

Interference Reference	Channel Chainage	Proposed Works Chainage (m)	General Description of Proposed Works
C01_G01	1643 to 5815	-	Channel maintenance, as and when necessary over a distance of 4172m from the confluence of The Glashaboy River with Mill Race 1 (C01_1643) to the confluence with Bleach Hill Stream (C01_5815).
C03_G01	0 to 626	-	Channel maintenance, as and when necessary over a distance of 626m along the length of Mill Race 2.
C03_G02	176	-	Marginal change in the peak water level for the 1 in 100 year fluvial flood event in the vicinity of the residential building at chainage 176 on Mill Race 2.

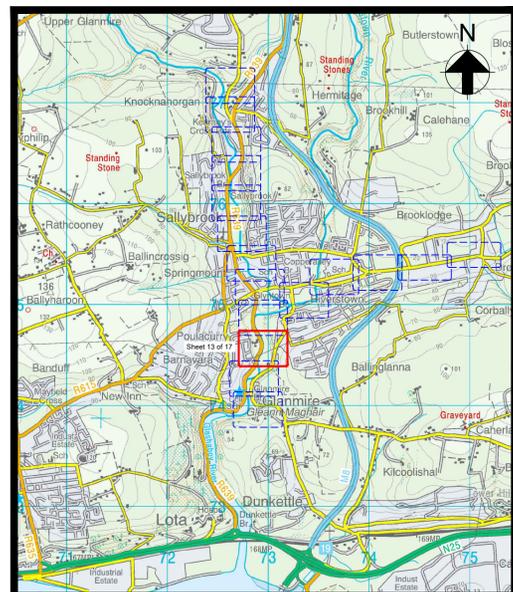
Notes:

- Do not scale from drawing.
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Location Plan



Scale 1:1,000 at A1
Scale 1:2,000 at A3



Key to Plan

- Watercourse
- Channel Centreline, Reference (C08) and Chainage (300m)
- Interference Reference
- Existing Culvert To Be Retained

Key Plan

Drg. No. GR_213 Proposed Flood Defences - Plan Layout (Sheet 13 of 17)

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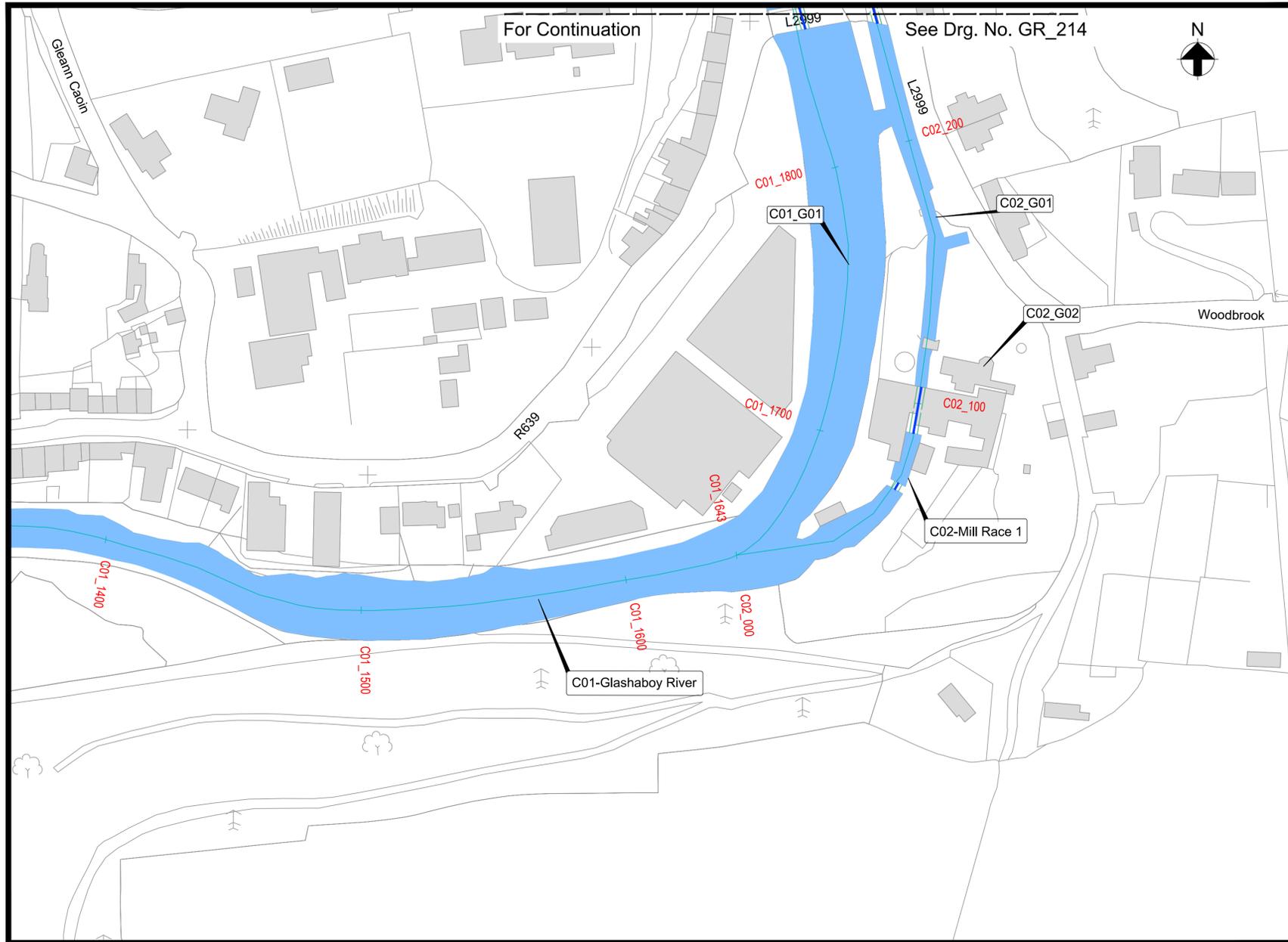
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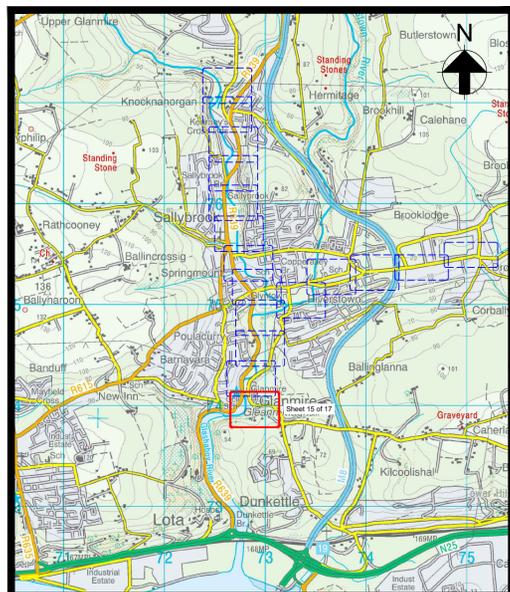
Interference Reference	Channel Chainage	Proposed Works Chainage (m)	General Description of Proposed Works
C01_G01	1643 to 5815	-	Channel maintenance, as and when necessary over a distance of 4172m from the confluence of The Glashaboy River with Mill Race 1 (C01_1643) to the confluence with Bleach Hill Stream (C01_5815).
C02_G01	0 to 434	-	Channel maintenance, as and when necessary over a distance of 434m along the length of Mill Race 1.
C02_G02	124	-	Marginal change in the peak water level for the 1 in 100 year fluvial/ 1 in 200 year tidal flood event in the vicinity of the residential building at chainage 124 on Mill Race 1.

- Notes:
1. Do not scale from drawing.
 2. This drawing should be read in conjunction with all other Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Confirmation Drawings and Schedules.

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Location Plan



Scale 1:1,000 at A1
Scale 1:2,000 at A3



Key to Plan

-  Watercourse
-  Channel Centreline, Reference (C08) and Chainage (300m)
-  Interference Reference
-  Existing Culvert To Be Retained

Key Plan

Drg. No. GR_215 Proposed Flood Defences - Plan Layout (Sheet 15 of 17)

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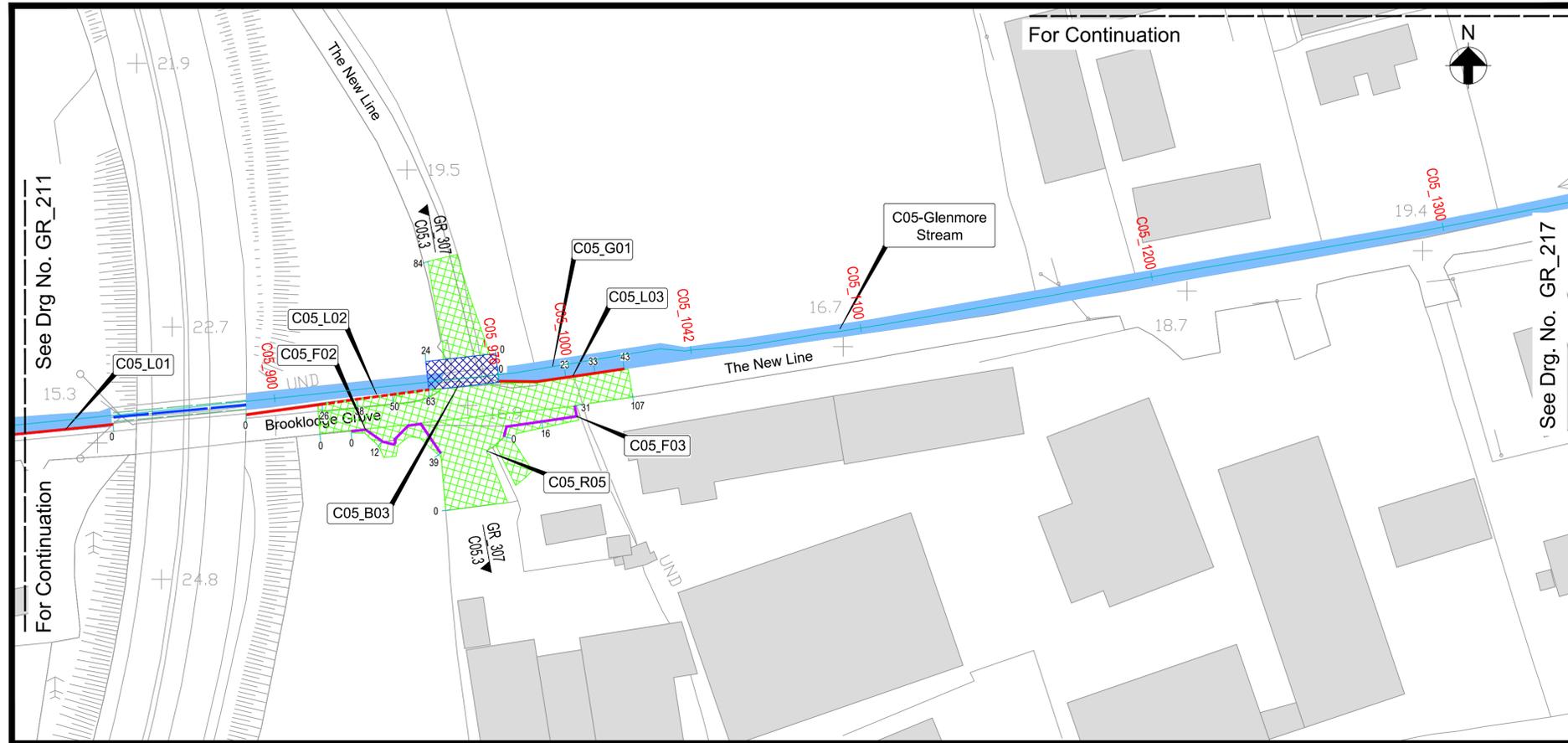
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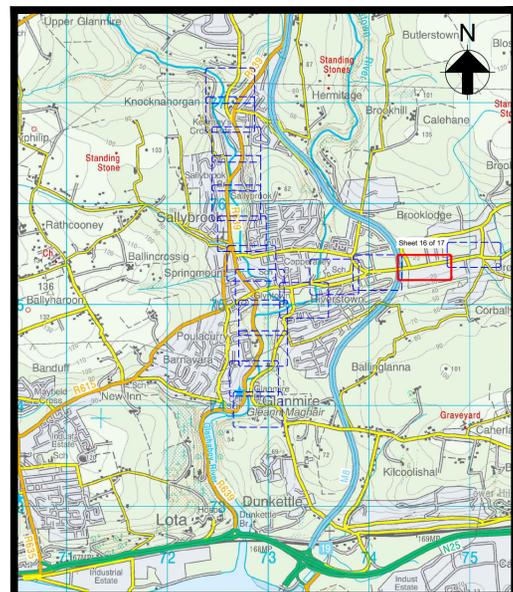
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Location Plan

Scale 1:1,000 at A1
Scale 1:2,000 at A3

Interference Reference	Channel Chainage	Proposed Works Chainage (m)	General Description of Proposed Works
C05_G01	0 to 1865	-	Channel maintenance, as and when necessary over a distance of 1865m from the confluence of the Glenmore Stream and the Butlerstown Stream (C05_000) to chainage 1865 on the Glenmore Stream.
C05_L03	975 to 998	0 to 23	Proposed reinforced concrete flood defence wall to be constructed above flood defence level to 19.75mOD (typically 2.41m above existing ground levels). All drainage outfalls to be fitted with non-return valves.
C05_L03	998 to 1008	23 to 33	Proposed reinforced concrete flood defence wall to be constructed above flood defence level to 19.38mOD (typically 2.07m above existing ground levels). All drainage outfalls to be fitted with non-return valves.
C05_L03	1008 to 1018	33 to 43	Proposed reinforced concrete flood defence wall to be constructed above flood defence level to 18.90mOD (typically 1.55m above existing ground levels). All drainage outfalls to be fitted with non-return valves.
C05_R05	914 to 1021	0 to 107	The New Line, Brooklodge Grove and the junction between the two roads to be upgraded to facilitate the construction of the proposed replacement culvert. Overland flow to be diverted back into the Glenmore Stream to the east of the proposed New Line bridge.
C05_B03	952 to 976	0 to 24	Replace existing 4.93m wide by 1.57m high culvert with a new reinforced concrete bridge. Bridge to be 8.25m clear span. Proposed bridge soffit level to be 17.43mOD.
C05_F03	973 to 988	0 to 16	Proposed boundary wall to be constructed to 19.52mOD (typically 2.52m above existing ground levels).
C05_F03	988 to 999	16 to 31	Proposed boundary wall to be constructed to 19.20mOD (typically 2.08m above existing ground levels).
C05_F02	925 to 934	0 to 12	Proposed boundary wall to be constructed to 18.85mOD (typically 1.96m above existing ground levels).
C05_F02	938 to 953	12 to 39	Proposed boundary wall to be constructed to 18.34mOD (typically 2.49m above existing ground levels). Vehicular access gate to be provided.
C05_L02	890 to 916	0 to 26	Existing wall to be strengthened. All drainage outfalls to be fitted with non-return valves.
C05_L02	916 to 928	26 to 38	Proposed reinforced concrete retaining wall to be constructed to 18.97mOD (typically 1.97m above existing footpath levels). All drainage outfalls to be fitted with non-return valves.
C05_L02	928 to 940	38 to 50	Proposed reinforced concrete flood defence wall to be constructed above flood defence level to 19.27mOD (typically 2.21m above existing footpath levels). All drainage outfalls to be fitted with non-return valves.
C05_L02	940 to 953	50 to 63	Proposed reinforced concrete flood defence wall to be constructed above flood defence level to 19.58mOD (typically 2.42m above existing ground levels). All drainage outfalls to be fitted with non-return valves.
C05_L01	693 to 845	0 to 150	Existing wall to be strengthened. All drainage outfalls to be fitted with non-return valves.

Notes:

1. Do not scale from drawing.
2. This drawing should be read in conjunction with all other Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Confirmation Drawings and Schedules.
3. All sections on this drawing are taken looking downstream.



Key to Plan

- Watercourse
- Channel Centreline, Reference (C08) and Chainage (300m)
- Interference Reference
- Location and Reference of Cross Section
- Proposed Works Chainage (m)
- Proposed Boundary Works
- Proposed Regrading of Ground Levels
- Proposed Flood Defence Wall
- Proposed Retaining Wall
- Proposed New Bridge
- Existing Bridge/Culvert to be Retained

Key Plan

Drg. No. GR_216 Proposed Flood Defences - Plan Layout (Sheet 16 of 17)

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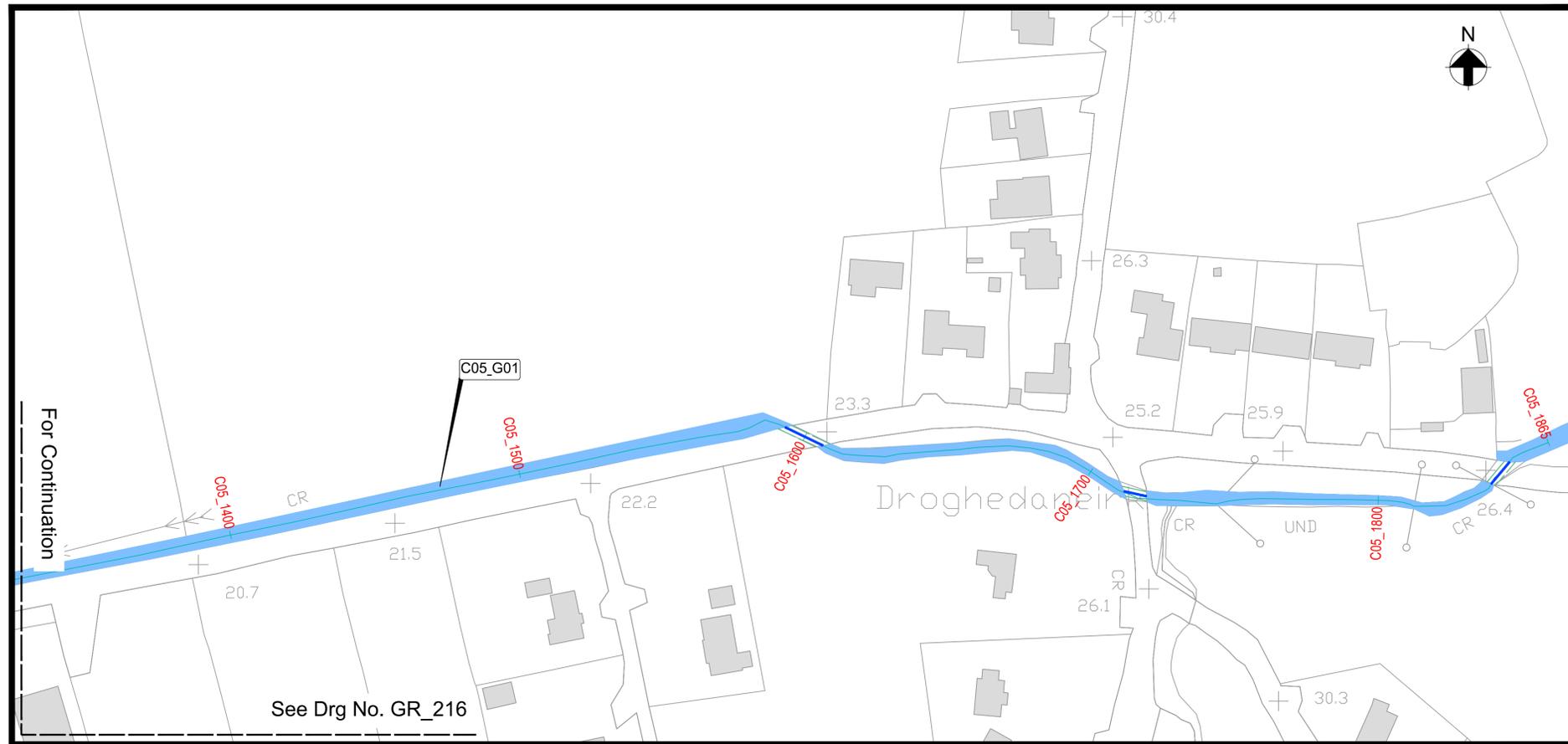
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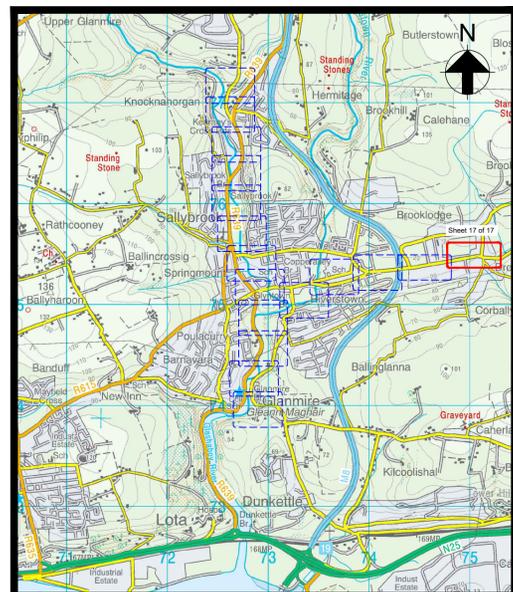


Interference Reference	Channel Chainage	Proposed Works Chainage (m)	General Description of Proposed Works
C05_G01	0 to 1865	-	Channel maintenance, as and when necessary over a distance of 1865m from the confluence of the Glenmore Stream and the Butlerstown Stream (C05_000) to chainage 1865 on the Glenmore Stream.

