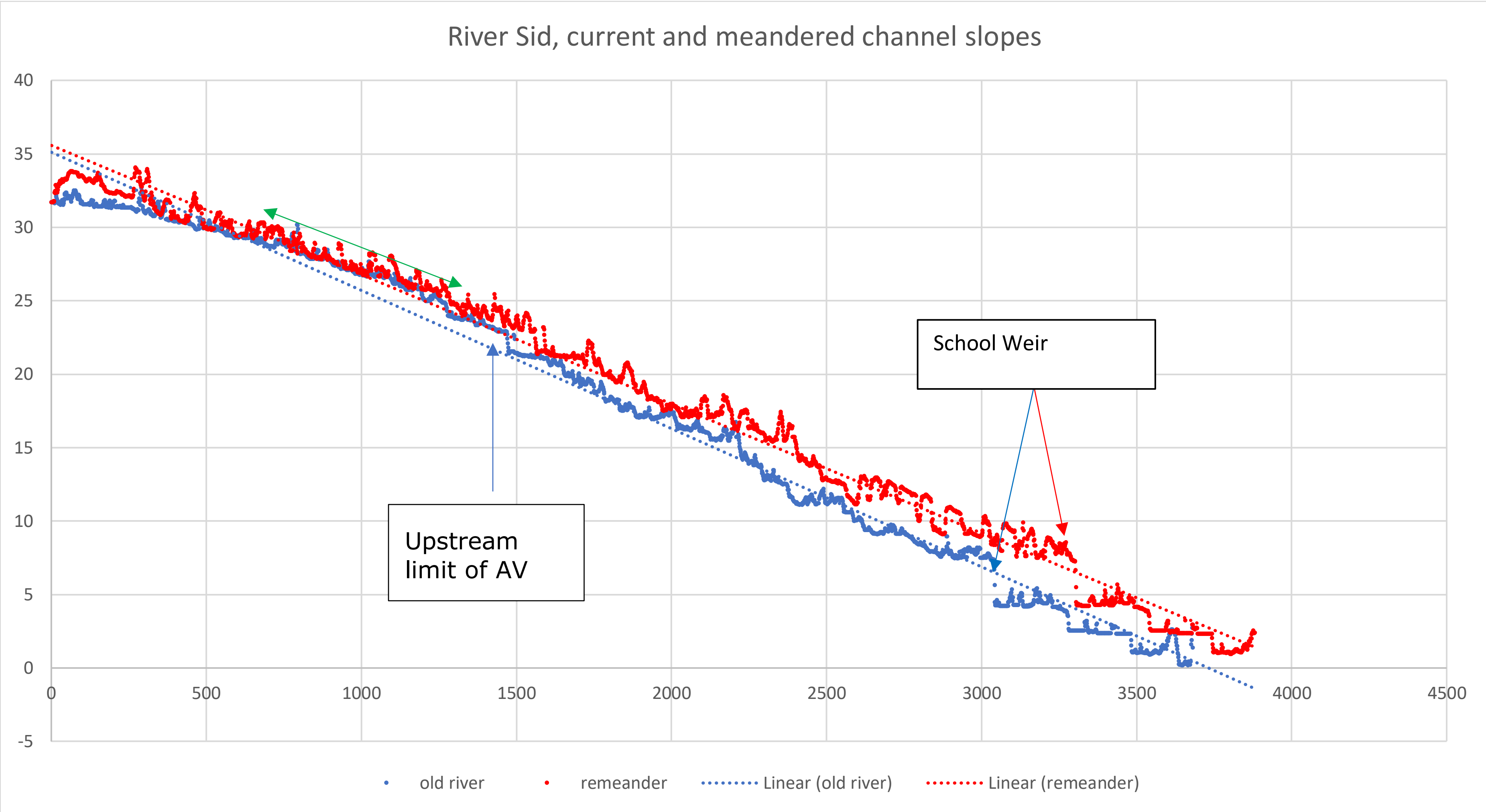



*Chart 1 The slope of the current channel (blue) and a conceptual meandered channel (red). The current gradient increases noticeably at 1500m, whereas the new channel maintains an average gradient throughout. Note the green arrows which roughly indicates the meandering channel above the reach inspected Shown in Map 2. Its current gradient is broadly similar to the meandered channel. Also the number of flat sections to the current river, that indicate the areas of impoundment caused by weirs. The noise in the red is caused by the meander form picking up spot heights from the higher river bank.*

