Enniscorthy (River Slaney) Flood Defence Scheme

Back Channel Restoration

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1. INTRODUCTION

While undertaking aquatic ecology surveys for the proposed Enniscorthy Flood Defence Scheme (FDS) potential opportunities for restoring an old distributary channel of the River Slaney became apparent. Creating and restoring back-channel features is often used as a method to increase habitat heterogeneity and such areas can provide important habitats for aquatic organisms and will improve biodiversity in general (River Restoration Centre, 2002; RSPB *et al,* 2001; Cramer 2001). Therefore, as part of developing the design of the proposed Enniscorthy FDS the current study was commissioned to look at the feasibility of restoring this back channel and develop preliminary designs

The subject channel is located within the footprint of the proposed FDS and runs along the east of the floodplain upstream of the town. This channel is currently partially dry and contains stagnant water, however based on historical mapping this was previously a functional distributary channel which became silted up. Historical mapping also shows that the main channel of the River Slaney in this area previously had additional islands and it is likely that these stretch of the river has been subjected to ongoing minor historical modifications which may have lowered water levels and caused the distributary channel to dry out. The lower reaches of the exiting back channel have also been depended to improve drainage.

2. METHODOLOGY

A desk study of the available literature creating and restoring backwater habitats was undertaken. These included the 'Manual of River Restoration Techniques' prepared by the River Restoration Centre (2002) and case studies including the 'River Nene: Castor Back Channel' project (Environment Agency 2012). A full bibliography is given in the references section. A site visit was undertaken on the 22nd June 2017 to review the back-channel site. Draft designs for the proposed restore channel were developed as a further desk exercise with reference to results from the desk and field surveys.

3. DESIGN

The location of the proposed back channel is presented in Figure 1. Figures 2 and 3 provide zoomed in sections of the back channel with aerial photography. A detailed schematic drawing is illustrated in Figure 4.

The proposed back channel to be constructed will cater for 5% (minimum) of ambient flow in the existing main channel of the River Slaney: c. 0.24m^3 sec^{-1} at 95%ile flow; c. 1.55m^3 sec^{-1} at Mean flow.

The proposed back channel is approximately 945 river metres long and flows from north-east to south-west. The existing back channel is currently partially dry and comprises of stagnant water. This channel was a former distributary channel of the existing River Slaney and is currently not connected to the main river at the upstream end.

In order to provide a rich biodiversity for species and habitats that will benefit from the proposed back channel restoration, a number of ecological features have been added to the design. Care has been taken to identify the benefits and characteristics of naturally functioning rivers and these characteristics have been applied to the design of the proposed back channel. The proposed back channel design will create River/Brook Lamprey ammocoete and spawning habitats but will also be utilised by salmonids and other fish species. River Lampreys are also likely to migrate through this back channel once constructed.

It is noted that the proposed back channel will be flooded out during floods, although this will not affect lamprey species.

Meanders have been included in the design to imitate the natural flow of a river and to promote oxygenation. The River Restoration Centre '*Manual of river restoration techniques'* including details on new meandering channels through open fields. It is noted in this manual that restoring meandering to straightened rivers results in satisfactory performance in all respects, *'a good range of flow currents, substrates and bank forms are sustained throughout the year'.* All the banks of the proposed back channel will be provided with a gentle slope. Root wads and brushwood mattresses are proposed will be installed as bank protection measures as required, and monitoring will be required in the first few years as these installations are likely to move around once the back channel has settled. Root wads are essentially the root systems of upended trees that are left exposed along the bank of a river. Brushwood mattresses are twigs / branches of trees that are tied together and placed along the bank of a river, which aid in the accumulation of silt and also prevent bankside erosion. Fencing will be installed to further protect the banks from erosion, and will be at least 5m back from the channel. New tree planting will also aid in holding banks together by roots and reduce the potential for the erosion of banks.

Three fish refuges have also been encompassed in the design at approximately 310rm, 627rm and 727rm downstream of where the existing River Slaney enters the back channel. These fish refuges will be agreed on site during construction as they should be located in low lying areas to provide a safe place for fish to reside free from predation during medium to high flows. It will also provide shelter for fish during unsuitable weather conditions. New tree planting is proposed around these fish refuges to provide shelter and shade for fish utilising these pools.