- Notes:
1. Do not scale from drawing.
 2. This drawing should be read in conjunction with all other Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Confirmation Drawings and Schedules.

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Location Plan

Scale 1:1,000 at A1
Scale 1:2,000 at A3



Key to Plan

-  Watercourse
-  Channel Centreline, Reference (C08) and Chainage (300m)
-  Interference Reference
-  Location and Reference of Cross Section
-  Proposed Works Chainage (m)
-  Existing Bridge/Culvert to be Retained

Key Plan

Drg. No. GR_217 Proposed Flood Defences - Plan Layout (Sheet 17 of 17)

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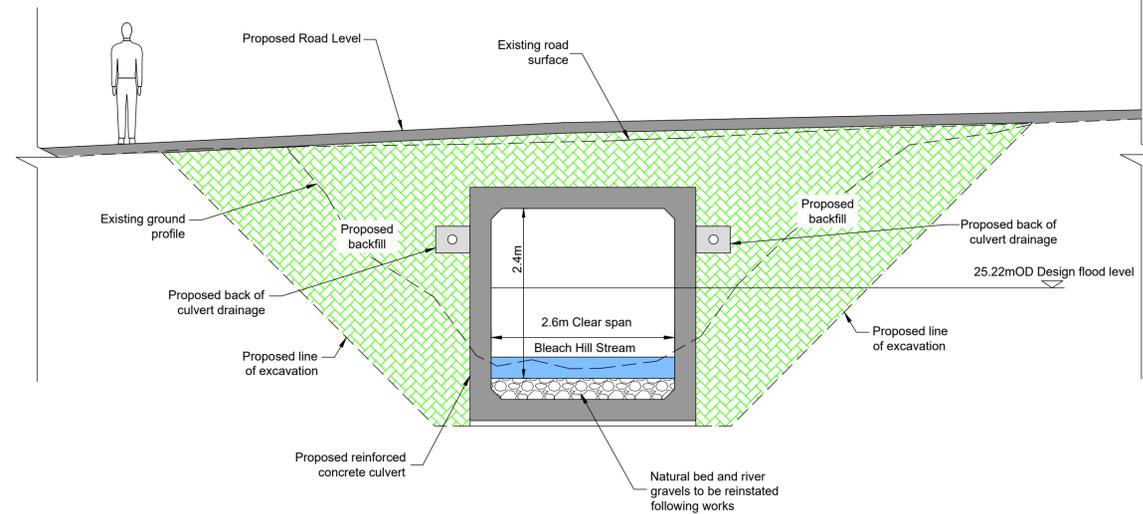
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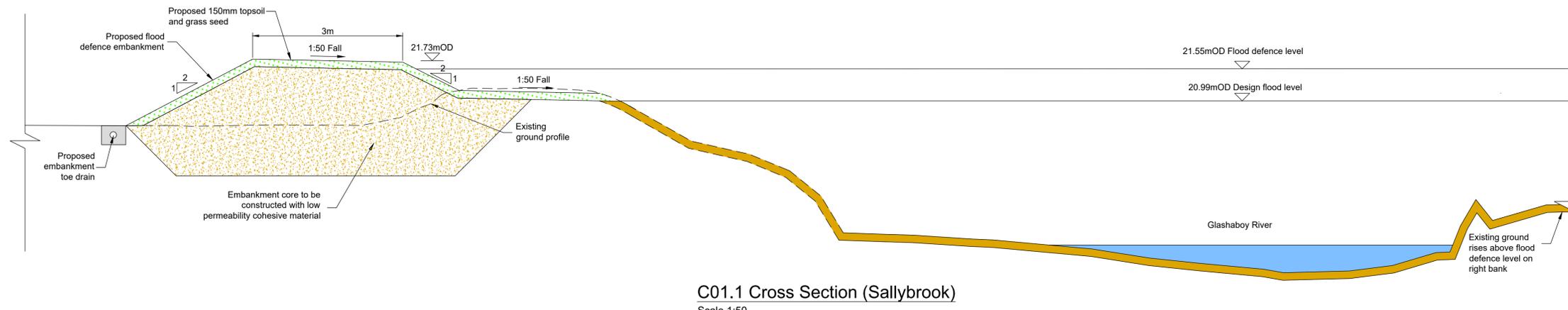
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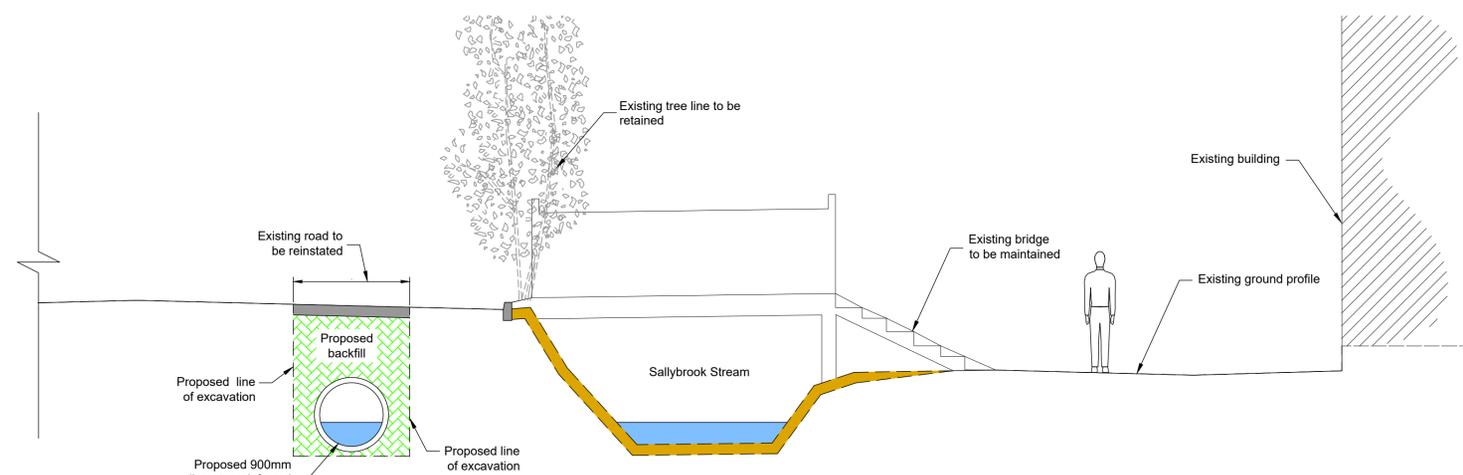
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C09.1 Cross Section (Cúil Chluthair)
Scale 1:50



C01.1 Cross Section (Sallybrook)
Scale 1:50



C10.1 Cross Section (Sallybrook House)
Scale 1:50

Notes:

1. Do not scale from drawing.
2. This drawing should be read in conjunction with all other Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Confirmation Drawings and Schedules.

Drg. No. GR_301 Proposed Flood Defences - Proposed Sections (Sheet 1 of 8)

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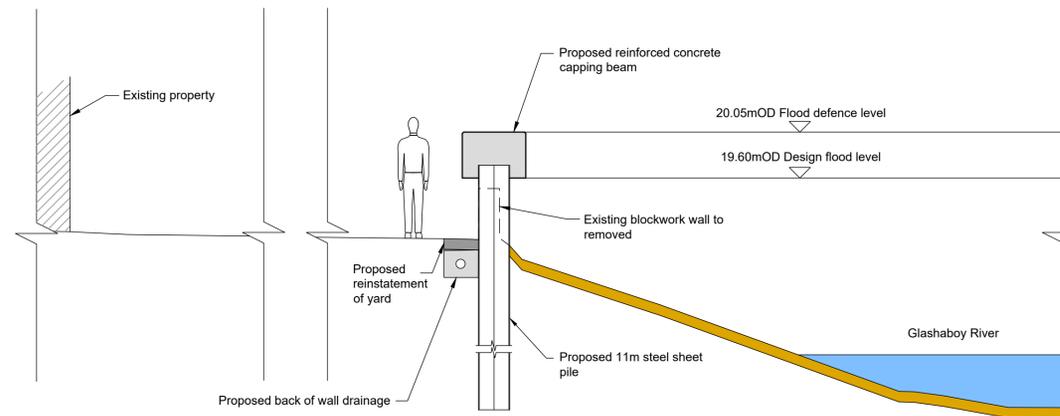
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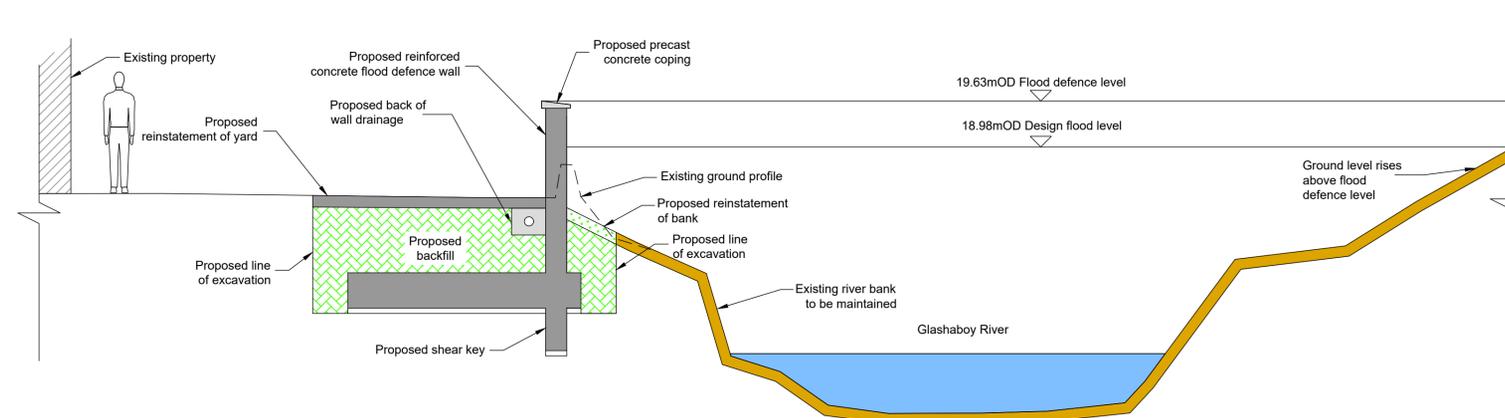


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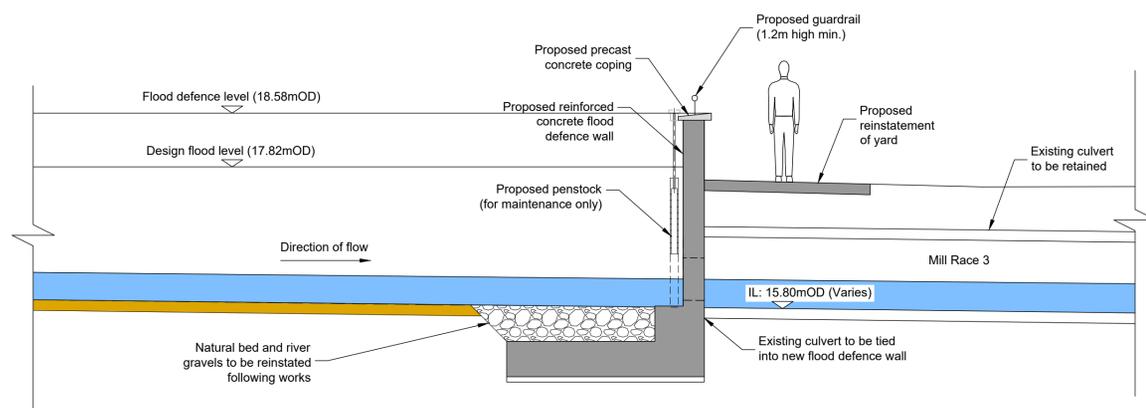
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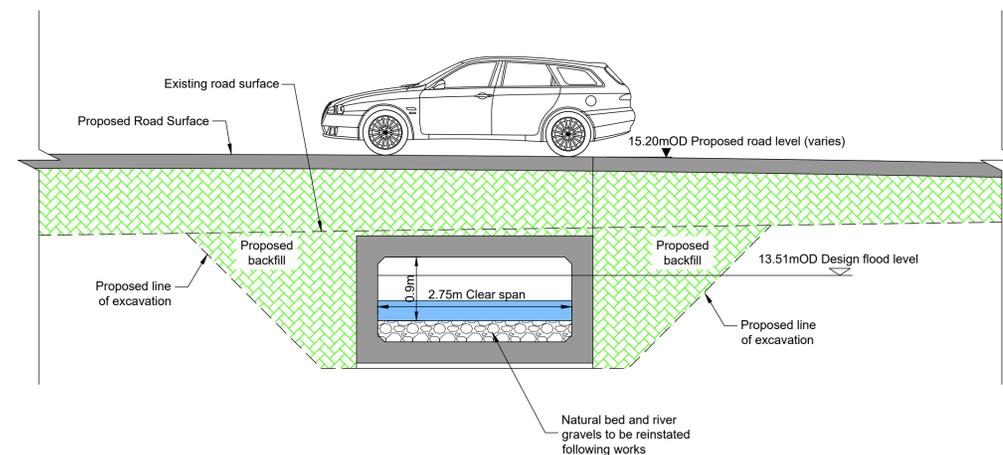
C01.1a Cross Section (Eurofins Ireland)
Scale 1:50



C01.2 Cross Section (Sallybrook)
Scale 1:50



C08.1 Cross Section (Grandon's Car Sales)
Scale 1:50



C07.1 Cross Section (Cois Na Gleann Stream)
Scale 1:50

- Notes:
1. Do not scale from drawing.
 2. This drawing should be read in conjunction with all other Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Confirmation Drawings and Schedules.

Drg. No. GR_302 Proposed Flood Defences - Proposed Sections (Sheet 2 of 8)

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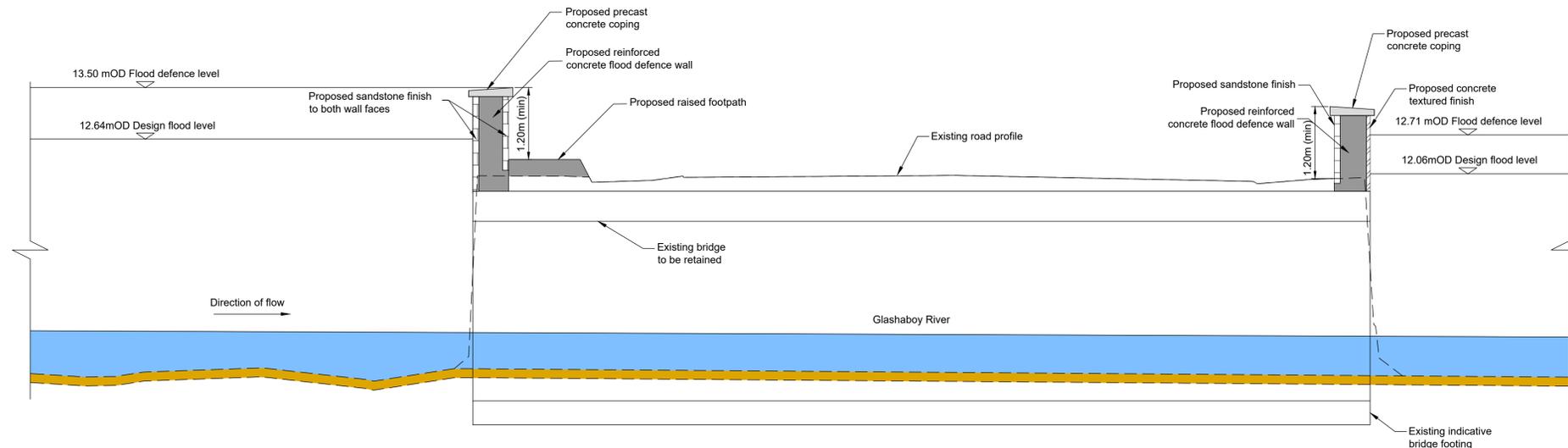
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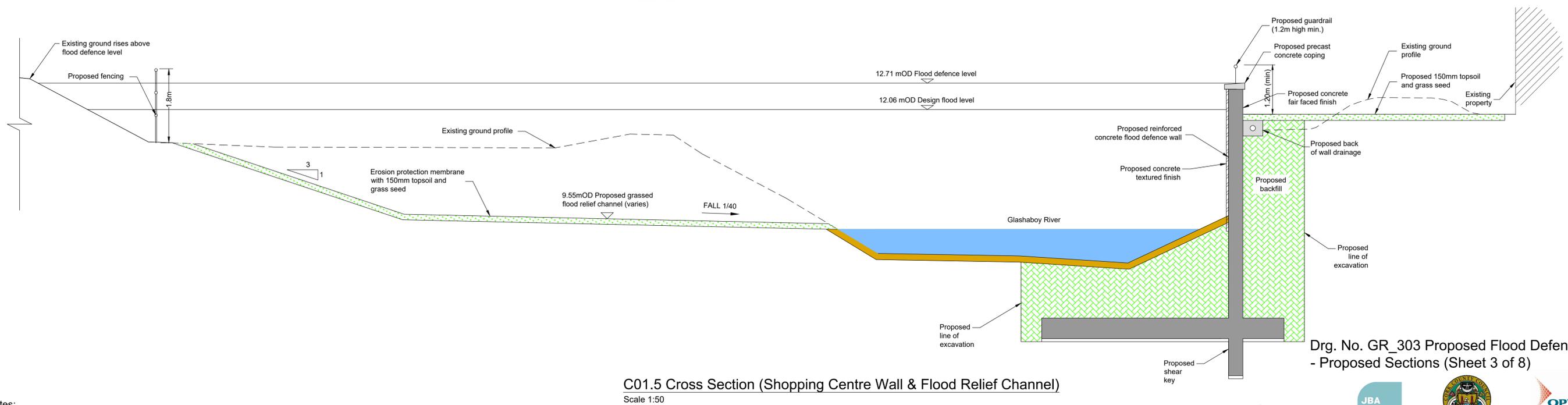
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C01.3 Cross Section (Hazelwood Avenue Bridge)
Scale 1:50



C01.4 Cross Section (Hazelwood Avenue Bridge)
Scale 1:50



C01.5 Cross Section (Shopping Centre Wall & Flood Relief Channel)
Scale 1:50

Drg. No. GR_303 Proposed Flood Defences
- Proposed Sections (Sheet 3 of 8)

Notes:

1. Do not scale from drawing.
2. This drawing should be read in conjunction with all other Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Confirmation Drawings and Schedules.

