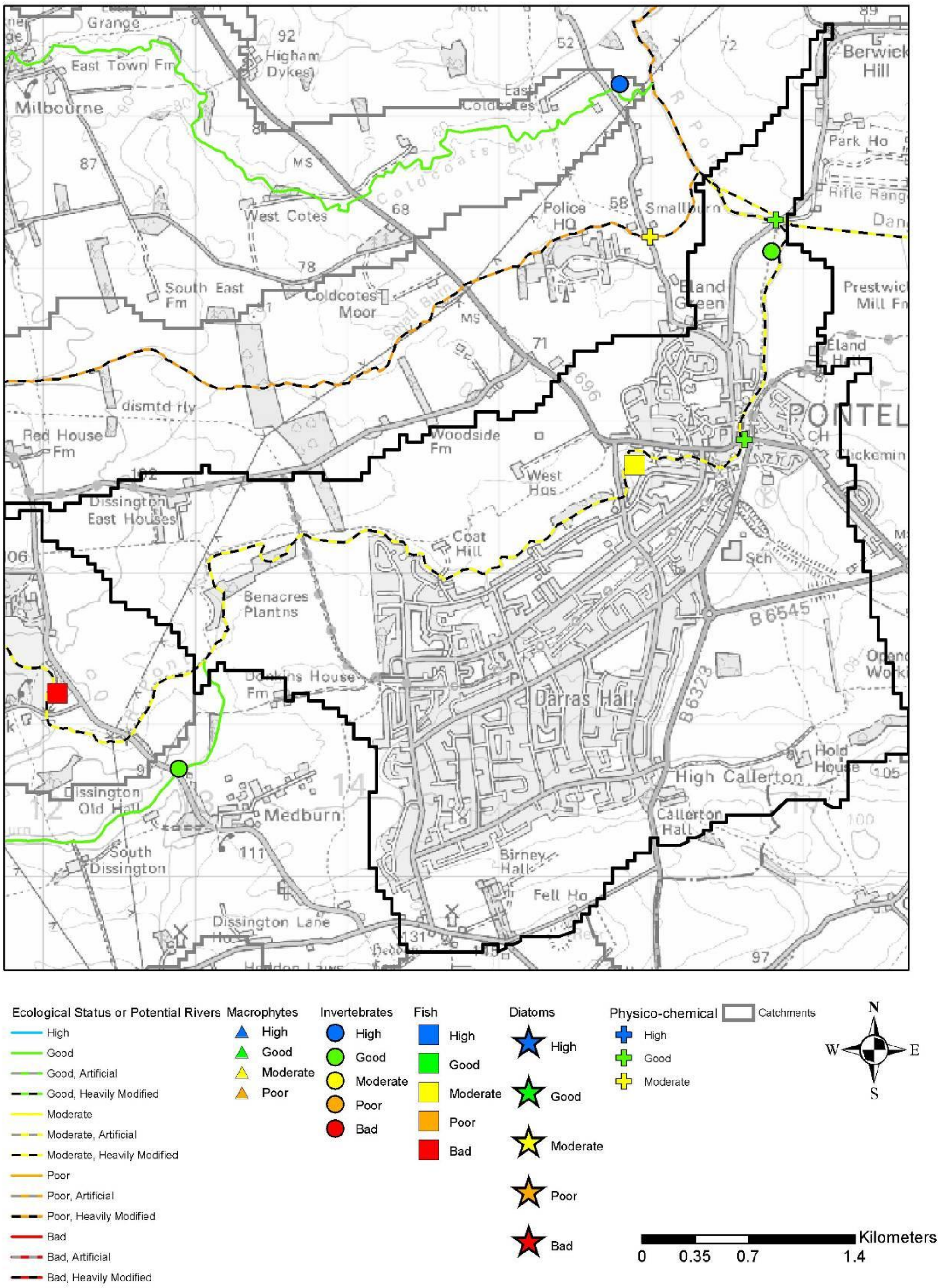
Pont and Blyth Investigation

River Pont – from Med Burn to Small Burn

(Waterbody ID – GB103022076860)

Date – 25/10/12

Ecological Status or Potential for GB103022076860



1.0 Introduction

This report is the output of a site visit undertaken by Gareth Pedley of the Wild Trout Trust to the River on 25 October 2012. Comments in this report are based on observations on the day of the site visit.