Woody deflectors, of which there are five in the design, will provide a barrier to the main channel behind which silt will deposit to create suitable lamprey ammocoete habitat. These flow deflectors will also provide variations in flow that will last all year round. It will increase the velocity of the flow and will promote natural vegetation growth in these areas. The distribution of woody deflectors in the main flow of the proposed back channel will encourage siltation. The woody deflectors that are placed near meanders will also reduce the potential for bank erosion.

Two spawning areas are included in the design which will be utilised lampreys and salmonids. These spawning areas will also provide habitat for invertebrate species. The spawning areas will be shallower riffled areas in which 'soft' engineering will be applied (no hard rocks) using a suitable washed gravel / cobble mix.

A rock armouring control structure will be constructed at the upper end of the back channel where it leaves the River Slaney flows. This will provide a flow control structure without the use of weirs, which can result in passage problems for lampreys. The proposed back channel to be constructed will cater for 5% (minimum) of ambient flow in the existing main channel of the River Slaney: c. 0.24m^3 sec^{-1} at 95%ile flow; c. 1.55m^3 sec^{-1} at Mean flow.

An Island feature is also included approximately 410 river metres downstream of where the existing River Slaney joins the back channel. This Island feature will create interesting habitat that may be used by otters commuting or foraging along the proposed back channel.

Maitland (2003) describes the habitat requirements for all three lamprey species in *'Ecology of the River, Brook and Sea Lamprey'*. It is noted that a clear migration route with suitable river flows and no barriers is an essential requirement for lamprey habitats. At spawning areas, suitable hiding places and clean

spawning gravels are crucial, in addition to a slower flowing nursery area of sandy silt in fresh water above estuaries. Also noted are water quantity, water quality, substrate requirements, channel structure and channel management. The habitats created for lamprey species in the proposed back channel design will provide no barriers to migration, suitable hiding places and clean spawning gravels. The areas of silt behind woody deflectors will be an ideal habitat for lamprey ammocoetes. The use of rip-rap as an armouring control section instead of a weir will ensure safe passage of lampreys into the proposed back channel.

It is considered that not only will the proposed back channel create suitable habitat for aquatic species including lampreys and salmonids, it will also potentially be of benefit to bats, birds and otters. Bats can utilise the back channel as a corridor for foraging in which insects (i.e. food source) will reside at dusk. Birds will also be able to forage for insects above the water level as a food source and the new tree planting will also create suitable habitat for particular species. Habitats that will be created along the banks of the river, such a brushwood mattresses and root wads may be suitable for the creation of Otter Holts.

The designs present in the current report are illustrative only and full engineering designs showing the control structure and levels required for functioning will be drawn up in advance of construction. In particular engineering input will be required in relation to the control structure to ensure that it will be the required dimensions and set at the correct level to ensure that c.5% of the ambient flow in the River Slaney can be diverted into the back channel (up to mean flows). A detailed method statement for the proposed works will need to be drawn up.

An advance ecology survey of the back-channel area will be required in advance of works. This may be important if the works in this area take place prior to the main scheme being constructed. In particular an advance otter survey is required.

It is also noted that the proposed back channel will be constructed in the dry, and will be shaped into the natural topography (as advised by the on-site lamprey ecologist / hydro-morphologist.

Ideally this proposed back channel should be constructed in advance of the main scheme as it would have the potential to act as a refuge area while the dredging works are ongoing in the main river.

It is envisaged that the channel will be constructed in the dry using track machines. It will be important that all the works are supervised by a lamprey ecologist. Works will be carried out from the downstream end upstream and will require digging and realignment of the existing channel. The works would need to follow a detailed method statement.

The bed of the river channel will be overdug in sections, in addition to all the fish refuge areas. The excavation of the fish refuge areas will be agreed on site with a lamprey ecologist / hydro-morphologist as the fish refuges should be located on low-lying land.

The new trees that will be planted along the proposed back channel will include Willow, Alder and Ash. Fencing that will be installed should be at least 5m back from the proposed back channel, to allow riparian vegetation to grow and to prevent bankside erosion.

The two spawning areas included in the design will be constructed using an introduced washed gravel / cobble mix, i.e. 'soft' engineering. The only flow deflectors to be used are woody deflectors placed along the flow of the back channel (see Figure 4) to aid in the accumulation of silt behind the woody deflectors to create suitable lamprey habitat.