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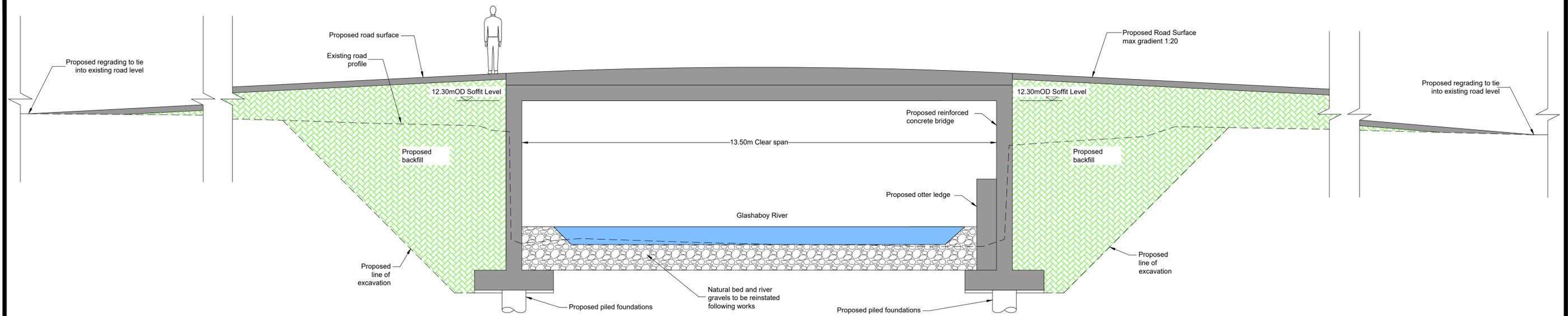
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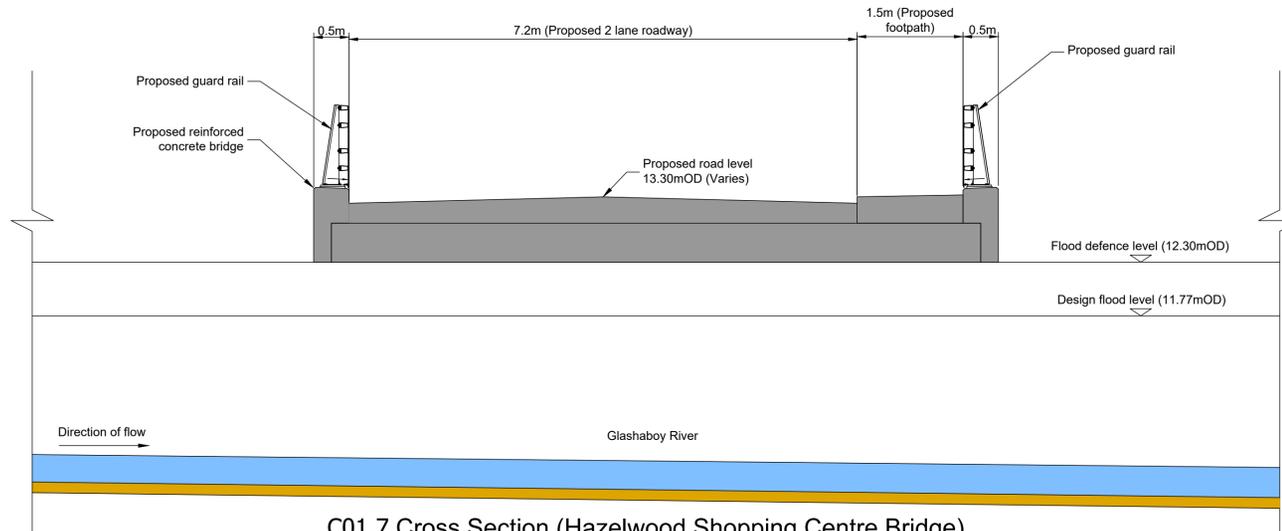
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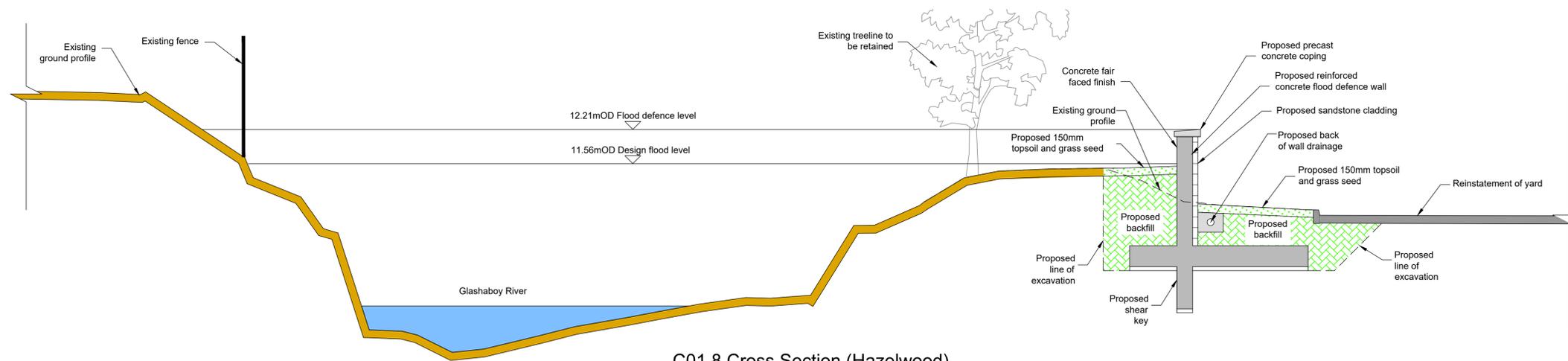
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C01.6 Cross Section (Hazelwood Shopping Centre Bridge)
Scale 1:50



C01.7 Cross Section (Hazelwood Shopping Centre Bridge)
Scale 1:50



C01.8 Cross Section (Hazelwood)
Scale 1:50

Notes:

1. Do not scale from drawing.
2. This drawing should be read in conjunction with all other Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Confirmation Drawings and Schedules.

Drg. No. GR_304 Proposed Flood Defences - Proposed Sections (Sheet 4 of 8)



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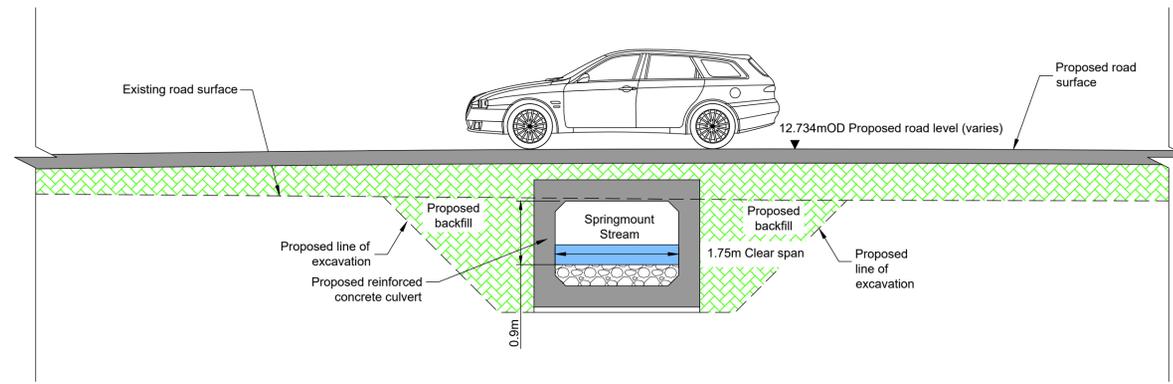
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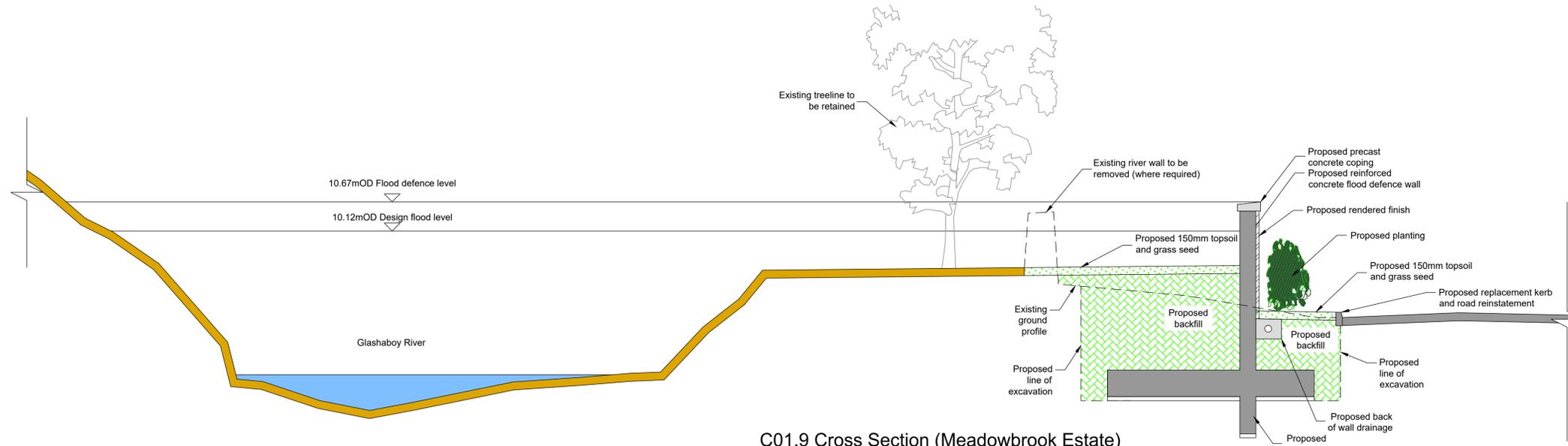
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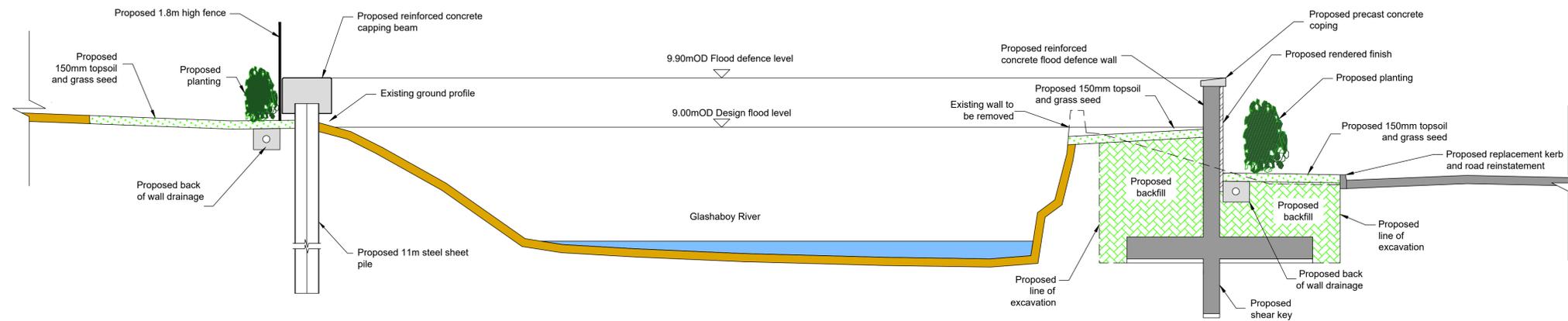
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C06.1 Cross Section (R639 at Hazelwood Centre)
Scale 1:50



C01.9 Cross Section (Meadowbrook Estate)
Scale 1:50



C01.10 Cross Section (Meadowbrook)
Scale 1:50

Notes:

1. Do not scale from drawing.
2. This drawing should be read in conjunction with all other Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Confirmation Drawings and Schedules.

Drg. No. GR_305 Proposed Flood Defences - Proposed Sections (Sheet 5 of 8)

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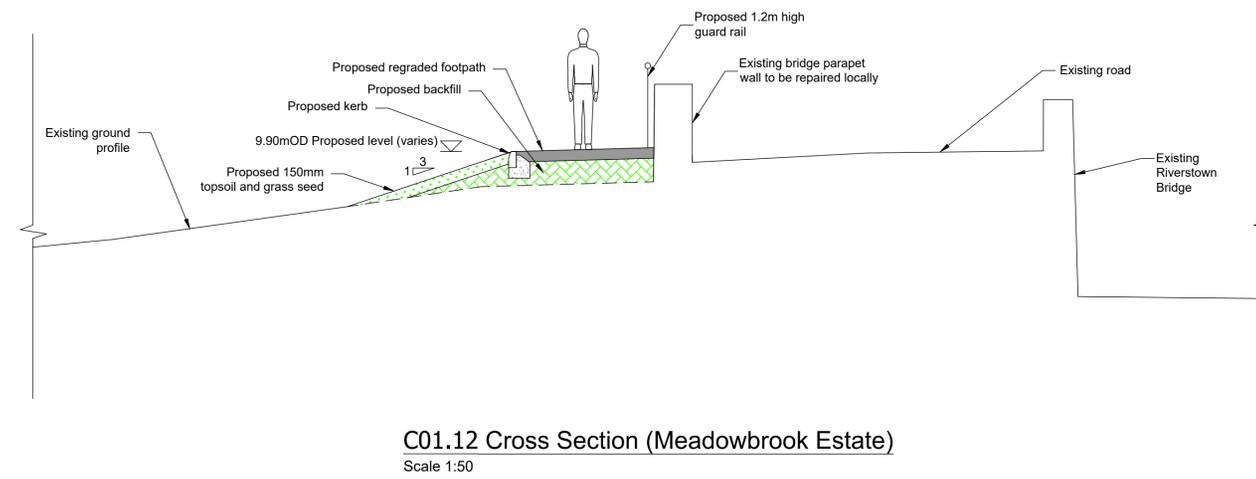
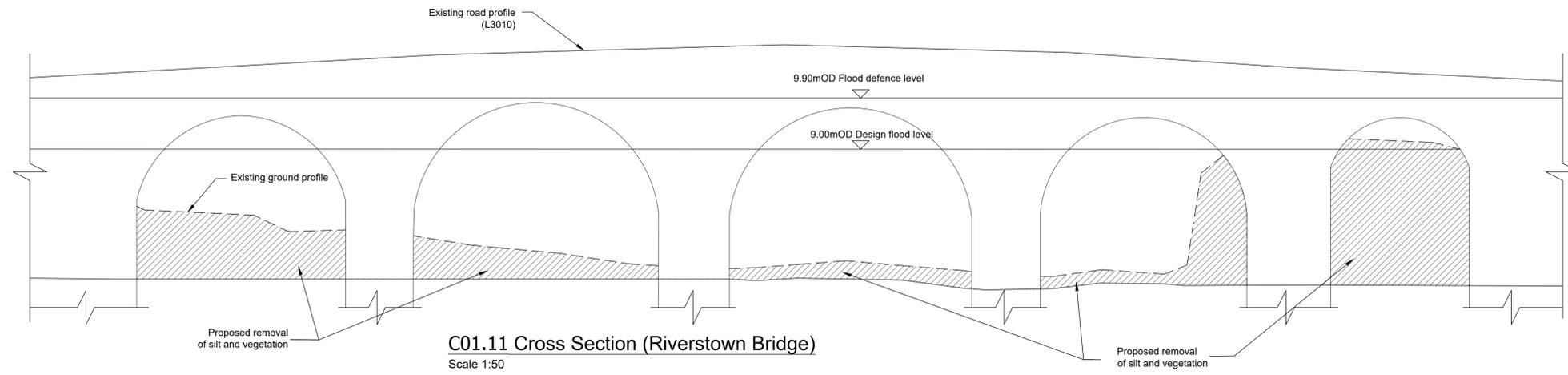
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Notes:

1. Do not scale from drawing.
2. This drawing should be read in conjunction with all other Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Confirmation Drawings and Schedules.