Normal convention is applied throughout the report with respect to bank identification, i.e. the banks are designated left hand bank (LB) or right hand bank (RB) whilst looking downstream. Location coordinates are given using the Ordnance Survey National Grid Reference system.

The walkover assessment was undertaken from the confluence of the Pont and Med Burn (NZ1302571417), following the course of the river downstream to the confluence with the Small Burn (NZ1631274637).

The waterbody has been assessed as moderate for fish under the Water Framework Directive (WFD) classification which suggests that less fish are present than would be expected. The waterbody is also classed as heavily modified.

This report will assess the suitability of habitats for fish within the waterbody, identifying pressures and possible mitigation measures that can be undertaken to improve habitats.

A map showing the extent of the waterbody and brief detail on its WFD designation can be found on the next page.

2.0 Habitat Assessment

2.1 Med Burn to Darras Hall Gardens (NZ1302571417 - NZ1414572288)

Habitat immediately downstream of the Med Burn is of a similar nature to the upstream waterbody, with a significantly straightened channel, but limited incision, so some natural substrate to create riffle and glide habitat was present (Picture 1). Aerial photographs (Google Maps) of the area confirm several different, more sinuous, previous channel courses.

In most areas water depth is <50cm and cobbles are the predominant bed feature, providing habitat that will favour parr, but is too fast for fry in most places, with little shelter, and is generally too shallow for larger adult fish. There was a distinct lack of smaller spawning-sized bed material (10-50cm dia), likely a result of the historic dredging and fast flows through a narrow, straightened channel preventing deposition and retention of such material.

As with most areas in this catchment with stock access to the river bank, marginal vegetation is limited, reducing cover and leading to poaching and increased bank erosion. Some trees were present, predominantly hawthorn (*Crataegus monogyna*), but buffer fencing to increase marginal vegetation, cover/shelter and allow tree planting would be very beneficial.

Picture 1. Straightened river section with limited bank-side vegetation and some riffle habitat. Note the greater level of vegetation and reduced erosion on the RB, where stock access is restricted. If areas of channel could be widened more spawning substrate may be retained.

Towards the bottom end of the 1st field the river exhibits some increase in sinuosity, and with this the availability of deeper pool habitat increases (vital for older year classes of fish), particularly around obstructions. Planting of goat willow or sallow (*Salix caprea and S.* cinerea) whips into the river bank along the deeper pool areas would greatly increase their habitat quality (particularly cover) and ability to hold larger adult trout (example Picture 2).

Picture 2. Possible locations for tree planting, particularly willow/sallow whips (these would require protection from livestock and should ideally be within buffer zones).

The river then enters a wooded section (NZ1319471715), where the sinuosity of the channel increases further. Bank-side trees provide in-channel diversity through their root systems, which along with branches and woody debris provide the low level cover that is lacking in other areas of the river. Correspondingly, the habitat is of much higher quality (Picture 3). There is still a general lack of smaller substrate suitable for spawning (10-50mm), but a more varied channel cross-section and profile has allowed small areas to accumulate. A small tributary joins the River within the wood, and as with many of the smaller tributaries, appears to be a source of increased sediment (Appendix A; Picture 1).

Picture 3. Improved habitat through the wooded section, where stock are excluded and less dredging has been undertaken.

Downstream of the wood, grazing again becomes an issue, predominantly on the LB, but even the lighter grazing on the RB is suppressing marginal vegetation. Buffer fencing of both banks would be beneficial. Significant realignment has taken place here, moving the River to a straightened, deepened course along the edge of the floodplain. This has left a long section of channel with an incised bed, lacking in shallower riffle sections, with little juvenile habitat. Where trees are present to provide cover and constrict the flow, pool type habitat is of a reasonable quality for adult fish (Picture 4).