Root wads and brushwood mattresses will be used as necessary to stabilise banks. Root wads and brushwood mattresses are discussed above in section 2.

The only rocks and armouring will be at the top of the channel, as in Figure 4. These rocks and armouring are included here as a flow control structure to avoid using a weir which can lead to passage problems for lampreys.

Monitoring of bank stabilisation features will need monitoring in the first few years as they are likely to move. It is noted again all of the features will be agreed on site with a lamprey ecologist / hydro-morphologist as the back channel is being constructed.

Consideration should be given to including some of the features described here in the main channel also. In particular root wads and tree crucifixes should be installed on the main channel.

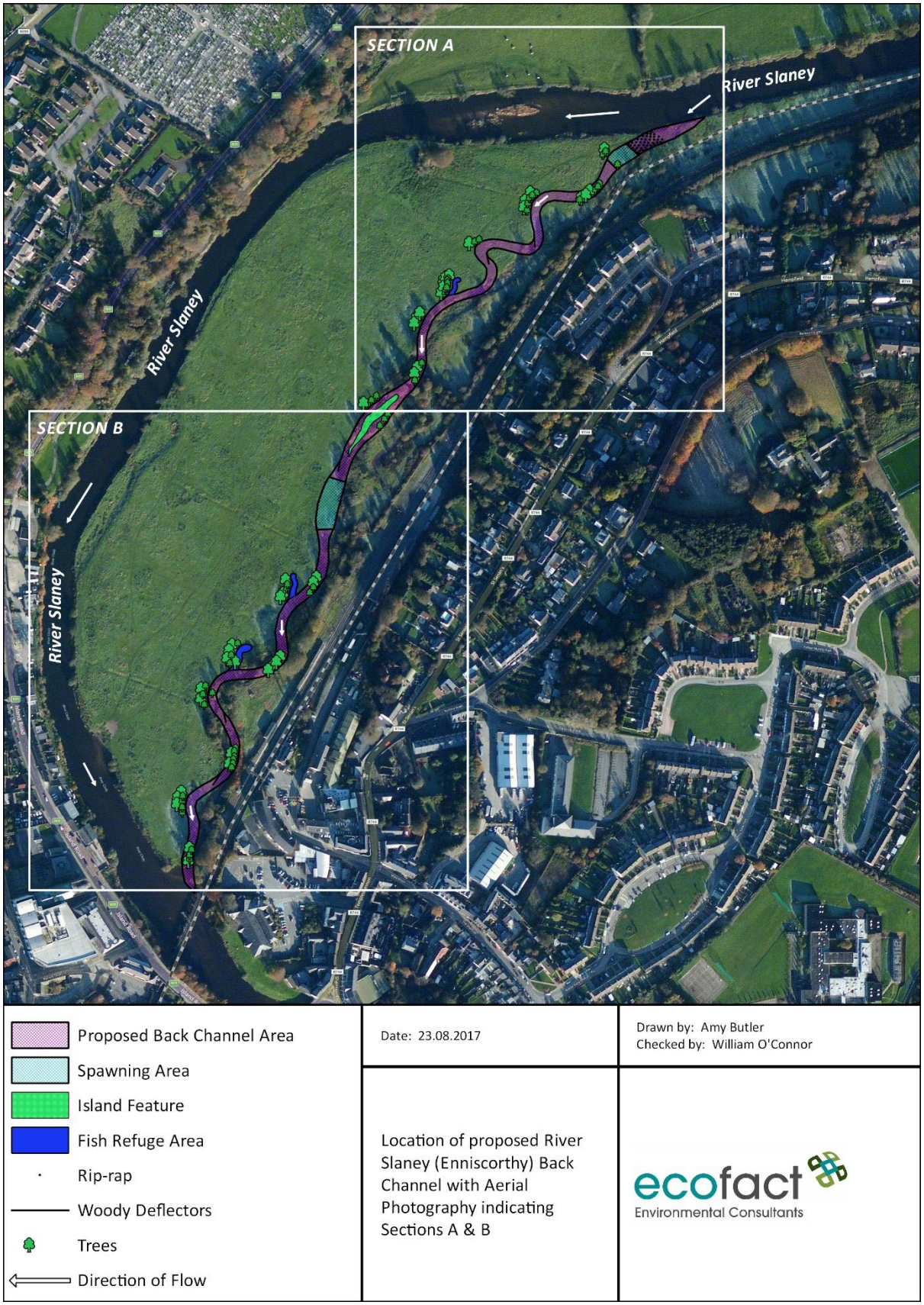

Figure 1 Location of proposed River Slaney (Enniscorthy) Back Channel with Aerial Photography indicating Sections A & B.