Drg. No. GR_306 Proposed Flood Defences - Proposed Sections (Sheet 6 of 8)

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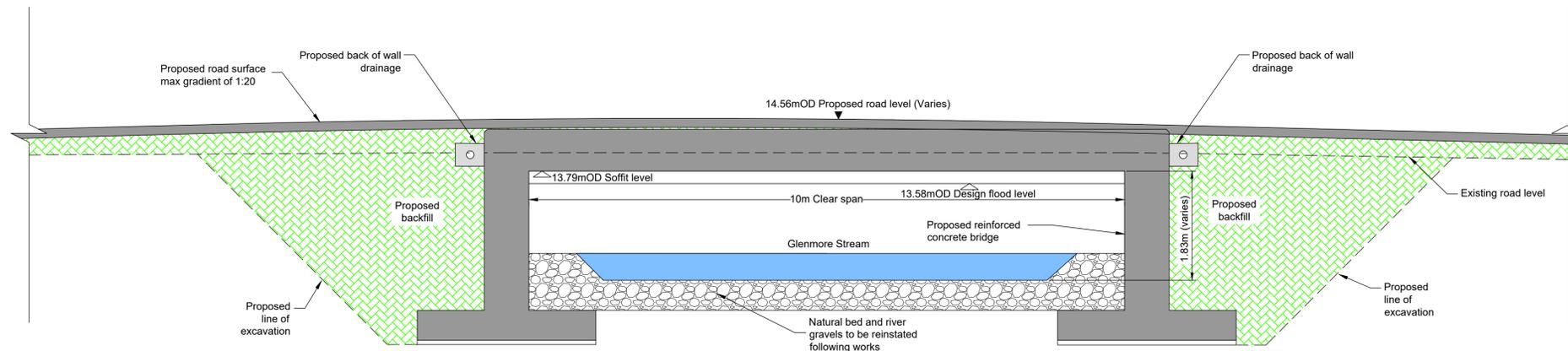
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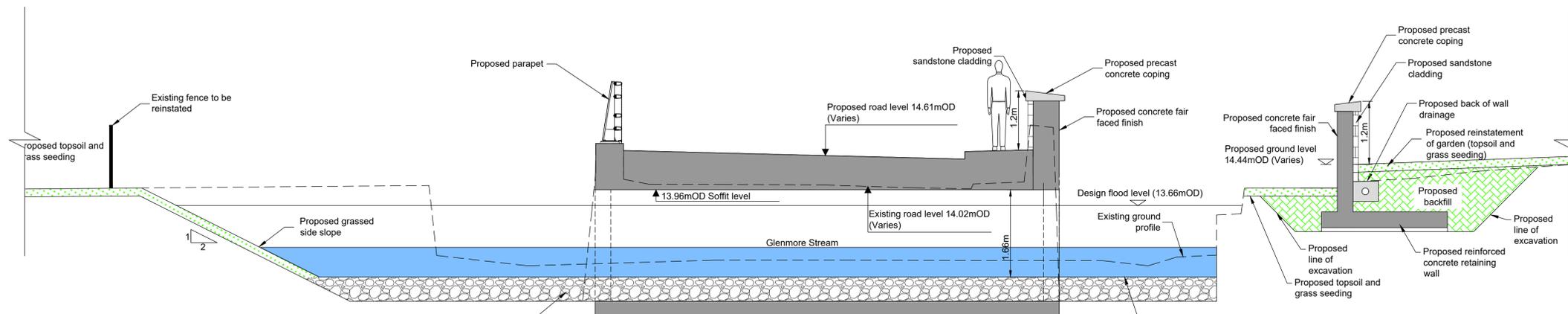
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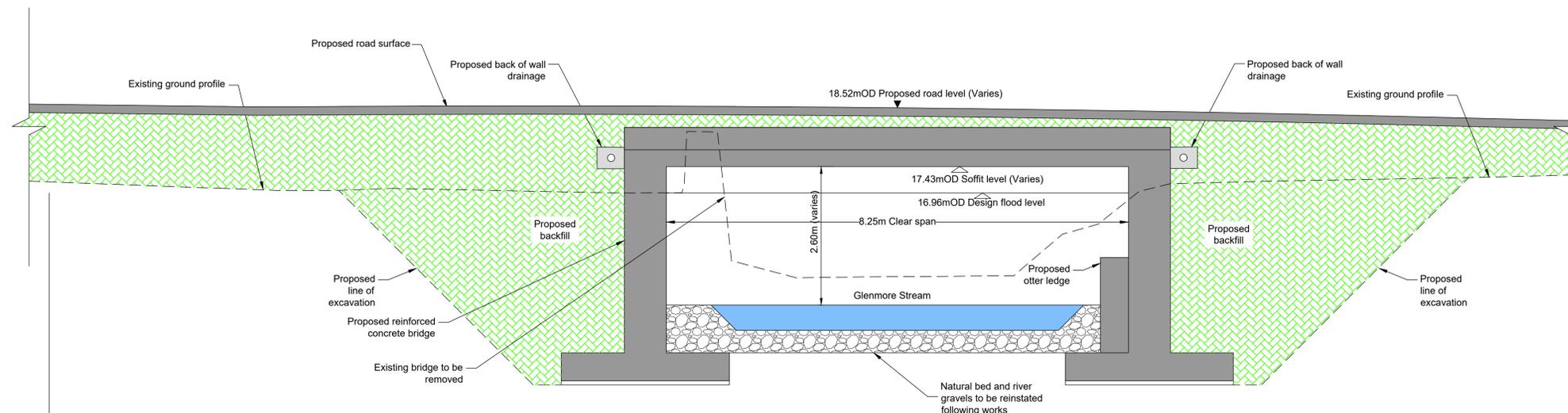
C05.1 Cross Section (Copper Valley Vue)

Scale 1:50



C05.2 Cross Section (Brooklodge Grove)

Scale 1:50



C05.3 Cross Section (The New Line)

Scale 1:50

Notes:

1. Do not scale from drawing.
2. This drawing should be read in conjunction with all other Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Confirmation Drawings and Schedules.

Drg. No. GR_307 Proposed Flood Defences - Proposed Sections (Sheet 7 of 8)

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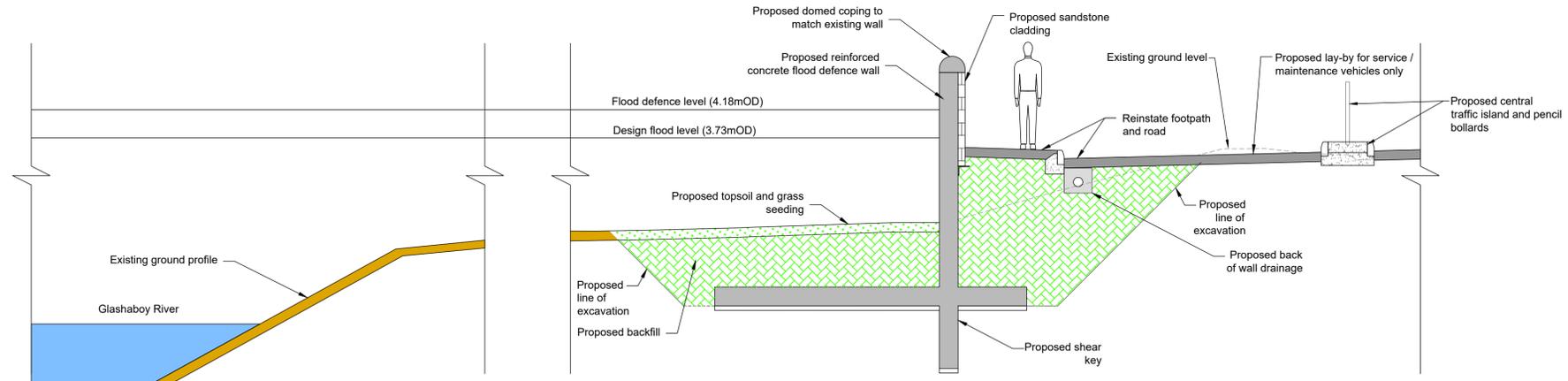
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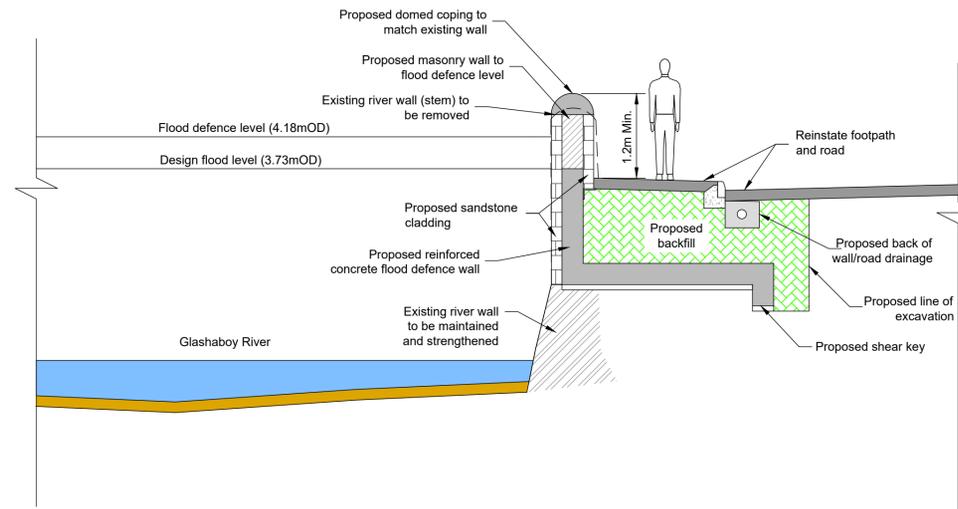
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C01.13 Cross Section (The Grove)
Scale 1:50



C01.14 Cross Section (The Grove)
Scale 1:50

Notes:

1. Do not scale from drawing.
2. This drawing should be read in conjunction with all other Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Confirmation Drawings and Schedules.

Drg. No. GR_308 Proposed Flood Defences - Proposed Sections (Sheet 8 of 8)

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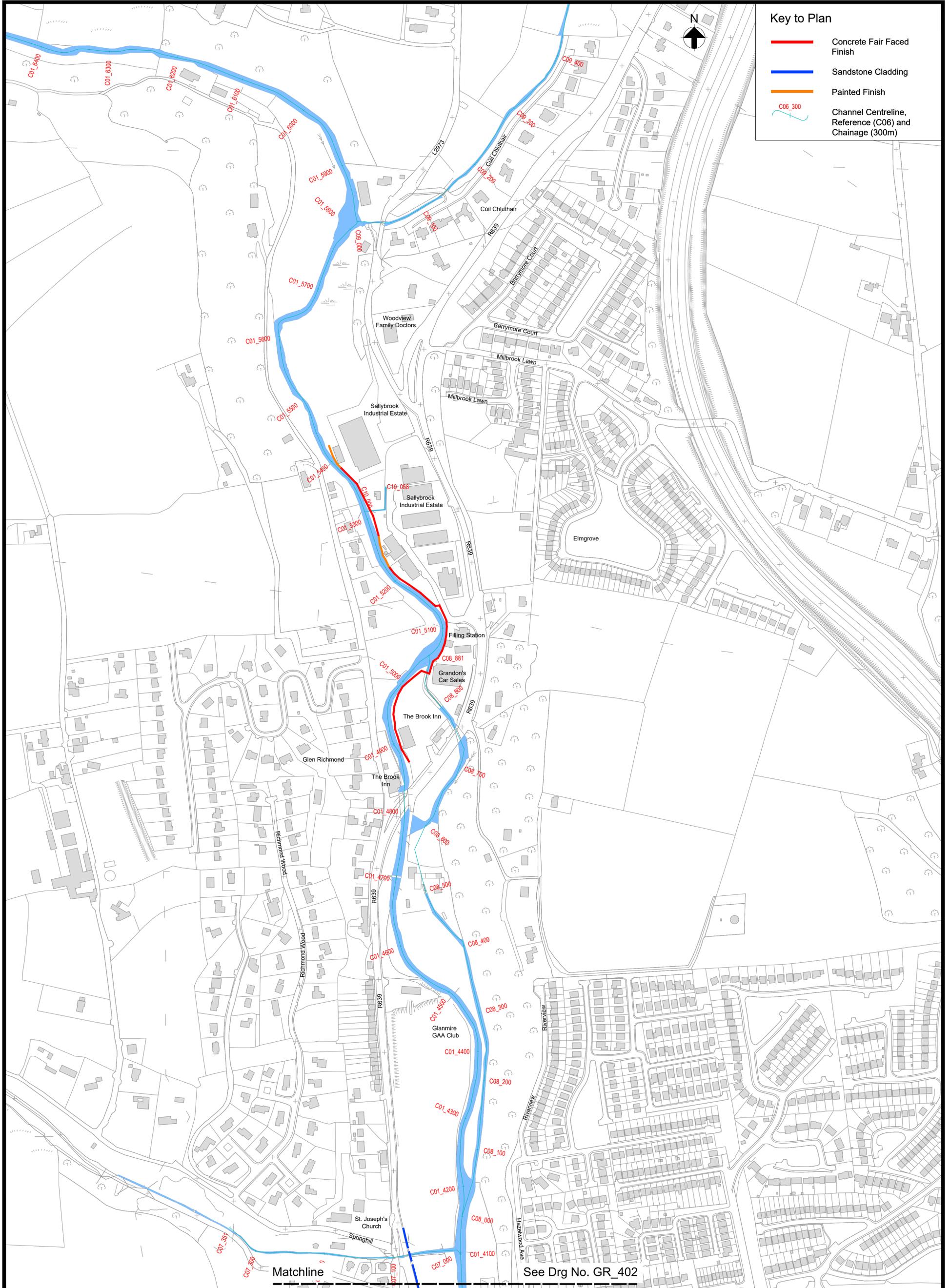
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Key to Plan

—	Concrete Fair Faced Finish
—	Sandstone Cladding
—	Painted Finish
C06_300	Channel Centreline, Reference (C06) and Chainage (300m)

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Scale 1:5,000 at A3

Drg. No. GR_401 Proposed Flood Defence Works Finishes (Sheet 1 of 3)



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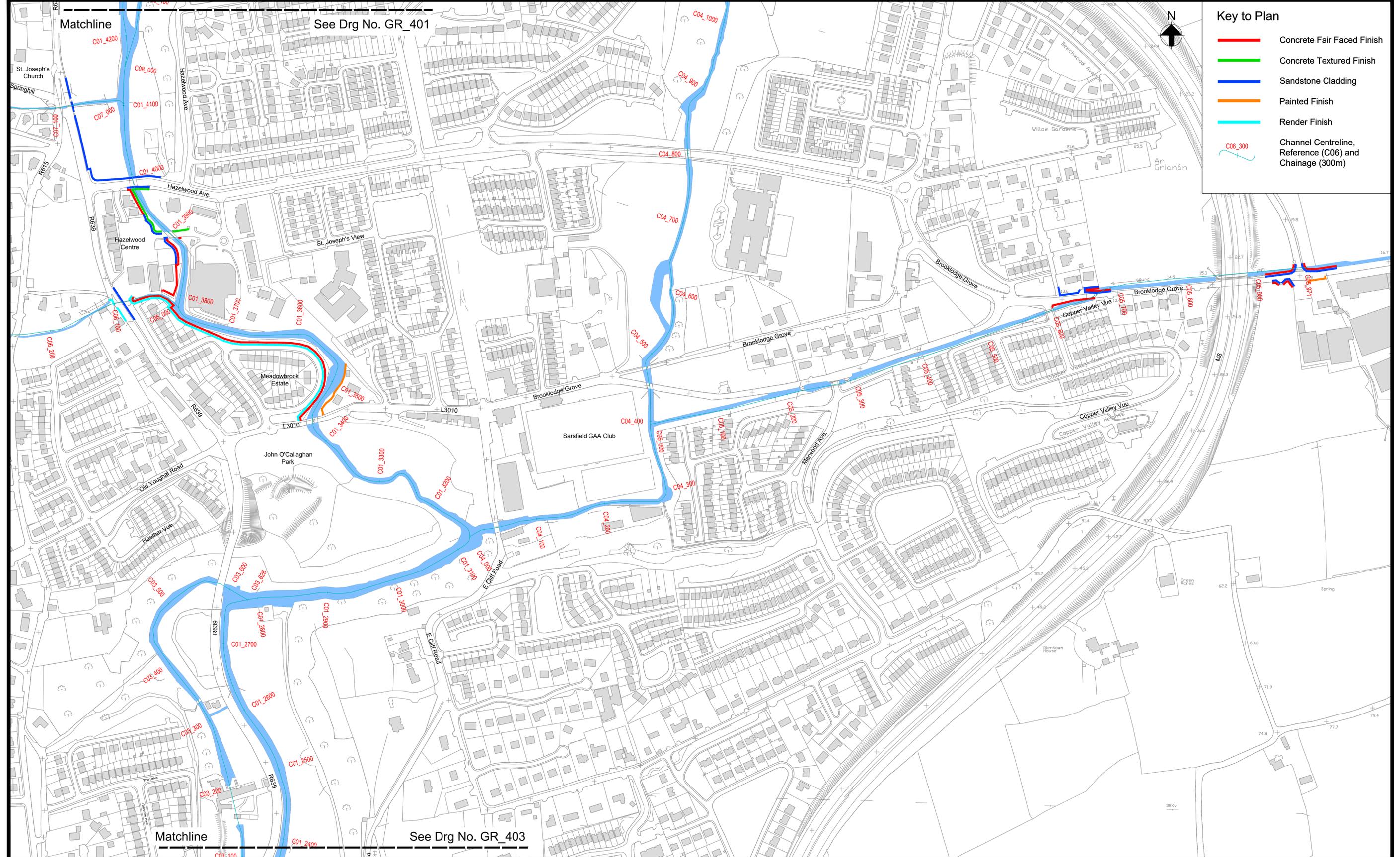
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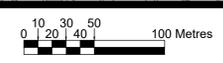
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Drg. No. GR_402 Proposed Flood Defence Works Finishes (Sheet 2 of 3)