Three significant sediment inputs were noted through this section, all a result of cattle access to the river bank. The first two being fording points, and the second, an area of poached, low lying, boggy land that was actively leaching the muddy water directly into the watercourse. These features would all create an even greater issue when inundated by high river flows (Appendix A; Pictures 2, 3 & 4).

Picture 4. Improved adult trout habitat provided by a tree encroaching into the river channel. This provides increased flow diversity and cover to an over deepened channel. The addition of buffer fencing would further enhance habitat by increasing bank-side cover and protecting the banks.

Downstream the river enters another wooded section, where again the sinuosity increases slightly and the extent of dredging/channel deepening is lessened. However, the channel still appeared to have been subjected to realignment from its natural course. In this area smaller substrate was again evident, but not in the volumes to provide significant spawning benefit, as much of it is compacted with fine sediment and much larger gravel/cobbles (Picture 5).

Woody debris was present within the channel, providing beneficial cover and flow diversity, as were falling/trailing marginal trees. Where these protruded far enough into the channel to facilitate some bed scouring/sorting gravel lifts had been created, but again, only with limited potential for spawning due to the high sediment content and lack of 10-50mm gravel.

Picture 5. Typical example of the smaller substrate to be found within the reach, which is of limited use for spawning.

Below the wood the River flows through a large culvert. This poses no issues to fish passage, but there were several notable sediment inputs to the River around that location (Appendix A; Pictures 5 & 6 & 7). Downstream of the culvert was a significant pool, seemingly created by the accelerated flow that would occur in high water as it exits the structure. The habitat value of this pool could be enhanced by planting willow along the LB, which would also provide increased protection to the outside of the bend and protect the footpath.

Proceeding downstream, the River flows through an area of set-aside land. The footpath has been diverted away from the watercourse and a small field either side remains untouched. This section has been subjected to the ubiquitous dredging and realignment, leaving uniform morphology, but some secondary habitat features, such as marginal vegetation/cover are beginning to establish (Picture 6). Left relatively undisturbed, the channel has started to form some more natural morphological features, such as islands (Picture 7). This would be an ideal section of river to further develop channel morphology through increased meandering, creating wider, shallow riffle areas and increasing structure.

Picture 6. A good example of the healthy herbaceous vegetation that would benefit all sections of the river and wildlife throughout the river corridor.

Picture 7. Some natural in-channel features starting to develop.

2.2 Darras Hall Gardens (NZ1414572288 - NZ1532172300)

At the downstream extent of the undisturbed section the River flows into the start of the gardened section, signifying the start of Darras Hall. In the first garden, more sediment inputs were evident, perhaps from garden land drains, also suggesting that the sediment input from the other drains further upstream may simply be a result of land drainage through the light clay based soil type, rather than particular land use issues. A small area of Himalayan balsam was encountered in the vicinity of the gardens around NZ1537172346.

As would be expected there was a recurring issue of land use throughout the gardens, with most lawns mowed down to the rivers edge, leaving no marginal fringe. A more significant issue, however, was the vast array of weirs that have been created throughout most of this section. These weirs range from small barriers that pose issues for small fish species, juveniles fish and sediment transport, through to large-scale structures that are likely to be impassable to a large percentage of the River's fish population for most of the time (Appendix B). Pictures 9 & 10 show examples of two of the worst obstructions.

Picture 9. Significant weir (c. 60cm high), likely to be impassable to a large percentage of the Pont's fish stocks at most flows (also Appendix B; Picture 3).

Picture 10. Another significant barrier to juvenile fish stocks c.45cm high (also Appendix B; Picture 10).

One of the major consequences of these barriers is the fragmentation of available habitat within this waterbody. It has already been identified that there is a distinct lack of potential spawning on the system, including the upstream waterbody, so access to any available good quality habitat is paramount. These weirs not only restrict the movement of adult fish upstream through this section to spawn, but also prevent the upstream movement of any smaller fish that are spawned downstream. The weirs also create significant impoundments to the river throughout much of the reach, preventing transport of substrate downstream, drowning out any potential spawning areas with deep water and smothering what gravels there are with fine sediment.