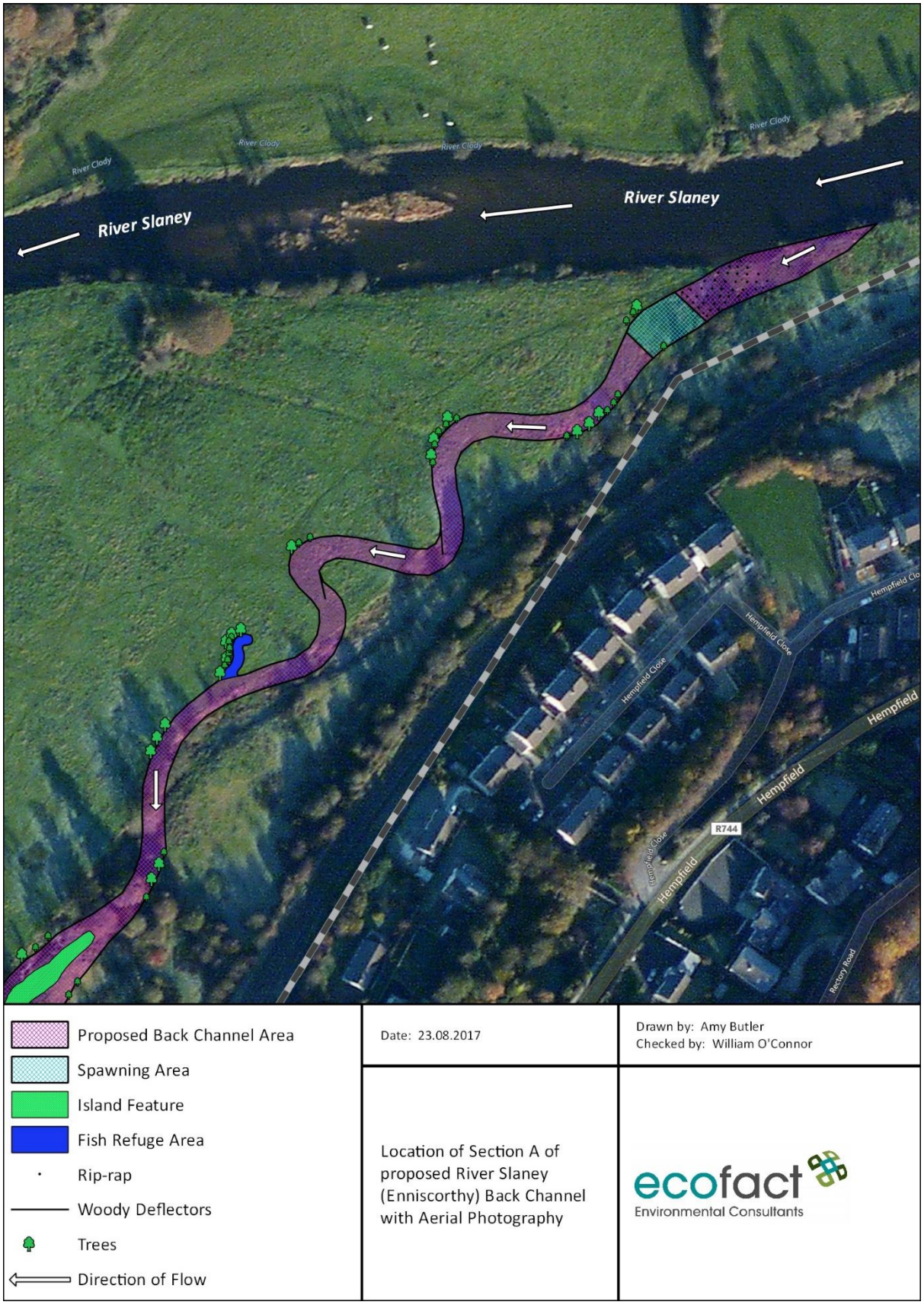

Figure 2 Location of Section A of proposed River Slaney (Enniscorthy) Back Channel with Aerial Photography.