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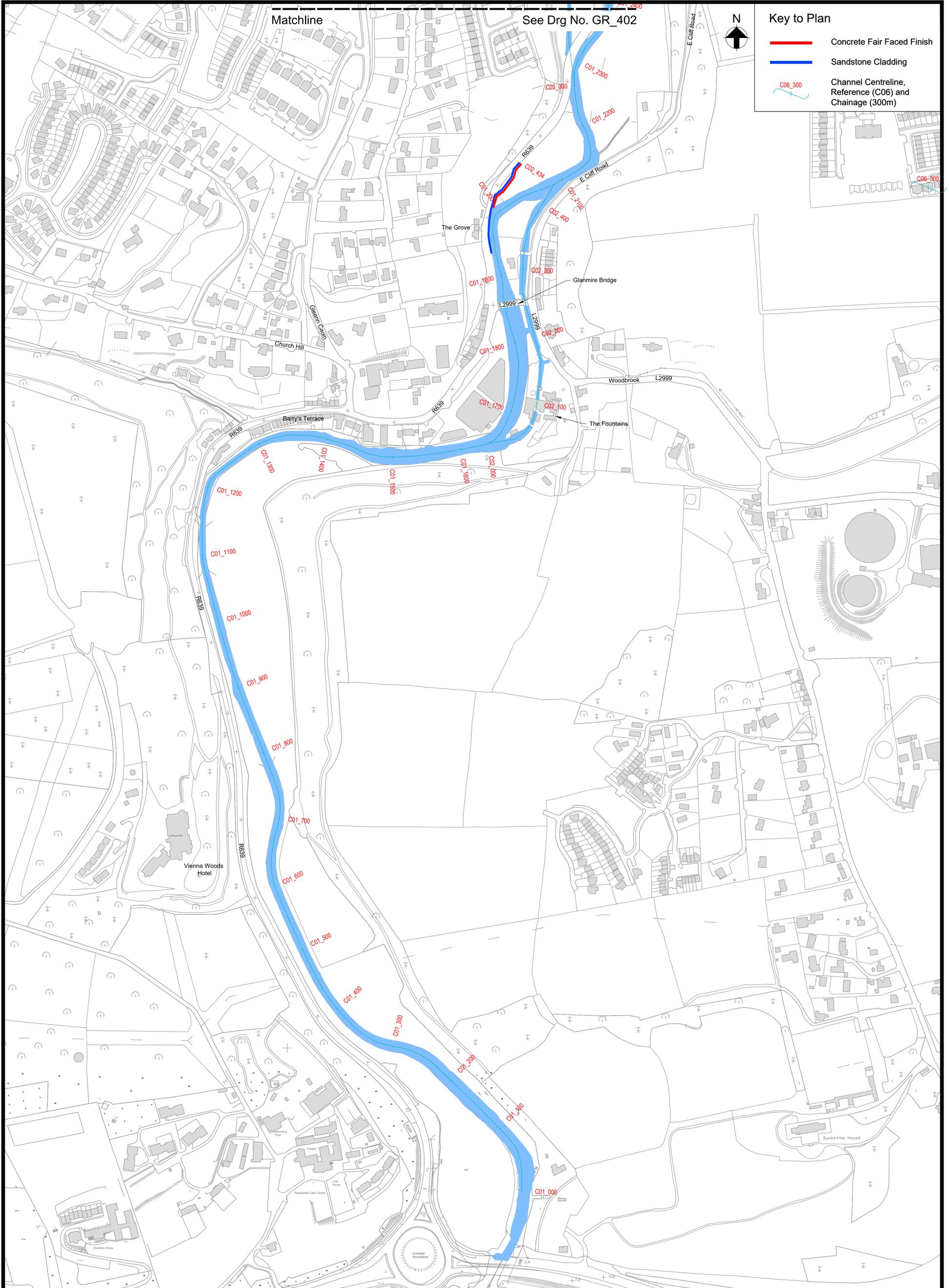
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Drg. No. GR_403 Proposed Flood Defence Works Finishes (Sheet 3 of 3)

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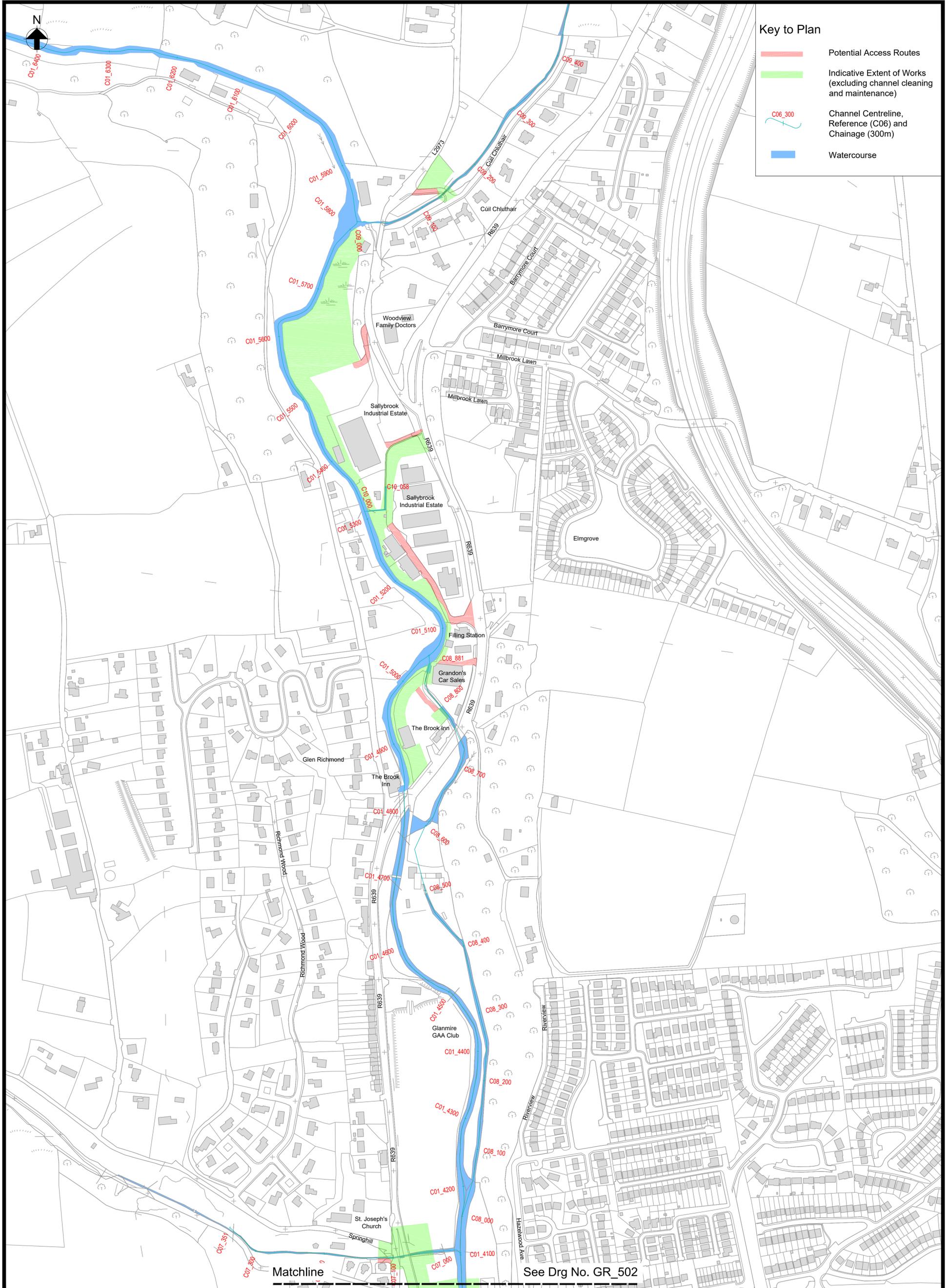
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Drg. No. GR_501 Possible Access Routes and Works Areas (Sheet 1 of 3)

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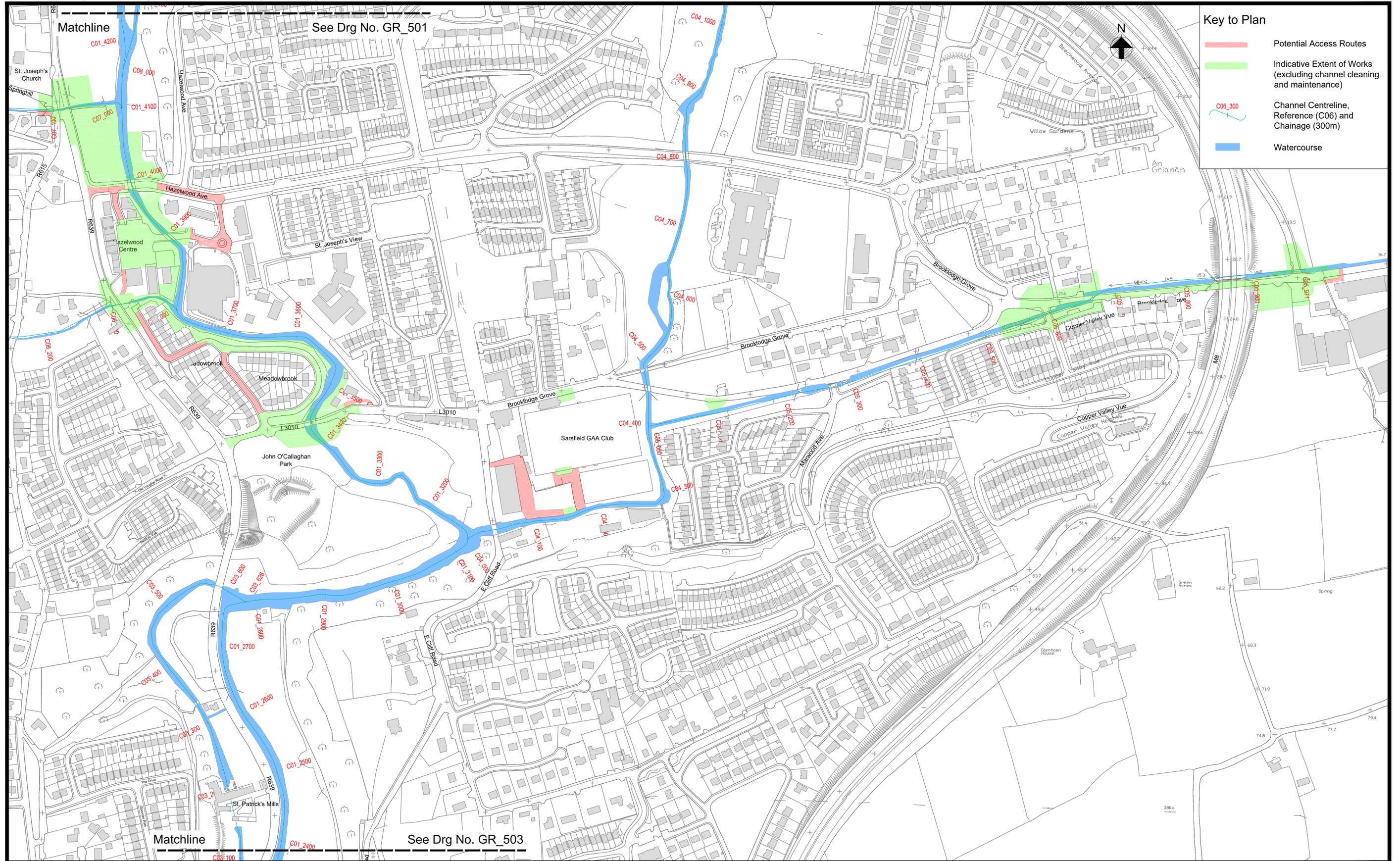
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Drg. No. GR_502 Possible Access Routes and Works Areas (Sheet 2 of 3)

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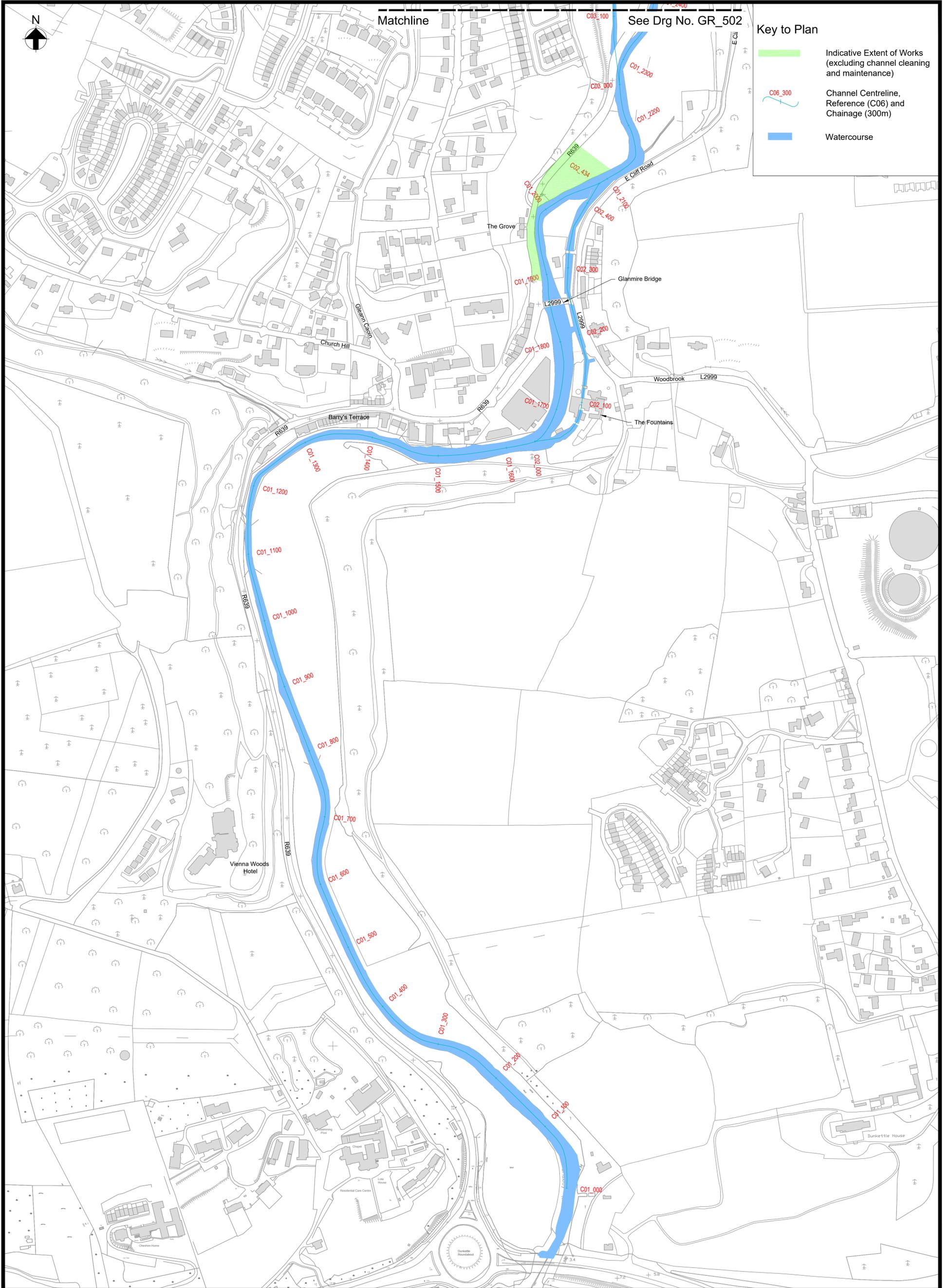
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Appendix B (NIS)

Construction Activities

CEMP

Outline Invasive Species Mgt.
Plan

B Construction Activities and Management

Appendix B (NIS)

**Construction Activities
(extracted from Chapter 4 of
EIAR)**

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4 Construction Activities

4.1 Introduction

This chapter describes the construction activities and sequencing for the proposed drainage scheme and outlines the general mitigation measures which will be implemented to ensure the potential impacts of the construction activities on the environment are avoided, prevented or reduced. Construction mitigation measures for specific issues such as biodiversity, air, noise and water protection are detailed in the relevant chapters.

The proposed drainage scheme is described from north to south where possible. The plan layout is presented in **Series 2 (GR_201 to GR_217)** and is referred to throughout this chapter whilst the Sections are presented in **Series 3 (Drawing No.'s GR_301 to GR_308)** of **Appendix 3.1**. The proposed access routes and works areas are presented in **Series 5 (Drawing No.'s GR_501 to GR_503)**.

A Construction Environmental Management Plan (CEMP) has been prepared and is included in **Appendix 4.2** which will be updated and finalised by the Contractor prior to construction commencing. The CEMP comprises all of the construction mitigation measures, which are set out in this EIAR, and will be updated with any additional measures which are required by the conditions to the Minister for Finance and Public Expenditure and Reform (DFPER) statutory confirmation of the Scheme under the Arterial Drainage Acts.

Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum. The plan has regard to the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK, *Environmental Good Practice on Site Guide, 4th Edition* (CIRIA 2015). The plan also has regard to the TII Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan.

Every effort will be made to ensure that any negative environmental effects will be avoided, prevented or reduced during the construction phase. It is anticipated that, with the proper implementation, phasing and management of construction activities described in this chapter, the construction phase of the proposed scheme will have no significant or long-term impact.

A construction management team shall be appointed for the duration of the construction phase. This team will supervise the construction of the proposed drainage scheme, including monitoring the performance of the contractors to ensure that the proposed construction phase mitigation measures are implemented and that construction impacts and nuisance are minimised. The construction management team will liaise with neighbours and the general community during the construction phase to ensure that any disturbance is kept to a minimum. Furthermore, the provision of a dedicated Community Liaison Officer (CLO) with their contact details available through local media outlets will be included in the Contract Documents. The CLO may be part of the resident engineering team.

The CEMP summarises the overall environmental management strategy that will be adopted and implemented during the construction phase of the proposed drainage scheme. The purpose of the CEMP is to demonstrate how the proposed construction works can be delivered in a logical, sensible and safe sequence with the incorporation of specific environmental control measures relevant to construction works of this nature. The CEMP sets out the mechanism by which environmental protection is to be achieved during the construction phase of the proposed drainage scheme. Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum.

The CEMP has been prepared in conjunction with the Environmental Impact Assessment Report (EIAR), having regard to consultations with a range of specialists and environmental organisations, in particular, the National Parks and Wildlife Service (NPWS) and Inland Fisheries Ireland (IFI). The CEMP supports the information already provided in this EIAR and must be read in conjunction with the information already provided in this EIAR. The CEMP is a working document and will be finalised by the Contractor following appointment and prior to commencing works on site.

4.2 Main elements of the drainage scheme

The main aspects of the drainage scheme comprise construction works entailing the following:

- Replacement of a number of existing culverts with either new culverts or bridges and culvert extensions;
- Replacement of Hazelwood Shopping Centre bridge;
- New flood relief channel and culvert at Hazelwood Avenue;
- Replacement of existing flood defence walls and construction of new flood defence walls;
- Construction of a new earthen flood defence embankment at Sallybrook;
- New surface water pumping stations and one foul pumping station;
- Localised in-channel conveyance improvements at culvert/bridge structures;
- Local channel widening, deepening, realignment and re-grading of river channel;
- Provision of civil works such as road/footpath re-grading at a number of locations;
- Protecting drainage outlets along the line of flood defence works with non-return flap valves;
- Retaining walls;
- Flow control structure on a millrace;
- Removal of vegetation and trees to facilitate construction works;
- Reinstatement of boundary walls and fences and landscaping and replanting of trees on completion in agreement with landowners; and

- Once construction is completed, ongoing maintenance of the river channel.

An outline of the methodology to construct the major elements of the works is described below.

4.3 Outline Construction methodology

4.3.1 General environmental considerations applicable to all areas of the proposed drainage scheme

The construction of the drainage scheme will be undertaken using industry standard construction methodologies. The anticipated construction methodology for the major elements of the scheme is described hereunder.

Traffic management will be set up for the works as required. Temporary road diversions and closures are likely to be required. Alternative access routes will be agreed with Cork County Council and An Garda Síochána. Refer also to the relevant chapters for specific construction details such as construction traffic management (**Chapter 14 Roads and Traffic**).