2.3 Downstream of Darras Hall Gardens to the A696 (NZ1532172300 - NZ1660472872)

Continuing downstream, the impact of weirs and gardening on the river decreases, and correspondingly habitat value greatly increases. The substrate is much more suitable for spawning and flows are more natural. Here, the impact of the weirs on fish passage and habitat continuity becomes very evident. The section downstream of the gardens (upstream (u/s) and downstream (d/s) of Fox Covert Lane) and through Ponteland Park provides some of the best spawning substrate on the entire Pont system, for both trout and grayling (Picture 11). The obstacle to upstream migration from here for all fish life-stages created by the weirs, and the potential impact on fish stocks should not be underestimated.

The presence of the beneficial substrate in this area is likely to be a direct consequence of reduced dredging effort away from agricultural land use, and probably explains the comparatively good numbers of juvenile trout found here in EA electric fishing surveys. That said, the habitat around this area is far below optimal, due to excessive maintenance/tunnel cutting of bank-side trees and removal of woody debris/in-stream structure, which has left a long section of river with greatly reduced cover for fish, particularly adult trout. The lack of structure within the channel also limits vital natural scouring and gravel sorting; thereby also limiting the potential of any spawning substrate within the reach and therefore natural fish production of the River.

Picture 11. A good example of the improved substrate (10-50mm) for salmonid spawning in the section of river between the downstream limit of the gardens in Darras Hall and the downstream limit of Ponteland Park.

Maintenance work was underway while the walkover was conducted and it was disappointing to see that in a wide, open area of floodplain in the park, all the valuable low level, overhanging branch habitat was being removed (Picture 12) – despite the section being bracketed by two bridges whose hydrological limit are likely to make such vegetation clearance redundant for reduction of flood risk.

Prior knowledge of the maintenance regime around Ponteland Park and discussion with one of the operatives confirms that this treatment would be carried out throughout the park and continued into the area upstream of Fox Covert Lane (all of the highest potential habitat in this waterbody). The impact of removing the low level branch cover/trailing branch type habitat can be seen in Appendix C (before, during and after), where an area of valuable fish holding cover is removed, leaving open, poor quality habitat.

Picture 12. One of two bridges that create a significant constriction through the Park and restrict flows to a much greater degree than would be created by retention of low branches along the river margin.

Picture 13. The widest floodplain profile throughout Ponteland Park, between two low bridges, yet all of the low level branches have been removed along the RB to create a tunnel cut effect, leaving no low level or in-channel cover habitat.

Downstream of the Park, upstream of the A696 road bridge, is another area where significant levels of channel maintenance are carried out. The wide, straight area directly above the A696 bridge accumulates gravel after high flows, as is to be expected where an over-wide channel is maintained. With this in mind it is suggested that options are investigated for increasing flood capacity through development of a two-stage channel, rather than the intrusive maintenance dredging that currently occurs. If the large area of unused land on the LB, upstream of the bridge were lowered and graded to increase flood capacity, the wetted river channel and margins could be left un-dredged. Once naturalised, this should improve conveyance of bed material within the river channel at most flows, while providing high flow capacity in the second stage of the channel (Picture 14).

Picture 14. Upstream of the A696 road bridge, where it may be possible to reduce dredging by lowering the LB (hatched red) to increase flood capacity. This would allow the river channel to naturalise and remove the ongoing impact of dredging on the river.

2.4 A696 Road Bridge to Small Burn (NZ1660472872 - NZ1631274637)

Downstream of the road bridge the River is again heavily straightened, but where deeper pools occur, with good cover and in-channel structure, habitat quality improved (Picture 15). Correspondingly, several fish were observed taking insects from the river surface in this section.

Picture 15. Straightened channel, but with sufficient depth, cover and in–channel features to provide reasonable trout habitat.

Further downstream the channel remains heavily straightened and dredged and livestock have access to the river bank. This further increases issues on the watercourse, with greatly increased bank erosion and sedimentation occurring. There is a short section of buffer fencing on the left bank where improved cover was present, but below this open stock access to the river occurs, with stock crossing over from the opposite bank in sections where only one bank is fenced. Continued grazing pressure/trampling is also inhibiting recolonisation of vegetation in areas of slumped banks where natural re-grading is occurring (Picture 16). The substrate in this area is severely compromised by the resulting heavy sediment loading (Picture 17).