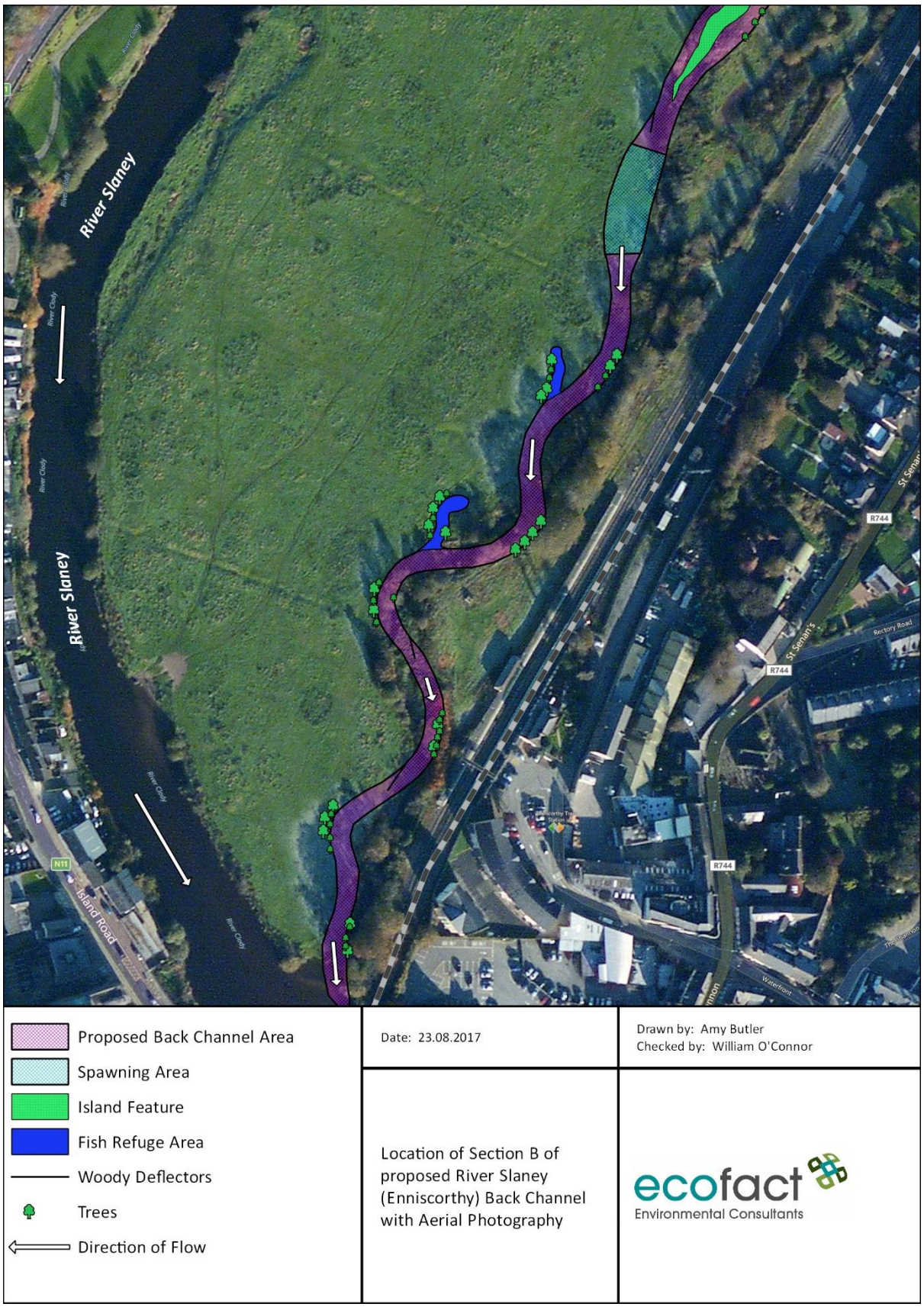

Figure 3 Location of Section B of proposed River Slaney (Enniscorthy) Back Channel with Aerial Photography.