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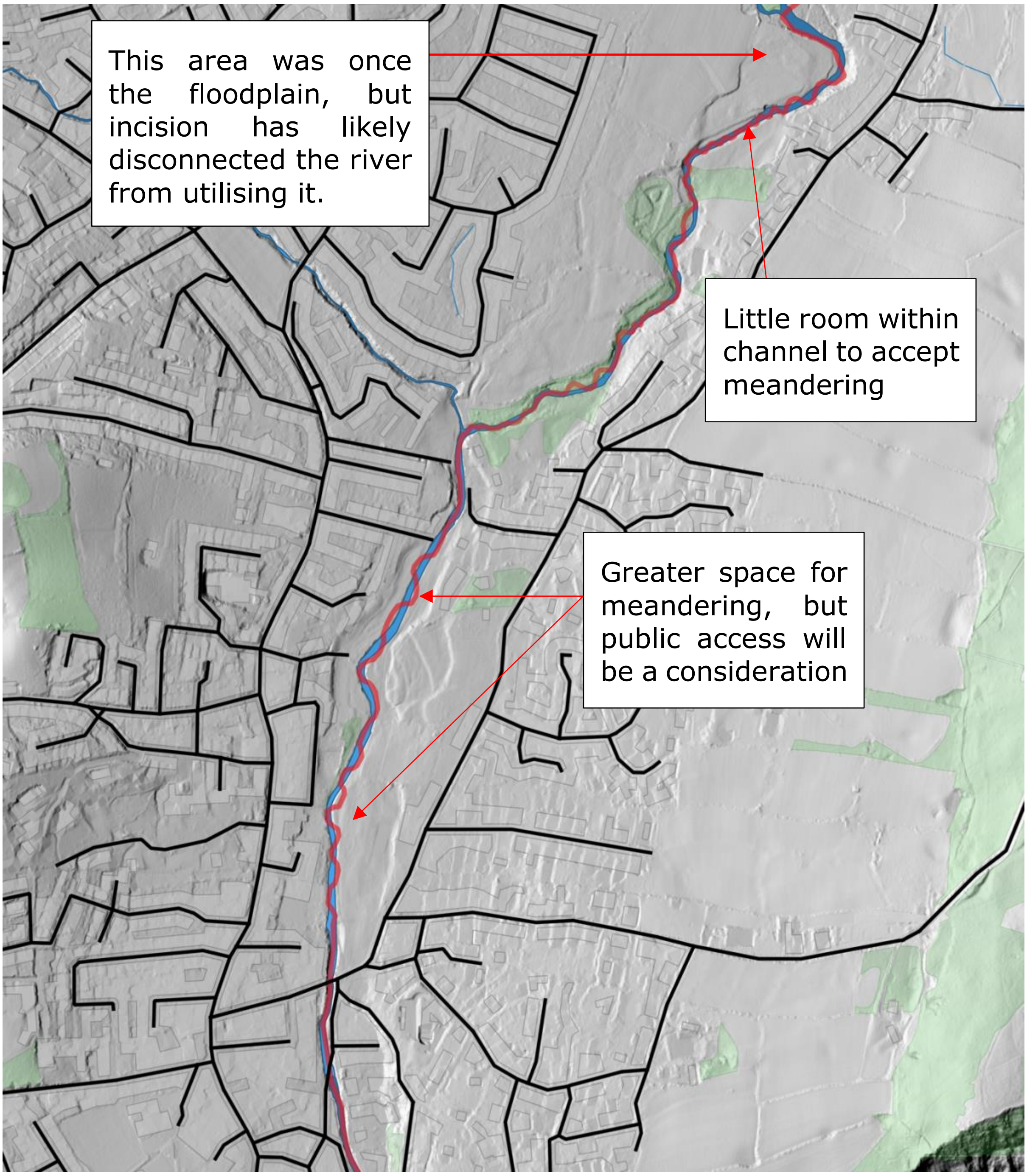