Picture 16. Erosion and livestock scarring on an area of naturally re-grading slumped bank. Note the obvious grazing pressure within the buffer zone that must be occurring from livestock crossing the river.

Picture 17. Evidence of heavy sedimentation of the river substrate, with a large silt plume liberated by shuffling on the bed.

This situation continues for the remainder of the waterbody downstream, with some small areas of improved channel morphology where the river has reinstated small meanders and slight improvements in habitat occur (Picture 18). As with sections upstream, if this section was buffer-fenced and more trees were planted throughout, there would be greater potential for improved flow diversity when they grow into the river, and an increased source of woody material to the channel as they die; both of which would increase beneficial erosion and scour of the channel and encourage development of more natural channel features and morphology.

One other significant feature of this lower section was the input from a tributary of a different type of turbidity to the river (Picture 19). Unlike the seemingly clay-based inorganic type inputs from most tributaries and field drains encountered, this tributary appeared to be discharging much darker water, with a higher organic content. Further investigation on Google maps revealed that the tributary drains Prestwick Carr (Picture 20), which is likely to explain the humic stain and organic content.

Picture 19. The dark brown component along the far bank is the discharge from Prestwick Carr.

Picture 20. The indigo line represents the River Pont, the brown line represents the tributary draining Prestwick Carr and the red perimeter outlines Prestwick Carr. The difference in the soil type around the Carr can be clearly seen.

3.0 Recommendations

A brief overview of the waterbody is as follows:

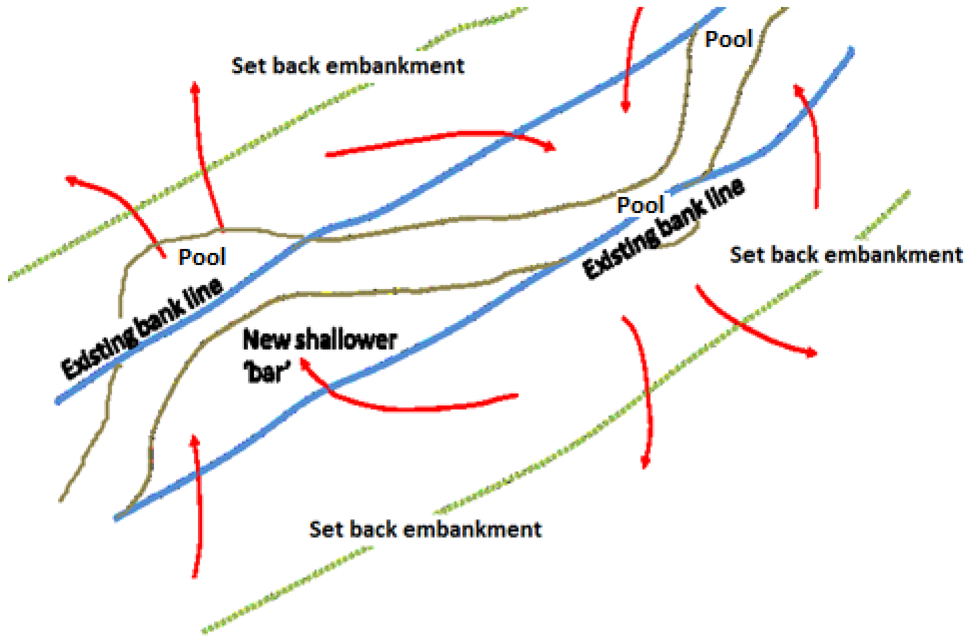
- The upper section (Med Burn to Darras Hall Gardens) is significantly lacking in spawning and fry habitat.
- The middle section (Darras Hall Gardens to the A696) suffers from major issues of impoundment and barriers to movement of both fish stocks and substrate, providing limited quality habitat for anything other than adult fish throughout the gardens. The section downstream and through the Park suffers from removal of almost all in channel features and marginal cover, greatly reducing the quality of adult habitat and reducing vital bed scouring and substrate sorting.
- The main issue on the lower section (A696 to Small Burn) is the dredging and incision of the channel, leaving many areas only providing adult habitat, with little or no spawning potential due to significant sedimentation of the bed.