There will be a number of trees and vegetation which will require removal to facilitate the works throughout the drainage scheme area. The trees to be removed are shown in **Figure 1 (Appendix 3.2b)** to **Figure 5 (Appendix 3.2b)**, detailed in **Appendix 3.2** of this EIA. All vegetation clearance works and site preparatory works will be conducted outside of the bird nesting season (1 March to 31 August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out, and the area proposed for clearance has been approved by a suitably qualified and experienced ecologist.

Where possible, tree roots will not be pulled from the river bank. Silt controls will be put in place to minimise silt generation into the river channel and banks will be stabilised. Further details are presented in **Appendix 4.2**.

It is noted that Cork County Council (CCC), as part of its responsibilities for ongoing river maintenance and flood prevention (which includes removing degrading, unstable and unsafe trees on the river edge) will be undertaking distinct separate works along the Glashaboy River and its tributaries between December 2018 and February 2019. The proposed works will comprise the removal (and/or crowning) of trees by suitably qualified personnel along the Glashaboy River and its tributaries, within the Glashaboy Catchment. Some of the trees identified for removal as part of those separate CCC works are also required to be removed to facilitate the Glashaboy Drainage scheme. Further details on those particular trees to be removed are provided in **Figure 1 (Appendix 3.2b)** to **Figure 5 (Appendix 3.2b)**, **Appendix 3.2**.

It is also noted that many of the linear defences will require the temporary removal of boundary walls and fences to facilitate construction access (generally parallel with watercourses). These boundary walls/fences will be reinstated on completion in agreement with the landowners.

Where possible, it is expected that the Contractor will primarily gain access from the river banks; however temporary working areas within the river channel may be required for certain works such as along the left bank of the Glashaboy River opposite Meadowbrook. It is expected that access to construct the proposed flood defences which are located away from the river's edge (e.g. embankments) will be from the landward side in order to avoid any impact to the river. Where in-stream works are proposed, machine movements in the river will be minimised.

Where access to the river channel is required, detailed method statements will be drawn up which deal specifically with the works proposed. Detailed silt control methods will be required for all in-stream works. Most works along the river banks will require effective control of silt and it is expected that a variety of methods may be required i.e. silt curtains, dewatering, silt sumps etc. The method statements will be drawn up in consultation with the supervising ecologist. Consultation will take place with the NPWS and Inland Fisheries Ireland (IFI) prior to the commencement of works.

In-stream works (including preparatory work) on the Glashaboy River and its tributaries will be undertaken in a window from July to September (inclusive) and in consultation with IFI to avoid accidental damage or siltation of spawning beds. In-stream works associated with the drainage scheme will be carried out under the supervision of a suitably qualified and experienced ecologist. All in-stream works will be designed and carried out in consultation with IFI and in accordance with the IFI (2016) *Guidelines on protection of fisheries during construction works in and adjacent to waters*.

There are a number of otter holts in the vicinity of Sallybrook, Hazelwood and Meadowbrook on the Glashaboy River. Otter activity has been observed both on the Glashaboy River and on the Glenmore Stream. Consultation is ongoing with the NPWS in relation to a specific otter mitigation strategy in the form of a derogation licence for disturbance, temporary closure of holts, installation of artificial holts and seasonal restrictions of works. A derogation licence for otters from the NPWS is provided in **Appendix 6.3**. A derogation licence for bats from the NPWS is also provided in **Appendix 6.4**. Further details are available in **Chapter 6 Biodiversity** of this EIAR.

4.3.2 Enabling works and site clearance

The proposed scheme will be a linear development along the various watercourses. The proposed access routes and works areas are presented in **Series 5 (Drawing No.'s GR_501 to GR_503)**. In general, the proposed construction works will be limited to these areas however, landscaping and reinstatement works for landowners may take place outside these areas with their agreement. Enabling works will typically consist of the following steps:

- Construction of the temporary site access.
- Once access is achieved the Contractor will install secure hoarding approximately 2.4m high around each of the working areas that will remain in-situ during the construction of the works in each area.
- Vegetation, tree and topsoil removal to take place as necessary.

Refer to **Section 4.3.1** above in relation to vegetation clearance, tree removal and in-stream works in general.

Similar enabling works will be required at each of the areas and are detailed below. Works specific to individual working areas are detailed separately where necessary.

Construction compounds will be located within the 'Indicative Extent of Works' areas as shown in Drawings GR_501 to GR_503. Some of the works areas will be used to accommodate site offices and welfare facilities as required. Refer to **Section 4.4.2** for further details.

4.3.3 New culverts, culvert replacements and or extensions

The construction of new culverts, replacement of culverts (with culverts or bridges) and/or extensions to culverts will generally be undertaken by excavating and removing the existing culverts before craning in new precast culvert units in short lengths. Some isolated sections of in-situ culvert may be required at changes in direction. The precast units come in standard lengths and will be joined on site. Temporary over pumping or piping of the watercourses or temporary diversion channels / culverts (where space allows) will be required to facilitate the construction of the culvert sections. Thus the works will be carried out in the dry.

In general, the new culverts will be constructed on the footprint of the existing river channel/existing culvert or in some cases offline.

The foundations will be excavated down to formation level. Utilities and drainage pipes will be diverted as required. Excavated material will be transported off site to a licenced facility or stored for reuse on site, where appropriate. Blinding concrete will be poured. The precast concrete culverts will be placed in position and where in situ culverts are required, formwork will be prepared and reinforcement bars fixed, followed by the pouring of the concrete. Utilities and drainage pipes will be diverted into permanent positions as required. The excavations will then be backfilled and road surfaces reinstated. Boundary walls/fences reinstatement and landscaping and replanting reinstatement will take place in agreement with landowners.

In the case of culverts constructed under the public road, permanent reinstatement may be required approximately six months following reopening of the road.

The works area will be isolated and traffic management set up as required. Specific traffic management measures will be required along the sections of culvert which are located beneath the public road. It is envisaged that traffic measures such as a stop-go system, temporary one-way traffic systems or similar will be implemented to allow the trenches for the culverts and utility diversions to be constructed and at the same time to manage traffic. Temporary road closures and diversions may be required however for short discrete periods, if it does not prove possible to maintain one lane of the existing road open at all times. They will be for a short duration only and will take place during the summer months or at other suitable times, i.e. long weekends or mid-term school holidays to minimise the impact on traffic in the area.

Every effort will be made to carry out the works as quickly as possible in order to minimise impacts on the residents in the area. Refer to **Chapter 14 Roads and Traffic** for further details on construction traffic and traffic management.

Refer to **Section 4.3.1** above in relation to vegetation clearance, tree removal and in-stream works in general.

4.3.4 Reinforced Concrete Flood Walls

Reinforced concrete flood walls will be constructed using industry standard techniques including excavation of foundations, fixing of steel reinforcement, pouring concrete and reinstatement of the works area. The construction of the reinforced concrete flood defence walls is likely to comprise the following activities:

- isolation of works area, including traffic management where the work area will overlap with a public road / pedestrianised area;
- temporary works including silt barrages where in stream works are required (the vast majority of new walls do not require any in-channel works);
- excavation for foundations;
- blinding of formation;
- fixing of reinforcement;
- placing of formwork; and
- placing of concrete.

In general, the construction of the reinforced concrete walls will be undertaken from the bank of the river for the majority of the scheme. In some locations however, in-stream works will be required to construct the walls due to access issues. For example, construction of the wall along the left hand side of the river bank (as one looks downstream) of the Glashaboy River, opposite Meadowbrook Estate, will require access from the river due to the steep bank topography and constricted working area at that location.

Refer to **Section 4.3.1** above in relation to vegetation clearance, tree removal and in-stream works in general.

Construction of the flood defence wall at The Grove may require that works are carried out on a scaffold attached to the bank over the river due to the constricted working area along the road at that location.

It is expected that any utility diversions required for the construction of the walls will be completed prior to excavating the foundations.

Any excavated material that cannot be reused in the works will be transported to a suitable licensed waste facility.

4.3.5 Pumping Stations

The footprint of the pumping stations will be set out. Where the proposed excavation is located in a paved area, the pavement will be saw cut. Where the proposed excavation is located in a grassed area, the topsoil will be removed and stored in close proximity to the excavation. The excavation will take place to the required depth. Sheet piling will likely be required in order to facilitate construction of deep excavations in an urban area.

Excavated material unsuitable for use as backfill material will be disposed of to an approved licenced waste management facility. Lean mix concrete blinding will be placed, followed by formwork and steel fixing. Once concrete has been poured and has cured, the formwork will be stripped and the area outside the pumping station will be backfilled. Excavations in grassed areas will be backfilled with suitable excavated material, following which the original topsoil will be replaced. Excavations in paved areas will be backfilled with granular material and reinstated to their original condition. Mechanical and electrical fit out of pumping stations will take place following backfilling.

Refer to **Section 4.3.1** above in relation to vegetation clearance, tree removal and in-stream works in general.

4.3.6 Construction of new flood defence embankment along Glashaboy River at Sallybrook

There is an existing embankment along the left bank of the Glashaboy River. The existing embankment will be replaced with a new flood defence embankment.

The trees and vegetation on the existing embankment firstly require to be cut to ground level outside of the bird nesting season (1st March to 31st August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out, and the area proposed for clearance has been approved by suitably qualified and experienced ecologist. The trees required for removal in the Sallybrook area are shown on **Figure 3 (Appendix 3.2b) in Appendix 3.2**.

It is likely that construction will be carried out during the summer months when river levels are low. A silt fence will firstly be installed along the edge of the river channel before earthworks commence. A minimum buffer of approximately 2m will remain between the edge of the river channel and the toe of the embankment to facilitate the installation of the silt fence.

The root balls of the cut trees within the existing embankment will require removal to facilitate the construction of the new embankment however they will be retained along the minimum 2m buffer between the edge of the river channel and the toe of the embankment.

The construction of the embankment will be undertaken from the river bank with no in channel works required. The existing top soil will be removed and low permeability cohesive soils will be placed to the required flood defence level. Refer to cross-section **C01.1** in **Drg No. GR_301**.

Topsoil will be placed on top of the embankment and seeded. All material excavated during the construction will be reused where feasible. Any material that is not suitable for use elsewhere in the scheme will be disposed of off-site. It is likely that it will be necessary to import most of the cohesive soils required to construct the embankment as it is unlikely that sufficient quantities of suitable excavated soil will be available from elsewhere in the project.

Any utility diversions necessary to facilitate the construction of the embankment will be completed prior to the construction of the embankment.

Refer to **Section 4.3.1** above in relation to vegetation clearance, tree removal and in-stream works in general.

4.3.7 Flood relief channel and culvert parallel to Glashaboy River at Hazelwood Avenue

It is proposed that a flood relief channel will be constructed with engineered grassed slopes parallel to the Glashaboy River on the north side (**C01_R01**) of Hazelwood Avenue bridge and on the south side (**C01_R02**) of the bridge. The flood relief channel will facilitate the movement of water through the area during high flows. The channel will cross underneath Hazelwood Avenue via a proposed 6.2m wide by 1.75m high rectangular flood relief culvert (**C01_B02**).

Some trees will require removal to facilitate construction. These are shown on **Figure 3 (Appendix 3.2b)** in **Appendix 3.2**.

Refer to **Section 4.3.1** above in relation to vegetation clearance and tree removal in general.

In relation to the flood relief culvert underneath Hazelwood Avenue, it is envisaged that this will be constructed in two halves, allowing a minimum of a single lane to remain open at all times, and for at least part of the duration, two lane traffic will be possible due to the generous width of the existing road. If feasible, the reinforced concrete flood relief culvert (cast in-situ) will be constructed during a period of school holidays when traffic volumes will be reduced. A construction period of circa four to eight weeks is envisaged. The works will be constrained such that work on the Hazelwood Avenue flood relief culvert will not be allowed at the same time as works in the Shopping Centre/Commercial Centre, to minimise temporary traffic impacts.

It is likely that the flood relief culvert will be constructed in advance of re-grading the flood relief channels at the upstream and downstream ends to ensure that the culvert can be placed in the dry.

Construction of the flood relief channel will consist of the excavation of the left bank of the river (looking downstream) both north and south of Hazelwood Avenue. Refer to **Drg No. GR_303** which shows the cross sections at Hazelwood Avenue bridge (**C01.3**, **C01.4** and **C01.5**). As the flood relief culvert and approach channels at Hazelwood Avenue are offline from the main Glashaboy River channel, they can be constructed in the dry and are therefore not seasonally constrained aside from the tie-in points which will be seasonally constrained.

Connection of the flood relief channel to the Glashaboy River (via removal of sections of the bank) will only be carried out once all of the other works to the flood relief channel have been completed.

Service diversions associated with the construction works in this area will be required.

In particular, a gas main which currently crosses over the Glashaboy River parallel to Hazelwood Avenue Bridge will need to be buried and installed underneath the Glashaboy River. Further details on the proposed diversion are provided in the section below.

The preliminary design has been agreed with Inland Fisheries Ireland (IFI) and NPWS and consultation will continue during the detailed design and construction stages. The construction methodology for the culvert beneath Hazelwood Avenue will be similar to the methodology described above for the other culvert works.

Refer to **Section 4.3.1** above in relation to in-stream works in general.

4.3.8 Gas Diversion beneath Glashaboy River at Hazelwood Avenue

The existing gas main (180PE-80 4 bar / 4 In ST 4 bar) which is attached to the upstream face of the existing Hazelwood bridge is required to be diverted to facilitate construction of a flood defence bridge parapet wall and reinforced concrete flood relief culvert. Due to cover constraints within the existing bridge, the gas main is proposed to be diverted underneath the Glashaboy River channel approximately 3-5m upstream of the existing bridge. The diversion will be undertaken in line with Gas Network Ireland's standard ditch and stream crossing details and requirements.

It is envisaged that the proposed diversion will be undertaken as advance works ahead of the main scheme and will take place during the in-stream fisheries works window (July to September). It is envisaged that duration of the works to complete the diversion should take approximately two weeks. The diversion works are envisaged to be undertaken in two phases for flood management purposes within the main channel. It is envisaged that site clearance, installation of trench sheeting/cofferdam and dewatering of half the river channel area will be undertaken to facilitate the first section of the gas diversion. Appropriate removal of fish will be undertaken during dewatering of the works area. Water removed during dewatering will be discharged via a filtration pond/other measure as appropriate.

A concrete sleeve (pipe) will be installed and covered by a precast reinforced concrete slab for cover/protection requirements, the excavation will be backfilled and river gravels reinstated. The remaining half of the concrete sleeve installation works will then be undertaken as described above. Tree clearance works will be required to provide sufficient space within the works area. The gas pipeline can then be installed in the concrete sleeve at a later date (without further disturbance to the river bed assuming the concrete sleeve extends some distance beyond the banks of the river).

This would avoid the need to form a connection in the gas pipeline in the bottom of a coffer-dammed trench in the middle of the river which is preferable on safety grounds.

Once the diversion is installed and gas is diverted through the new alignment, demolition and removal of the existing pipeline on the upstream face of the bridge may take place.

Gas Networks Ireland (GNI) have been consulted and a proposed diversion design has been submitted for GNI's review and approval. The final diversion design will be based upon the tender and construction drawings issued to GNI for final review and costing.

4.3.9 Bridge Replacement along Glashaboy River at Hazelwood Shopping Centre

The bridge at Hazelwood shopping centre will be replaced in order to increase the conveyance of the Glashaboy River. The works area will be isolated and traffic management set up as required. During the bridge replacement, both vehicular and pedestrian access between the shopping centre and the commercial centre will be maintained via the existing access to the commercial centre along Hazelwood Avenue. It is expected that access via the Hazelwood shopping centre bridge will be restricted for approximately 12 to 16 weeks. Access will be fully restored on completion of the bridge replacement works. Refer to **Chapter 14 Roads and Traffic** for further details on construction traffic.

Due to the potential in-stream works (including preparatory work) on a watercourse supporting salmonids, it is envisaged that this work will be undertaken in a window from July to September (inclusive) and in consultation with IFI to avoid accidental damage or siltation of spawning beds. Temporary works will be put in place, including silt barrages.

It is envisaged that the existing bridge deck will initially be dismantled/deconstructed, which will likely involve some in-channel works, but these will be minimised and of short duration. Following this, it is envisaged that a temporary cofferdam will be constructed around each of the existing bridge abutments, to allow for the existing abutments to be removed, and new abutments constructed in the dry, whilst maintaining the Glashaboy flow between the two cofferdams, and minimising pollution risk. The new bridge will be constructed using reinforced concrete abutments placed in situ with a precast concrete deck.

Construction of the reinforced concrete bridge abutments would typically involve:

- Fixing of reinforcement for abutments and piers;
- Placing of formwork for abutments and piers;
- Placing of cast in-situ concrete for abutments and piers; and
- Stripping of formwork.

Once the abutments are in place, the temporary cofferdam will be removed, allowing the placing and fixing of a precast concrete bridge deck, followed by the following:

- Construction of bridge parapets;
- Excavated material will be transported off site to a licensed facility or stored for reuse on site. The excavation will be backfilled, the area reinstated, and the works area reopened; and
- Permanent reinstatement of road surfaces may be required approximately six months following reopening of the road.

Any utility diversions necessary to facilitate the construction of the bridge will be completed prior to and after its construction.

4.3.10 Flood Defence walls at Meadowbrook

It is proposed to construct a steel sheet pile flood defence wall (**C01_L06, Drg No. GR_208**) on the left bank of the Glashaboy River opposite Meadowbrook Estate, close to Riverstown Bridge. Some trees will require removal to facilitate construction. These are shown on **Figure 3 (Appendix 3.2b)** in **Appendix 3.2**.

Refer to **Section 4.3.1** above in relation to vegetation clearance, tree removal and in-stream works in general.

It is envisaged that the installation of the proposed steel sheet piles on the left bank at Meadowbrook (refer to cross-section **C01.10** in **Drg. No. GR_305**) will require installation from both the river and land side. It is anticipated that the proposed steel sheet pile wall will be installed using a vibratory rig on a tracked excavator in order to minimise noise and vibration impacts on surrounding receptors and buildings. Access to construct the steel sheet piles will be required from the river as the steep bank topography at that location and constricted working access from the north and west of the existing property makes it very difficult to install from the left bank. Access to the river may be provided via a temporary ramp into the channel on the right bank immediately upstream of the existing Riverstown Bridge. Construction access for this is likely to be provided on the land/dry side via the front garden of the property on the left bank. As noted before, in-stream works (including preparatory work) on the Glashaboy River will be undertaken in a window from July to September (inclusive) and in consultation with IFI to avoid accidental damage or siltation of spawning beds.