*Map 2 The current straightened course of the channel (blue) and a conceptual meandering course (red). Spot heights taken from LiDAR data constructed the chart above.*

With such an incised channel, lateral movement is difficult. Where the constraints of the channel are limiting such movement, repositioning the boulders to swing the stream from one side to the other will produce some of the desired effect, but needs to be done with care as bank erosion could occur in undesirable places such as riverside gardens.

With good design, the stream could be directed at sacrificial land allowing deposition at the foot of gardens. This would actually increase the ease of access to the river and shore up overhanging banks that may have needed future maintenance. The dynamics of river morphology are never 100% certain, so such work comes with risk to property that should not be understated.

With the current course, from Sidbury to the sea, having an approximate gradient of 1 in 100 re-meandering could reduce this by approximately 7% but the measures to establish this will also increase hydraulic roughness, further decreasing discharge (Chart 1). As such, allowing lateral erosion will have a net benefit to flow reduction, habitat value and slowing the bed erosion.

*Map 3 A LiDAR map of the naturally meandering river above the reach inspected. Such an unconstrained, meandering planform is to be aimed for. Clear evidence of recent paleochannels can be seen, showing the river's ability to re-route itself and fully access its flood plain: all things essential for good river function. Note the steepness of the channel sides (red circle) where straightening downstream has begun to take effect, causing bed erosion and incision.*

## Weir

*Figure 24 School Weir seen from downstream. At around 3m high, it is beyond the scope of any salmonids to ascend without help. SY 12790 87895*

The current School Weir is an Ogee type, standing at around 3 metres tall, likely built against the downstream end of the original mill weir. Total removal is unlikely as the reduction in river height upstream would leave gardens and the public space, The Byes, dangerously perched above the river.

Should the old weir be structurally sound, a cascade of smaller weirs could be created with associated notches to allow passage in the greatest range of flows. e.g. reducing the old weir by around 1m and School Weir by approximately 2m. To augment this further, any remaining height on School Weir (after reduction) could be softened with a bolder/rock ramp. Though not ideal, an alteration such as this should greatly improve upstream and downstream migration in combination with better natural river function for the entire reach.

To maintain bed height upstream of the weir, artificial riffles may be needed to control the increased gradient (around 1:70), though a more sinuous channel form could be utilised also (reducing gradient by about 12% based on the conceptual path described above).