3.1 Sedimentation

As with other waterbodies in the Pont and Blyth system, sedimentation is a significant issue that has to be addressed. It is understood that this will be tackled to an extent by the Northumberland Rural Diffuse Pollution Partnership. Remediation of this issue will be pivotal to future improvements to the river, particularly fish stocks. However, Appendix A highlights numerous inputs to the waterbody that were encountered during the walkover.

3.2 Channel Realignment

The level of dredging and re-alignment throughout much of this waterbody has left the river straight and deeply incised for long sections. The ideal solution would be to reinstate the original course of the river wherever possible. Where this is not possible, a second option would be to re-meander the channel with dig and dump type channel re-working (Picture 21), or at least re-grade the banks to increase the river’s ability to naturally adjust.



Picture 21. A diagram of the type of channel re-meandering that could be undertaken (adapted from the River Restoration Centre). The red arrows indicate areas where bank materials could be removed and/or placed within the channel.

This kind of re-alignment project would involve major work, moving large volumes of earth and involving significant amounts of time and money. It is understood that at present there is no budget for this, but if funds were available significant habitat benefits could be gained. The prime locations for this treatment would be within areas already generously buffer fenced, or where new large buffer zones could be negotiated. This is something that might be feasible, and could be investigated with the landowners.

If funding became available, this type of work should be undertaken throughout most of the waterbody, but prime locations would be:

- NZ1308471491. In the in the most upstream field of this waterbody. The right bank already appears subject to little or no grazing. Ideally both banks, if agreement could be gained.
- NZ1316672165. Particularly the RB side where the ground is wet and of limited use for grazing.
- NZ1382572217. This is potentially the most likely place that could be developed, as the area appears to be left completely unmanaged at present.
- NZ1454172073. Similar to the above site, where limited management appears to be occurring.

- Anywhere from the downstream limit of Ponteland village (NZ1676173457), down to the lower limit of this waterbody and into the next.

In reality, while this would be the optimal scenario, it is likely that funding and landowner agreement will be an issue. In addition, the river is already starting to naturalise in areas, increasing in sinuosity and re-grading the over-steep banks. This means that it may be worth concentrating on assisting the natural adjustment that is already occurring in the short term unless funding becomes available.

3.3 Assisting Natural Adjustment

It is recommended that the re-naturalisation processes already underway are assisted by planting of trees to increase flow diversity within the channel and promote areas of beneficial scour and deposition. LWD and flow deflectors/pinch points could also be employed to similar effect. Prime locations for this kind of work would be all of the locations highlighted above for channel realignment

For optimal benefit, some of these structures could be installed in conjunction with gravel riffles, using the enhanced flow to reduce sedimentation of the gravel; however, deflectors, woody debris, and an increase in marginal trees may help to scour and sort what bed material is available.

3.4 Gravel Reinstatement

Gravel riffles could be created at intervals throughout the waterbody, particularly in the more heavily dredged and incised sections, where they could be used to break up the long sections of river that currently provide little or no spawning.

Any riffle created should be two to three times as long as the channel width and stabilised by first lining the bed with large stones or cobbles, before top dressing with 20-50mm, angular river gravels. The installed riffle should not raise upstream water levels by more than 30cm at normal discharge, and ideally any impact on the upstream water level should be kept to a minimum.

This can be achieved by starting the riffle well upstream of a natural lift in the bed and working down towards the lift, thereby increasing velocity by lifting the bed of the dredged channel; or by working downstream of the lift and ensuring that the highest point of the riffle does not greatly exceed that of the natural lift.

The profile of the riffle should always be designed higher at either bank, to focus flow to the centre of the channel; however, varying the low point of the channel to increase bed diversity would be beneficial.