It is proposed to construct a reinforced concrete flood defence wall (**C01_L05** in **Drg. No. GR_208**) on the right bank of the Glashaboy River along the entire length of the Meadowbrook Estate. There is an existing wall along the same stretch of river which will be removed where required. At either end of the proposed wall, the existing wall will be replaced with the new flood defence wall on the same alignment. Along the middle reach of the proposed wall, the new wall will be constructed along the Meadowbrook estate side (“dry side”) in order to minimise tree removal in the area. The levels are shown on **Drg No. GR_208**.

If piling is required during the breeding bird season (1 March to 31 August inclusive), noise and vibration restrictions will also be required in the vicinity of the kingfisher nests which, are in the Meadowbrook area. Further details are provided in **Chapter 6 Biodiversity** of this EIAR.

Refer also to **Drng No. GR_305** which shows the cross sections at Meadowbrook Estate (**C01.9** and **C01.10**).

4.3.11 Riverstown Bridge

It is proposed that the existing Riverstown Bridge parapet wall will be modified (including localised minor stonework repairs) to provide guarding height protection to pedestrians (**C01_F04**). Localised re-grading of road and footpath will take place in same area (**C01_R04**). Recambering of the road will also take place to divert surface water runoff, during a flood event, southwards into the Glashaboy River via O'Callaghan Park, downstream of Riverstown Bridge (**C01_R04**). A hand rail will be constructed adjacent to the parapet wall. Refer to the cross sections of Riverstown Bridge (**C01.11**) and at Meadowbrook Estate in the same area (**C01.12**).

At Riverstown Bridge on the left bank of the Glashaboy River, the existing bridge arch will be cleared by removing built up silt and vegetation (**C01_C01**). Similarly, on the right bank of the river, the existing Riverstown bridge arch will be cleared by removing built up silt and vegetation. The existing manhole in the bridge arch is to be removed and services diverted (**C01_C02**).

Refer to **Section 4.3.1** above in relation to vegetation clearance, tree removal and in-stream works in general.

4.3.12 Channel modifications of Glenmore Stream at Brooklodge Grove

Channel modifications will generally be undertaken from the bank of the watercourse using an excavator. Temporary works will be put in place, including silt barrages, and flow diversions/ over pumping where in stream works are required. Any material unsuitable for reuse in the project will be disposed at a licensed waste facility. Any utility diversions required to widen and deepen the watercourse will be completed prior to the widening and deepening works commencing.

Refer to **Section 4.3.1** above in relation to vegetation clearance, tree removal and in-stream works in general.

4.3.13 Future Maintenance Regime

Under Section 37 of the Arterial Drainage Act 1945 as amended, the Office of Public Works (OPW) is statutorily obliged to maintain all rivers, embankments and urban flood defences on which it has executed works since the 1945 Act, in “*proper repair and effective condition*”.

Channel and embankment maintenance operations can encompass a variety of activities, including silt and vegetation management, aquatic vegetation cutting, bank protection, bush cutting/branch trimming, tree cutting, mulching, mowing and structure maintenance (Ryan Hanley, 2014). Channel maintenance operations are defined as follows by the OPW (2011): *'channel maintenance normally involves removing the build-up of foreign or natural material that impedes the free flow of water. Predominately this consists of the removal of water-entrained silt and associated vegetation from the bed of the channel by suitably rigged hydraulic excavators. In most cases, no alterations to the bank are required and in some cases the channel is not disturbed at all if no build-up of material is present.'*

This is a responsibility of the Office of Public Works (OPW). All OPW maintenance work is undertaken in accordance with Environmental Management Protocols and Standard Operating Procedures (OPW, 2011) along with additional measures where the Standard Operating Procedures (SOPs) show deficiencies, to ensure adverse impacts on the environment are considered and minimised. OPW drainage maintenance activities will also be subject to a separate Ecological and Appropriate Assessment process to ensure no adverse impacts arise.

Future channel maintenance will apply to the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme. The location of channel maintenance is shown as general interferences on the drawings from **GR_201** to **GR_217**.

A channel maintenance programme will be required throughout the reach of the watercourses impacted by the proposed works. The channel maintenance programme will pay particular attention to locations where silt, gravel and debris are likely to accumulate, such as at structures, sharp bends, culvert inlets, blockages from trees etc. At this stage, the exact nature and scale of channel and embankment maintenance work likely to be required for the Glashaboy River Drainage Scheme is unknown, however Inland Fisheries Ireland (IFI) has indicated that dredging is to be avoided in the Glashaboy River. The purpose of any channel maintenance is to ensure that the scheme elements are kept in "proper repair and effective condition". Channel maintenance to that end will include the removal of silt/gravel build-ups and vegetation to maintain the as-designed channel cross section but this will not require removal of material below the existing bed. This removal of silts to maintain the designed cross section is not considered dredging. The following measures will also be incorporated into the channel maintenance method statement as requested by the IFI:

- a) *This work is carried out as much as possible from the river bank without in stream tracking,*
- b) *Any unavoidable in stream work is carried out between May and September,*
- c) *Tree removal is limited to fallen trees or overhanging branches*
- d) *Tree roots are not pulled from the river bank.*

The proposed pumping stations will require regular maintenance and it will be necessary to jet the surface water sewers to maintain the hydraulic capacity to drain flood waters.

Other measures will include regular inspections of flood walls and embankments, regular scheduled maintenance of the river channel and pruning of trees (including removal of trees where necessary), planning and control measures. The inspection regime will ensure that there is no deterioration in the structural integrity of the defences which may occur as a result of a vehicular collision for example. It is expected that the flood defences will otherwise be relatively maintenance free. In general, maintenance will typically consist of the following activities:

- The channels will be monitored by means of a walkover survey from the banks on a regular basis (likely quarterly, and also following a significant flood event). The walkover surveys would aim to identify issues with implications for flood risk (e.g. fallen trees, excessive vegetation build-up, overgrown trees, illegal dumping, accumulation of granular deposits, etc.). In-channel debris will typically be removed by a long reach excavator working from the banks. Excessive overhanging vegetation will typically be pruned back or removed by hand using a cherry picker, depending on access.
- The structures will be monitored by means of a walkover survey from the banks on a bi-annual basis. The walkover surveys would aim to identify issues with implications for flood risk (e.g. damage to structures, settlement of embankments, etc.).
- Culverts will be inspected on an annual basis and following a significant flood event. Any debris present in the culvert will be cleared by hand. A full CCTV survey and clearing of silt/sediment from the culvert is expected to take place approximately every five years. Removal of debris will be carried out as required.

Consultation will be required with the relevant stakeholders as necessary during the planning of these maintenance works including landowners, IFI, the National Monuments Service (NMS), Cork County Council (CCC) and National Parks and Wildlife Service (NPWS) to ensure that the works are carried out with minimal environmental impact.

4.4 Construction Site Layout

4.4.1 Construction Access

It is anticipated, where possible, that access to the works area will be gained from the dry (land) side of the channel to minimise impact on the watercourse. In some locations however as previously discussed, due to a constricted working area or access issues, temporary in-stream access will be required to facilitate the construction of the works from within the river channel.

The proposed construction works will generally be limited to the areas shown in **Series 5 (Drg No.'s GR_501 to GR_503)** of **Appendix 3.1**. Accommodation works for landowners may take place outside these areas with their agreement. Traffic management setups will be required outside these areas on the approaches to the works areas.

In general, the public will be excluded from entering these areas during the construction period for reasons of health and safety, however, it is acknowledged that some works will be located within residential areas such as in Meadowbrook, Brooklodge Grove, Cúil Chluthair and Copper Valley Vue, where vehicular and pedestrian access will need to be maintained to the residential properties and therefore construction access to these properties will need be discussed and agreed with residents prior to construction works commencing. Temporary access routes will be required outside of the construction works areas at some locations so that construction workers and construction vehicles can access certain areas. Refer to **Series 5 (Drawing No.'s GR_501 to GR_503) of Appendix 3.1.**

It is noted that many of the linear defences will require the temporary removal of boundary walls and fences to facilitate construction access (generally parallel with watercourses). These boundary walls / fences will be reinstated on completion in agreement with the landowners.

4.4.2 Construction Compounds

A number of potential locations for the construction compounds, in the immediate vicinity of the works, have been considered.

Construction compounds will be located within the 'Indicative Extent of Works' areas as shown in Drawings **GR_501 to GR_503** and are shown in **Series 5 (Drawing No.'s GR_501 to GR_503) of Appendix 3.1.** The final selection of the compound(s) will be made by the Contractor appointed to construct the works in consultation with the OPW, Cork County Council and the project ecologist. Due to the length of channel involved, the Contractor may choose to move the compound during the construction period, in which case the same selection process shall apply. Site compounds will comply with the mitigation measures identified within this EIAR.

4.4.3 Utilities

Temporary planned utility diversions will be required in most of the working areas during the construction phase. The works are in built up areas which are serviced with utilities such as gas, water, electricity, telecoms, foul and surface water drainage etc. In particular, a gas main which currently crosses over the Glashaboy River parallel to Hazelwood Avenue Bridge will need to be buried and installed underneath the Glashaboy River. Refer to Section 4.3.9 above for further details. The most likely impacts on utilities will be during the diversion works. It is possible that a short term disruption to some services may occur when the diversion is being undertaken. However, it is not considered that these disruptions will result in significant negative impacts on customers. All utility diversions will be carried out in consultation with the relevant utility company. The Contractor will be required to submit diversion proposals to the relevant utility company for their approval prior to works being carried out. Refer to **Chapter 15 Material Assets** for further details on utilities.

4.4.4 Hoarding

Where possible, a site boundary in the form of hoarding or fencing or similar where appropriate (approx. 2.4m), will be established around working areas before any significant construction activity commences.

Construction site hoarding is used to provide a secure site boundary to what can be a dangerous environment for people who have not received the proper training and are unfamiliar with construction operations.

Hoarding works will be of the same nature as that carried out for similar operations at most construction sites.

Site hoarding also performs an important function in relation to minimising some of the potential environmental impacts associated with construction, namely:

- Noise;
- Visual impact; and
- Dust minimisation.

Excavation for mounting posts for hoarding will be carried out by a mini-digger. The size and nature of the posts and hoarding will be dependent on the requirements for any acoustic mitigation as well as Contractor preference.

4.4.5 Site Lighting

Temporary construction lighting may be required at some locations especially during the winter months where daylight hours are short. Site lighting will generally be provided by tower mounted 1000W metal halide floodlights, which will be angled downwards to minimise spillage of light from the site. These will be powered by mains supplies in general. Lighting will be provided on the exterior of hoarding for walkways for public safety where required. Specific lighting requirements which are close to residential properties will be discussed with the residents in advance.

4.4.6 Construction Compound Site Drainage

The construction site drainage within the construction compounds will be designed in such a manner so as to minimise the risk of contamination of the surrounding soil, surface water and groundwater. Rainwater run-off from the contractor's compounds will be controlled via a temporary surface water control system comprising measures such as swales (ditches) and settlement ponds (or similar system) which will minimise the risk of pollution to soil, surface water or groundwater. The temporary surface water control system will be subject to a daily visual inspection as well as routine maintenance. The inspection frequency will be increased during periods of exceptional high rainfall. Written procedures will be maintained and a log recorded for the inspections.

The contractor facilities will contain toilets, canteen, construction containers and site office. A grease trap will also be installed at the canteen.

The disposal of sanitary effluent during construction will be via tankers to a suitable wastewater treatment facility.

Storm water will be managed carefully during construction. Any areas which will involve the storage of fuel will be paved and bunded and hydrocarbon interceptors installed to ensure no spillages will get into the surface water or groundwater.

Daily plant and machinery checks will be carried out as per contract requirements on all construction plant and machinery. Drip trays will be used both for refuelling and overnight parking and spill kits will be on hand at all times. Further details are provided below in **Section 4.7**.

4.4.7 Construction Traffic

A detailed construction traffic management plan will be prepared and agreed with Cork County Council by the Main Contractor in advance of any works taking place on site. Refer to **Chapter 14 Roads and Traffic** for further details on same.

As discussed previously, every effort will be made to carry out the works as quickly as possible in order to minimise impacts on the residents in the area. It is envisaged that traffic measures such as a stop-go system, temporary one-way traffic systems or similar will be implemented to allow the construction works and utility diversions to be constructed and at the same time to manage traffic. It is expected that the majority of the intense works on the public road will be programmed to be carried out in the summer months to avoid school traffic etc. It is not anticipated at this stage that full road closures will be required, however, if they are required, they will be for a very short duration only and will take place at night or other suitable times to minimise the impact on traffic in the area.

Traffic movement at the site will be planned to ensure traffic movements to and from site are managed efficiently and in accordance with Health and Safety requirements. In addition, any impacts on the local environment including local residents, road users and pedestrians will be minimised.

The following provisions will be adhered to as a minimum;

- All trucks entering and exiting the site will be covered with tarpaulin;
- Adequate parking will be provided to avoid queuing at the site entrances and prevent disruption to neighbouring businesses;
- Deliveries of materials will be planned and programmed to ensure that the materials are delivered only as they are required on site. Works requiring multiple vehicle deliveries to site, such as concrete pours, will be planned so as to ensure there will no queuing on the public roadways. Deliveries will be limited to outside of peak hours;
- Trucks will not be allowed to park on the public road either outside the site or on any of the approach roads leading to the site;
- All trucks entering the site will be restricted to suitable speed limit and will be directed to the relevant area by the site manager;

- Trucks required to wait on site will switch off engines to avoid unnecessary fuel usage and noise;
- All trucks exiting the site will be required to pass through a wheel wash. All water from the wheel wash will be collected, treated to remove silt or other contaminants, and discharged via an approved discharge licence to a local water course or drainage network. A lance will be provided to clean down the bodies and sides of the truck prior to leaving site; and
- Roads outside the site will be visually inspected on a daily basis and power swept and washed as and when required.

4.4.8 Craneage

Some of the construction works will require the use of standard mobile cranes on site in order to install the pre-cast bridge and culverts.

The cranes will generally be required for the moving of building materials on site such as concrete pipes, formwork for concrete, reinforcement, precast concrete, plant and general building materials. Heavy machinery movements will be restricted to outside of peak hours.

4.5 Duration, Phasing and Employment

Construction works are expected to commence in Quarter 1 of 2019 and the proposed construction period is estimated at circa 18-24 months. The total 18-24-month construction period has been estimated to allow for poor weather over the winter months, mobilisation between sites and seasonal ecological restrictions. The estimated period for individual locations is presented in **Table 4.1** below.

Table 4.1: Estimated Duration of Construction Works. Refer also to Figure 1.1 for location of works areas

Area of Works	General Location	Overview of Works	Estimated construction period (weeks)
1	Sallybrook	Culvert replacement along Bleach Hill stream at Cuil Chluthair, direct defences (embankment & flood walls) along Glashaboy River, Infilling of existing ditch along Sallybrook stream and provision of culvert. Flow control structure at Mill race at Grandons Garage and pumping Station	16 – 20 weeks
2	Hazelwood	Culvert replacements at Cois na Gleann Stream (R615 & R639), flood wall along R639 and curving around onto Hazelwood Avenue, across Hazelwood Avenue bridge. Flood relief channel parallel to river under Hazelwood Avenue, bridge replacement at Hazelwood Shopping Centre and flood wall along Glashaboy River, Road re-grading and pumping stations. Gas main diversion underneath Glashaboy River	32 – 40 weeks
3	Meadowbrook	Flood Walls along Glashaboy River, culvert replacement and extension along Springmount stream (R639) and road re-grading works along Riverstown Bridge and approaches, removal of existing manhole from the bridge arch and pumping stations	16 – 20 weeks
4-1	Butlerstown Stream	Minimal landscaping and re-grading of ground levels, to facilitate overland flow from the Butlerstown stream back into the Glenmore Stream	2-3 weeks
4-2	Copper Valley Vue Brooklodge Grove	Culvert upgrades, road re-grading and new flood defence walls, channel modification flood walls along Glenmore Stream, re-grading of small area of land adjacent to Glenmore stream to facilitate overland flow	12 – 16 weeks
5	The Grove	Flood wall along Glashaboy River (parallel to R369)	4 – 8 weeks

As discussed above, the construction works themselves will last approximately 18 to 24 months and will be subject to the following programme constraints:

- In-stream works (including preparatory work) on the Glashaboy River and its tributaries will be undertaken in a window from July to September (inclusive) and in consultation with Inland Fisheries Ireland (IFI) to avoid accidental damage or siltation of spawning beds. In-stream works associated with the drainage scheme will be carried out under the supervision of a suitably qualified and experienced ecologist. All in-stream works will be designed and carried out in consultation with Inland Fisheries Ireland (IFI) and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters*
- To avoid impacting on bird nesting sites, all vegetation clearance works and site preparatory works will be conducted outside of the bird nesting season (1st March to 31st August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out, and the area proposed for clearance has been approved by suitably qualified and experienced ecologist.
- There are a number of otter holts in the vicinity of Sallybrook, Hazelwood and Meadowbrook on the Glashaboy River. Otter activity has been observed both on the Glashaboy River and on the Glenmore Stream. Consultation is ongoing with the NPWS in relation to a specific otter mitigation strategy in the form of a derogation licence for disturbance, temporary closure of holts, installation of artificial holts and seasonal restrictions of works. A derogation licence for otters from the NPWS is provided in **Appendix 6.3**. A derogation licence for bats from the NPWS is also provided in **Appendix 6.4**. Further details are provided in **Chapter 6 Biodiversity** of this EIAR.

The co-ordination of people and materials on site will be one of the key activities throughout the construction phase. In order to ensure that construction workers do not create undue disruption, there will be a requirement that the Contractor provide adequate site supervision to co-ordinate, monitor and implement site regulations.

Normal construction working hours will be observed. These are 08.00 – 19.00 Monday to Friday; 09.00 – 16.00 on Saturday. It may be necessary to work outside these hours, including at weekends and at night, at certain stages. Working outside normal hours may be necessitated through consideration of safety or weather and sub-contractor availability. Heavy or noisy construction activities will be avoided outside normal hours and the amount of work outside normal hours will be strictly controlled. Approval from Cork County Council will be obtained for works outside normal hours.

It is envisaged that the average number of construction personnel on site will be circa 30 personnel but this will vary depending on the construction activities required, seasonal constraints and will likely peak during the summer months when up to 50 construction personnel are envisaged.