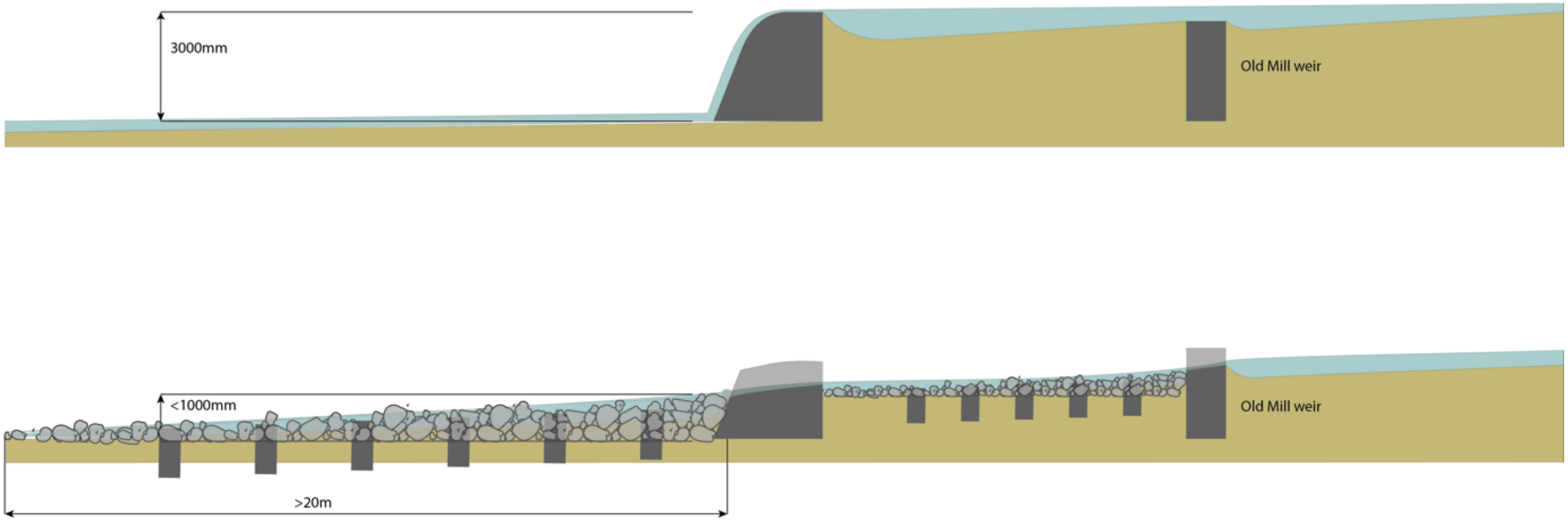


*Figure 25 A side view of a possible solution. Lowering of the old weir in combination with significant lowering of School Weir, could bring the gradient within tolerance. The construction of a rock ramp in between and downstream of the weirs will augment the design to provide the maximum range of passability. The heritage status of the old weir and its structure would need to be assessed to take this forward.*

Though eel were witnessed above the weir and have been found in electrofishing surveys, the current structure poses significant issue for upstream and downstream migration. Such free passage is regulated (The Eels (England and Wales) Regulations 2009). Not only should it be taken into design consideration, but it is also a legal requirement for the asset owner to implement with or without alteration for all other species. A rock ramp design would allow eel movement and passage for other local species in a range of sizes.

*Figure 26 The old mill weir, approximately 10 metres up from School Weir. With lowering and notching, this could form the first part of a cascade to ease passage while limiting the lowering of the river upstream. SY 12790 87895*

*Figure 27 The bund next to School Weir, designed to hold back flood water into the upper Byes. SY 12790 87895*

*Figure 28 The LB retaining wing wall of the School Weir seen from the top of the bund (Figure 27). SY 12790 87895*

*Figure 29 Looking upstream from Salcombe Rd Bridge. The hard engineered channel and reduced sediment load have contributed to a uniform and featureless channel. In combination with river and weir improvements upstream, low lying large woody material (LWM) could bring back some habitat diversity without affecting high flow conveyance. SY 12781 87811*

# Recommendations

- Improve sinuosity on the entire reach wherever there is space to do so.
- Manipulate boulder weirs to move flows laterally. This could be in conjunction with deliberate lateral erosion to produce meanders.
- Add LWM to increase channel diversity and increase hydraulic roughness.
- An environmental Permit from the Environment Agency will be necessary to complete such work.
- Investigate removal (or modification in some cases) of redundant weirs.
- Reduce School Weir in combination with a rock ramp to ease upstream and downstream fish migration while also improving natural river function.
    - Detailed design would need to be commissioned.

## Making it Happen

The WTT may be able to offer further assistance:

- WTT Project Proposal - further to this report, the WTT can devise a more detailed project proposal report. This would usually detail the next steps to take and highlight specific areas for work, with the report forming part of an Environmental Permitting Regulations application.

- WTT Practical Visit - where recipients are in need of assistance to carry out the kind of improvements highlighted in an advisory visit report, there is the possibility of WTT staff conducting a practical visit. This would consist of 1-3 days' work, with a WTT Conservation Officer teaming up with interested parties to demonstrate the habitat enhancement methods described above. The recipient would be asked to contribute only to reasonable travel and subsistence costs of the WTT Officer. This service is in high demand and so may not always be possible.