The gravel should start shallow at the upstream end, increasing in height (depth of gravel) as it progresses downstream to a crest, followed by a short section of grading back to bed level at the downstream end to reduce scour as water leaves the riffle.

If sections with a more natural, gradual bank profile are available the chance of wash-out during flood events is likely to be reduced. A key aspect in the successful installation and retention of these riffles is likely to be dependant upon creation of an adequate cobble base to each riffle to retain the gravel.

Even where the above criteria are not met, benefit would be gained by interspersing the long straightened sections with at least one raised gravel riffle. These areas may however, require more material to create the desired effect, depending on the severity of dredging in the area.

As the installation of gravel will reduce channel capacity at that location, it is advised that an area of protection is provided along the bank-line to reduce the potential for bank erosion. This would be best achieved through the planting of trees, or installation of brushwood along the margins, which would also further enhance habitat in the area, particularly for salmonid fry. Re-grading of the banks in the areas tackled would also be highly beneficial and should be considered as a complementary measure with the riffle creation.

This work would be well complemented by shallower, sheltered areas downstream of the riffles for juvenile habitat, through the inclusion of brushwood, and or cobbles along the margins for increased cover.

3.5 Weir Removal

Due to the lack of natural bed features, over-deep, incised channel and low gradient, the weirs present create a significant issue to the river, impounding flow, interrupting sediment transport and forming barriers to fish migration (Appendix B). It is recommended that all of these impoundments are removed down to river bed level.

Notching of a portion of the weir would be another option (significantly poorer option that removal), but if undertaken, this should be a wide enough notch to prevent over-accelerated flows that could also cause an obstruction and cause accelerated scour/erosion. It should also be ensured that the notch extends right down to bed level, thereby completely removing the obstruction to both fish and substrate migration.

3.6 Tree Management and Planting

Tree planting would be beneficial throughout all sections of this waterbody as there was a general lack of marginal tree cover throughout.

It is recommended that as a bare minimum, willow/sallow whips should be planted along the waterline to break up the long sections of riverbank where trees are absent. Planting of other species of tree would also be beneficial to increase diversity and the type of habitat created. A mix of alder (*Alnus glutinosa*), ash hawthorn and hazel would be beneficial.

Ideally, the trees should be allowed to grow out over, and into the river channel. Any trees that fall into the river should ideally be left in situ, forming LWD, as would naturally occur. If there is a perceived flood risk it may be appropriate to adjust the location of the LWD, anchoring it to other marginal trees, or posts driven into the bed or bank. Removal of this material, and tree pruning should be avoided where at all possible as LWD forms a vital part of any river habitat and facilitates sorting of bed materials.

This is particularly true through Ponteland, where it is suggested that the blanket policy of tunnel cutting and removal of any natural in-stream structure is urgently in need of review. A level of pragmatism is required here to balance the necessity of flood risk management with the requirements of natural habitat and performance under the Water Framework Directive. As highlighted in pictures 12 and 13, although causing some increase in channel roughness, the structures adversely affecting flood risk through Ponteland are unlikely to be the small overhanging and trailing vegetation that is so valuable for habitat. Where in-channel material absolutely has to be removed, it is recommended that permanent, substitute fish cover be installed, such as tethered tree kickers. Good, positive publicity could be gained with the local residents if the reasons for these actions were explained on interpretation boards.

Elsewhere on the waterbody, hinging and limited coppicing of bankside trees would be beneficial throughout all sections where low cover is lacking. Care should be taken to leave plenty of diversity in tree and shrub height.

3.7 In-stream Structures

Although well-placed trees will provide some flow variation, the extent of the dredging and straightening on the Pont and Blyth have left the channel so over-capacity that it will be beneficial to artificially restrict and divert flows within the channel.

Several options for achieving the desired effect exist, but it is recommended that natural techniques will be the most appropriate. Methods like introducing LWD into the channel, either tethered or lodged between existing trees, and narrowing with living willow hurdles or bundles would work well. They can be either paired, to create pinch points, or alternating to increase meandering of the channel, particularly in areas where there is plenty of buffer zone. The benefit of living willow bundles is that they are quick and easy to create and install. They are also likely to accumulate and consolidate the sediment from the abundant supply of the river, rapidly creating new bank-lines.