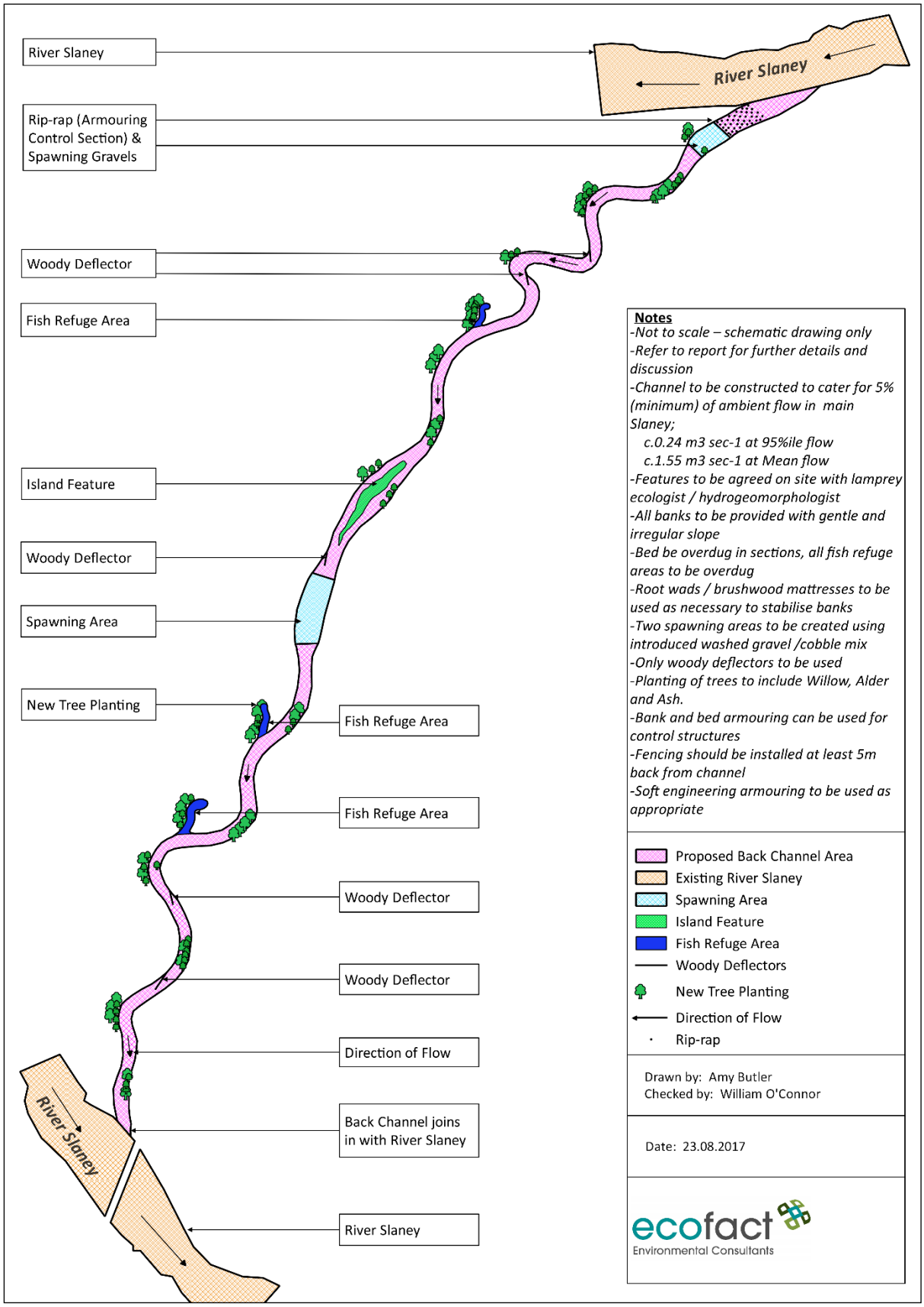

Figure 4 Proposed Back Channel Restoration Schematic Drawing (not to scale).

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PLATES

Plate 1 Existing confluence of the back channel with the River Slaney immediately upstream of the railway bridge in Enniscorthy (June 2017).