- WTT Fundraising advice - help and advice on how to raise funds for habitat improvement work can be found on the WTT website - www.wildtrout.org/content/project-funding

- In addition, the WTT website library has a wide range of free materials in video and PDF format on habitat management and improvement:
  - We have also 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 debris, enhancing fish stocks and managing invasive species.

  - The DVD is available to buy for £10.00 from our website shop or by calling the WTT office on 02392 570985.

## Acknowledgement

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


## 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.

# Appendix

Figure 30 A rock ramp installed on an impassable weir.

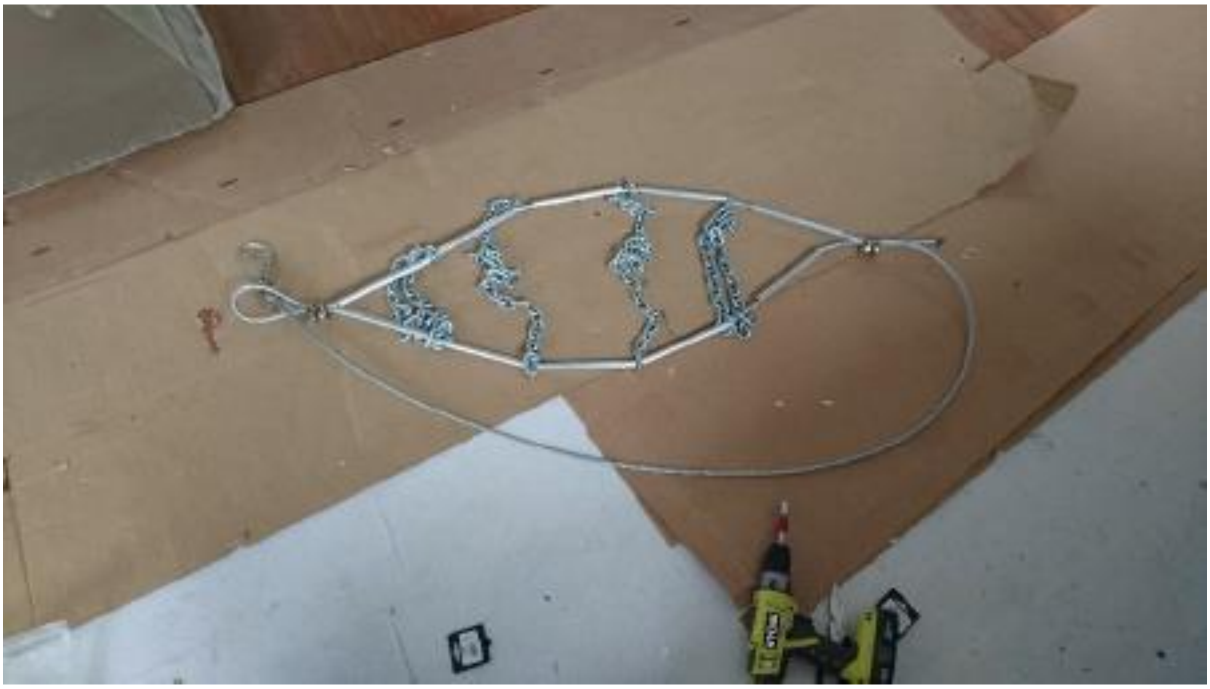

Figure 31 A home-made, low-cost winch sling for moving large boulders.

*Figure 32 The winch sling in action on the River Yeo, near Crediton, Devon.*

Figure 33 Hinged willow on the River Test. Hazel, small willows and small alders can be hinged into a river, creating diversity of flow and in-stream cover for fish. The trees are hinged in a similar manor to hedge laying, where the tree is partially cut through at the base and laid into the margins. Chestnut stakes and fencing wire can be used to secure the trees in place. Willow will survive perfectly well even with 70% of the branches submerged; however, hazel and alder should be laid to retain much of the structure above water level.

Figure 34 Another example of a tree successfully hinged into the margins of a river to improve habitat diversity.

Figure 35 Lodged woody material, the most natural of methods to mimic naturally fallen trees, wedged in another tree to secure it with no other materials required.