These methods would also work well in conjunction with areas of gravel introduction, where the increased flow velocity and diversity can be employed to keep the gravel clean. LWD should be installed throughout all sections covered in this report, with full consideration given to potential flood risk issues.

4.0 Disclaimer

This report is produced for guidance only. 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.

Appendix A

Sedimentation sources in sequential order, progressing downstream.

Picture 1. Sedimentation from a small tributary in wood (NZ1319871880)	**Picture 2. Fording point downstream of wood. Poaching and erosion issues continued u/s & d/s in this field (NZ1309572053)**

Picture 3. Cattle fording point (NZ1325672163)	**Picture 4. Poached boggy ground leaching sediment (NZ1343872194)**

Picture 5. Field drain on RB u/s culvert (NZ1366172217)	**Picture 6. Field drain on RB u/s culvert (NZ1368872251)**

Sedimentation sources in sequential order, progressing downstream.


Picture 7. Field drain on LB u/s culvert (NZ1369472252)	**Picture 8. Two land/garden drains on far bank (RB) in first Darras Hall garden (NZ1414572288)**


Picture 9. Bank erosion (NZ1452872086)	**Picture 10. Bank erosion and slumping in garden (NZ1464971978)**


Picture 11. Light sedimentation from tributary (NZ1514772185)	**Picture 12. Major cattle poaching and erosion around drinking point (NZ1675773473)**

Sedimentation sources in sequential order, progressing downstream.

Picture 13. Cattle poaching and erosion around access point (NZ1679873945). Another similar issue was present in the same field

Appendix B

Barriers to fish migration in sequential order, progressing downstream.


Picture 1. Small weir causing an obstacle to small fish, with some impact on transport of bed material (NZ1423672280)	**Picture 2. Small weir causing an obstacle to small fish, with some impact on transport of bed material (NZ1437672235)**


Picture 3. Significant barrier to most fish in most flows, significantly inhibiting transport of bed material (NZ1453772076)	**Picture 4. Small weir causing an obstacle to small fish, with some impact on transport of bed material (NZ1458572026)**


Picture 5. Small weir causing an obstacle to small fish, with some impact on transport of bed material (NZ1468171964)	**Picture 6. Small weir causing an obstacle to small fish, with some impact on transport of bed material (NZ1474071987)**

Barriers to fish migration in sequential order, progressing downstream.

Picture 7. Medium sized weir that is an issue for smaller fish and transport of bed material (NZ1493572026)	Picture 8. Medium sized weir that is an issue for most fish at low/medium flows, and for transport of bed material (NZ1495172035)

Picture 9. Medium sized weir that is an issue for smaller fish and transport of bed material (NZ1499272040)	Picture 10. Medium weir causing an obstacle to small fish, with some impact on transport of bed material (NZ1500372107)

Picture 11. Significant barrier to most fish in most flows, significantly inhibiting transport of bed material (NZ1529572247)	Picture 12. Small weir causing an obstacle to small fish, with some impact on transport of bed material (NZ1552172418)

Barriers to fish migration in sequential order, progressing downstream.

Picture 13. Small weir causing a minor obstacle to small fish, with some impact on transport of bed material (NZ1560772455)	Picture 14. Small weir causing an obstacle to small fish, with some impact on transport of bed material (NZ1583172503)

Picture 15. Small weir causing an obstacle to juvenile fish and some impact on transport of bed material (NZ1671373182). By the look of this obstruction it may be a pipe crossing so may require an easement, rather than removal.

Appendix C

Before, during and after tree maintenance work in Ponteland Park, demonstrating the impact of tunnel cutting on vital low-level cover and trailing vegetation habitats.

Before

Beneficial low-level cover that provides shade and security, particularly for adult fish.

During

After

All of the beneficial aerial cover has been removed. This prescription was carried out throughout Ponteland and upstream towards Darras Hall, removing almost all of this type of habitat for an extended section of river.