Plate 2 Lower section of the existing back channel with stagnant water apparent (Canadian pondweed visible).

Plate 3 Japanese knotweed and other non-native species occur along the existing back channel.

Plate 4 Parts of the existing background are overgrown (Himalayan balsam visible).

Plate 5 Middle section of existing back channel has been depended in some areas and has standing water.

Plate 6 Standing water in middle section of existing back channel is not stagnant, suggesting that a pollution source may be affecting lower reaches of channel.

Plate 7 Back channel may receive storm water – the purpose of this structure near the middle reaches of the back-channel needs to be confirmed.

Plate 8 Same structure as in previous plate.

Plate 9 Sections of the middle section of the existing back channel are more open.

Plate 10 Upper section of back channel was dry at the time of the survey (June 2017).

Plate 11 Junction of the back-channel route (2016 photo) and River Slaney (back-channel is dry in this area).

Plate 12 River Slaney at the upper end of the back-channel route (June 2017). The back channel is dry in this location.

APPENDIX 1 EXAMPLES OF FEATURES

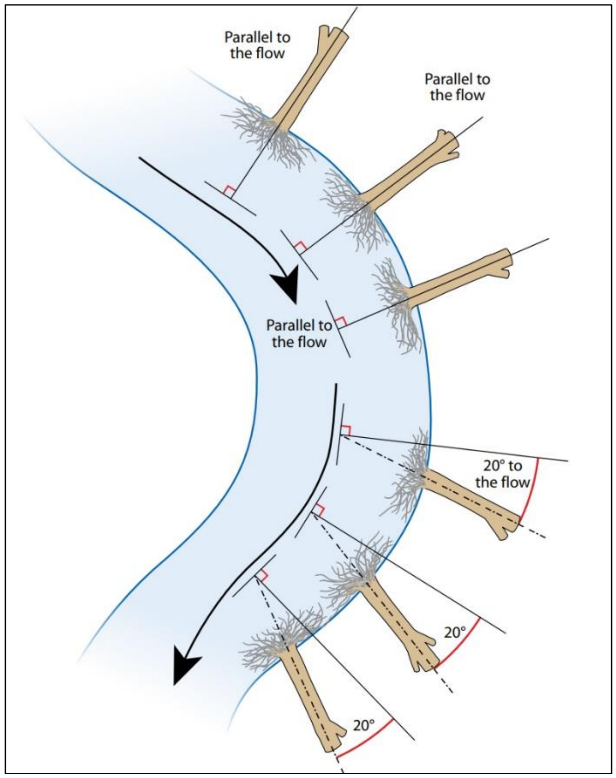

Plate A1.1 Root wads (from RRC 2013).

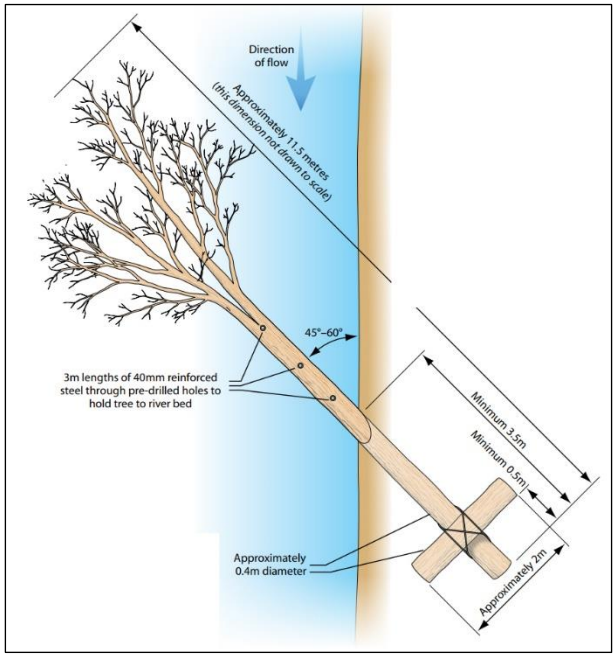

Plate A1.2 Tree crucifix (from RRC 2013).

Plate A1.3 Brushwood mattresses

Plate A1.4 Woody Deflector

Plate A1.5 Fish refuge area

Plate A1.6 Example of what construction of a back channel looks like.