4.6 In-stream works

- Where access to the river channel is required, detailed method statements will be drawn up which deal specifically with the works proposed. Detailed silt control methods will be required for all in-stream works. Most works along the river banks will require effective control of silt and it is expected that a variety of methods may be required i.e. silt curtains, dewatering, silt sumps etc. The method statements will be drawn up in consultation with the supervising ecologist. Consultation will take place with the NPWS and Inland Fisheries Ireland (IFI) prior to the commencement of works.
- All concrete works will be carried out in dry conditions with no in-stream pouring of concrete. It may be necessary therefore to effectively sheet-pile or cofferdam sections of the river and pump out the river water during the construction of the proposed works. If required, fish populations which become isolated, will be salvaged via electrofishing under licence from the Department of Communications, Climate Action and Environment and in consultation with Inland Fisheries Ireland.
- It is expected that most of the equipment used will be standard construction plant for a project of this nature, e.g. mechanical excavators, dump trucks, dewatering pumps, ready mix concrete lorries, pile drivers, rock breakers etc. All machinery will be maintained in good condition to prevent leakage of hydrocarbons. Fuelling and lubrication of equipment will not be carried out within 30m of any watercourse.
- All contractors, sub-contractors and in particular machinery operators will be made aware of the provisions for protecting water quality as outlined in the method statements.
- Where possible excavated material will not be stockpiled within 10m of a watercourse. Where this measure is not implementable, then specific silt control measures will be planned as part of the detailed method statement for site works in each specific area. Precautions will be taken to minimise the run off of soil into watercourses.
- All culverts and walls will be designed to minimise impacts on fish and macroinvertebrate populations. Where possible, gravel substrates and as natural a flow pattern as possible under low water/ low tide conditions will be provided in channels affected by site works. The structure and flow pattern with culverts on minor streams will be designed to allow fish to move through them. The slope of culverts will follow the existing gradient and trash screens are not currently envisaged as part of the Scheme.
- Input from a qualified fisheries/aquatic ecologist with experience in the design of in-stream structures is required for the design of culverts and the post works flow patterns and channel structure. The specialist in conjunction with the supervising ecologist will be required to visit the watercourses prior to the commencement of site works to assess the existing channel structure, fish holding features, substrate composition, flow patterns etc.

Where feasible such structures will be incorporated into the channels following completion of work.

4.7 Environmental Construction Management

4.7.1 General

Every effort will be made to ensure that any detrimental environmental effects will be avoided, prevented or reduced during the construction phase of this project.

A Construction Environmental Management Plan (CEMP) has been prepared and is included in **Appendix 4.2** which will be updated and finalised by the Contractor prior to construction commencing. The CEMP comprises all of the construction mitigation measures, which are set out in this EIAR, and will be updated with any additional measures which are required by the conditions to the Minister for Public Expenditure's statutory confirmation of the Scheme under the Arterial Drainage Acts.

Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum. The plan has regard to the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK, *Environmental Good Practice on Site Guide, 4th Edition* (CIRIA 2015). The plan also has regard to the TII Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan.

A construction management team shall be appointed for the duration of the construction phase. This team will supervise the construction of the proposed road development, including monitoring the performance of the contractors to ensure that the proposed construction phase mitigation measures are implemented and that construction impacts and nuisance are minimised. The construction management team will liaise with neighbours and the general community during the construction phase to ensure that any disturbance is kept to a minimum.

The Employer's Representative will have a construction management team on the project site for the duration of the construction phase. The team will supervise the construction of the scheme including monitoring the contractors' performance to ensure that the proposed construction phase mitigation measures are implemented and that construction impacts and nuisance are minimised. The construction management team will liaise with residents and the general community during the construction phase to ensure that any disturbance is kept to a minimum and to ensure that all anticipated nuisances are minimised and that the construction activity will have the lowest possible impacts on the residents and other properties.

It is also proposed that a Community Liaison Officer (CLO) will be appointed who will coordinate communications and liaise with the local community during the construction phase. The appointed CLO may be part of the resident engineering team.

4.7.2 Soil, Surface Water and Groundwater

The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off, adjacent watercourses and groundwater. The Construction Industry Research and Information Association (CIRIA) in the UK has issued a guidance note on the control and management of water pollution from construction sites, *Control of Water Pollution from Construction Sites, guidance for consultants and contractors* (Masters-Williams *et al.* 2001). Additional guidance is provided in the CIRIA technical guidance on *Control of Water Pollution from Linear Construction Projects* (Murnane *et al.* 2006).

The guides are written for project promoters, design engineers and site and construction managers. They address the main causes of pollution of soil, groundwater and surface waters from construction sites and describe the protection measures required to prevent pollution of groundwater and surface waters and the emergency response procedures to be put in place so that any pollution, which occurs, can be remedied.

The guides address developments on green field and potentially contaminated brownfield sites. The construction management of the site will take account of the recommendations of the CIRIA guidance to minimise as far as possible the risk of soil, groundwater and surface water contamination.

Site activities considered in the guidance include the following:

- Excavation;
- earthmoving;
- concreting operations;
- spreading of topsoil;
- road surfacing;
- site drainage, and the control and discharge of surface water runoff from the site;
- soil and fuel delivery and storage; and
- plant maintenance.

Measures, as recommended in the guidance above, that will be implemented to minimise the risk of spills and contamination of soils and waters, include:

- Training of site managers, foremen and workforce, including all subcontractors, in pollution risks and preventative measures;
- Careful consideration will be given to the location of any fuel storage facilities. These will be designed in accordance with guidelines produced by CIRIA, and will be fully bunded;
- All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment to deal with spills will be maintained on site;

- Where feasible, soil excavation will be completed during dry periods and undertaken with excavators and dump trucks. Topsoil and subsoil will not be mixed together;
- Ensure that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g. by a roll-over bund, raised kerb, ramps or stepped access;
- Use collection systems to prevent any contaminated drainage entering surface water drains, watercourses or groundwater, or draining onto the land;
- Wheel wash at site entrance to clean vehicles prior to exiting onto public road network;
- Minimise the use of cleaning chemicals;
- Use trigger-operated spray guns, with automatic water-supply cut-off;
- Use settlement lagoons or suitable absorbent material such as flocculent to remove suspended solids such as mud and silt;
- Use silt control methods for in-stream working e.g. silt curtains, silt sumps; and
- Ensure that all staff are trained and follow vehicle cleaning procedures. Post details of the procedures in the work area for easy reference.

The implementation of the above measures will ensure that the risk of pollution of groundwater, soils and surface waters, resulting from the construction activities will be minimised. Furthermore, appropriate mitigation measures will be implemented prior to the construction phase to ensure that water quality of the Glashaboy River and its tributaries are not adversely affected through pollution incidents and silt mobilisation. This mitigation will include:

- Appropriate sediment control measures will be employed.
- Where cast-in-place concrete is required, all work must be carried out in the dry and effectively isolated from any flowing water (or water that may enter streams and rivers) for a period sufficient to ensure no leachate from the concrete;
- Waterproofing and other chemical treatment to structures in close proximity to watercourses shall be applied by hand; and
- All pumps used for dewatering excavations shall be located in sump to minimise the sediment generation.

Refer to **Chapter 11 Soils, Geology and Hydrogeology** and **Chapter 12 Hydrology**) for further details on mitigation measures in relation to water protection and silt prevention.

4.7.3 Emissions to Air

As construction activities are likely to generate some dust emissions, particularly during the site clearance and excavation phase, a dust minimisation plan will be prepared and implemented by the contractor during the construction phase of the project. Refer to **Chapter 10 Air Quality** for further details on same.

4.7.4 Site Tidiness

The following are some of the measures that will be taken to ensure that the site and surroundings are maintained to a high standard of cleanliness:

- Daily site inspections will be undertaken to monitor site tidiness;
- A regular programme of site tidying will be established to ensure a safe and orderly site;
- Scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind;
- Food waste will be strictly controlled on all parts of the site.
- Mud spillages on roads and footpaths outside the site will be cleaned regularly and will not be allowed to accumulate;
- Wheel-wash facilities will be provided for vehicles exiting the site; and
- In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed to storage on site, and subsequently disposed of in the normal manner.

4.7.5 Noise Emissions and Vibration

Construction noise will be kept to a minimum. The contract documents will specify that the contractor, undertaking the construction of the works, will be obliged to take specific noise abatement measures and will comply with the British Standard BS 5228 – 1: 2009 +A1 2014: *Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise*. Specific mitigation measures are detailed in **Chapter 9 Noise and Vibration**. Refer to **Chapter 9** for details on same.

4.7.6 Invasive Species

Invasive plant species, particularly Japanese knotweed is known to be within some of the proposed works areas. Special consideration will need to be taken by the contractor when working within these areas so as to avoid spreading the material to unaffected areas and downstream. The treatment of knotweed infested soil and associated biosecurity measures to prevent the spread of knotweed is described in **Appendix 4.1**.

4.7.7 Construction Waste Management

Waste generated during the construction phase will be carefully managed according to the accepted waste hierarchy which gives precedence to prevention, minimisation, reuse and recycling over disposal with energy recovery and finally disposal to landfill.

This hierarchy will be implemented by identifying opportunities to firstly prevent waste from being produced, and secondly minimise the amount of waste produced. Where prevention and minimisation will not be feasible, ways to reuse or recycle waste will be sought, preferably on-site to avoid the impacts arising from transportation. If this is not feasible, opportunities to reuse or recycle the waste off-site will be investigated. If this is not feasible, then waste will be sent to an energy recovery facility, and only where there is no alternative, will waste be disposed of to landfill. To achieve this, existing waste management programmes and networks will be used such as the National Waste Prevention Programme, which is implemented by the Environmental Protection Agency.

All waste removed from the site will be collected only by contractors with valid waste collection permits, under the Waste Management (Collection Permit) Regulations.

All facilities to which waste will be taken will have appropriate waste licences or permits, under the Waste Management Act 1996, as amended, and the regulations thereunder, allowing them to accept the type of waste that is to be sent there. Hazardous waste generation will be minimised, and such waste will be recovered where feasible, and only disposed of if recovery is not feasible. Hazardous waste will be managed in accordance with the relevant legislation.

4.7.7.1 Waste Arising

In general, construction waste materials may include general construction debris, scrap timber and steel, machinery oils and chemical cleaning solutions. The practice of excessive purchase of materials and equipment to allow for anticipated wastage will be avoided.

It is anticipated that the majority of the excavated material, which is expected to be uncontaminated soil will be suitable for reuse onsite. In the unlikely event of any evidence of soil contamination being found during work on site, the appropriate remediation measures will be employed. The treatment of knotweed infested soil and associated biosecurity measures to prevent the spread of knotweed is described in **Appendix 4.1**.

Any work of this nature would be carried out in consultation with Environmental Department of Cork County Council, IFI, EPA and NPWS as necessary. The material would be transported to a permitted site via the national and regional road network.

Timber from trees, felled as part of the site preparation, will be sold to the timber industry where possible.

4.7.7.2 Waste Management Plan

The contractor will be required to develop, implement and maintain a Waste Management Plan during the construction works. A senior manager will be responsible for the waste management plan. The manager will be competent in waste management, and will receive training, where necessary, such as the CIF Site Waste Management and Environmental Awareness course.

The key principles underlying the plan will be to minimise waste generation and to segregate waste at source. The measures to achieve these aims include:

- Ordering of appropriate quantities of materials, with a just-in-time philosophy;
- Immediate and careful storage of materials delivered to the site;
- Storing materials which are vulnerable to damage by rain under cover and raised above the ground;
- Careful handling of materials, using appropriate equipment, to avoid undue damage; and
- Designation of separate storage areas for different types of waste, in order to maximise the reuse and recycling potential of the waste.

The Waste Management Plan will outline how residual waste will be handled as follows:

- The identification of disposal sites;
- The identification of quantities to be excavated and disposed of and classification of this material;
- The identification of measures to prevent nuisance, etc.;
- The identification of the amounts intended to be stored temporarily on site and the location of such storage;
- The contractor's approach to waste management; and
- The names, roles, responsibilities, and authority of the key personnel involved in the waste management.

The Waste Management Plan will include documented procedures for dealing with waste management including liaison with third parties, statutory undertakers and other companies.

The Waste Management Plan will meet the requirements of the guidelines prepared by the National Construction and Demolition Waste Council (NCDWC), *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects*, NCDWC (2006).

The following will also be considered as part of the Waste Management Plan:

- The identification of the amounts of materials intended to be stored temporarily on site and the location of such storage;

- Procedures for controlling sub contracts i.e. for checking waste procedures of subcontractors and ensuring sub-contractors fulfil design teams and contractor obligations in respect of waste management;
- Designation of separate storage areas for different types of waste materials in order to maximise their re-use and recycling potential;
- Procedure for record keeping for waste retained on site;
- Procedure for record keeping for hazardous waste, for example, C1 forms and trans-frontier shipment documents; and
- Details of authorised waste hauliers with appropriate and up-to-date Waste Collection Permits. Details of permitted or licensed recovery and/or disposal facilities where waste materials will be sent, including copies of permits and licenses.

4.7.7.3 Waste Minimisation

The main contractor will be required to minimise waste and to segregate waste at source. The possible measures used to achieve these aims will include:

- Ordering of appropriate quantities of materials, with a just-in-time philosophy.
- Immediate and careful storage of materials delivered to the site.
- Storing under cover and raised above ground materials, which are vulnerable to damage by rain.
- Careful handling of materials, using appropriate equipment, to avoid undue damage.
- Designating separate storage areas for different types of waste in order to maximise the re-use and recycling potential of the waste.
- Anticipated wastes arising can be summarised as follows:
- Sanitary waste from toilet and washing facilities. These will be tankered offsite; and
- Construction Waste – e.g. packaging, pallets, and metal waste will be disposed off-site at suitably permitted waste facilities.

4.8 Materials Source and Transportation

In so far as is feasible, all construction materials will be sourced from local suppliers if these are available within the Cork area. The selection and specification of construction materials will be informed by local availability of these materials. Within the necessary constraints of performance, durability and cost, construction materials will be sourced from local suppliers and manufacturers, where possible. The coordination and logistics of construction traffic will be captured within the construction traffic management plan which will be agreed with CCC and An Garda Síochána.

4.9 Construction Safety

As required by the Safety, Health and Welfare at Work (Construction) Regulations 2013, a Health and Safety Plan will be prepared which will address health and safety issues from the design stages through to the completion of the construction and maintenance phases. This plan will be reviewed as the scheme progresses. The contents of the Health and Safety Plan will comply with the requirements of the Regulations.

The Regulations require the developer of a project to appoint a “Project Supervisor Design Process” (PSDP) and “Project Supervisor Construction Stage” (PSCS). Cork County Council has appointed Arup as PSDP in accordance with the current legislation.

The PSDP will assemble the Safety File as the project progresses. The Safety File will be incorporated into the overall technical record system at the end of the project.

Safety on site will be of paramount importance. During the selection of the contractors and subcontractors, their safety records will be investigated. Only contractors with high safety standards will be selected.

Prior to working on site, each individual will receive a full safety induction and will be provided with all of the safety equipment relevant to the tasks the individual will be required to perform during employment on site.

Safety briefings will be held regularly and prior to any onerous or special task. ‘Toolbox talks’ will be held to ensure all workers are fully aware of the tasks to be undertaken and the parameters required to ensure the task will be successfully and safely completed.

All visitors will be required to wear appropriate personal protective equipment prior to going on to the site and will undergo a safety briefing by a member of the site safety team.

Regular site safety audits will be carried out throughout the construction and the complied with at all times.

At any time that a potentially unsafe practice is observed, the site safety manager will have the right as well as the responsibility to halt the work in question, until a safe system of working is again put in place.

Appropriate site personnel will be trained as first aiders and fire marshals. In addition, appropriate staff will be trained in environmental issues and spill response procedures. Tanks and drums of potentially polluting materials will be stored in secure containers or compounds which will be locked when not in use. Secure valves will be provided on oil and fuel storage facilities. Equipment and vehicles will be locked, have keys removed and be stored in secure compounds.

The Main Contractor will be required to maintain an emergency response plan which will cover all risks i.e. fire, flood, collapse etc.

In preparing this plan the Contractor will be required to liaise with the emergency response services.

4.10 Community Liaison During Construction

Effective community liaison is essential in order to help ensure the smooth running of construction activities and in relation to residents and public welfare. Important key issues in ensuring good relations are:

- Availability of information for the public during the construction phase, (particularly nearby sensitive receptors);
- Having the correct points of contact and being responsive; and
- The need for good housekeeping in all aspects of the operations.
- Due to the nature of construction works it is essential to operate ‘Good Neighbour’ policy in so far as possible. Key aspects of this policy include:
- Early implementation of the policy, i.e. from the commencement of construction;
- Reduction of nuisance factors;
- Access to amenity areas, walkways and cycle paths and for neighbouring premises;
- Clear and concise information; and
- Undertaking timely liaison with stakeholders.

A Community Liaison Officer (CLO) will be appointed who will coordinate communications and liaise with the local community during the construction phase. The appointed CLO may be part of the resident engineering team.

A Community Liaison Plan will be prepared, which will include details of how the local community, road users and affected residents will be notified in advance of the scheduling of major works, any temporary traffic diversions and the progress of the construction works.

This plan will typically include details of the following:

- Contractor’s community relations policy;
- Personnel nominated to manage public relations (Community Liaison Officer, CLO);
- A methodology for processing observations, queries and complaints from the general public, relevant authorities, the media, emergency services and the like; and

The strategy for project wide liaison with all relevant parties.

Cork County Council’s construction supervision team will also take an active role in community liaison and will work in close collaboration with the CLO.

4.11 Construction Site Decommissioning

On completion of construction, all construction facilities and equipment such as plant, materials, signage, contractors' offices and laydown areas, etc. will be removed from site.

Temporary entrances will be removed, boundary walls, fences and all roads reinstated as necessary. Construction site fencing will be removed and landscaping/replanting will be completed.

Appendix B (NIS)

**Construction Environmental
Management Plan (CEMP)
extracted from EIAR**

Document Verification

ARUP

Job title		Glashaboy River (Glanmire/Sallybrook) Drainage Scheme		Job number		234334	
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1 Introduction

Cork County Council, on behalf of and as Agents of the Commissioners of Public Works in Ireland (Office of Public Works), intend to develop the proposed Glashaboy River (Glanmire/Sallybrook) Drainage Scheme in accordance with the provisions of the Arterial Drainage Acts of 1945 and 1995, (as amended).

This scheme is being undertaken for the purpose of preventing or substantially reducing the periodical localised flooding of lands and properties in the area of this watercourse.

This Construction Environmental Management Plan (CEMP) summarises the overall environmental management strategy that will be adopted and implemented during the construction phase of the proposed drainage scheme. The purpose of the CEMP is to demonstrate how the proposed construction works can be delivered in a logical, sensible and safe sequence with the incorporation of specific environmental control measures relevant to construction works of this nature. The CEMP sets out the mechanism by which environmental protection is to be achieved during the construction phase of the proposed development. Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum.

The CEMP has been prepared in accordance with industry best practice guidance including:

- TII's Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan
- Construction Industry Research and Information Association (CIRIA) in the UK, Environmental Good Practice on Site Guide, 4th Edition (CIRIA 2015)

The CEMP has been prepared in conjunction with the Environmental Impact Assessment Report (EIAR) and the Natura Impact Statement (NIS), having regard to consultations with a range of specialists and environmental organisations, in particular, the National Parks and Wildlife Service (NPWS) and Inland Fisheries Ireland (IFI). It is noted that this CEMP must be read in conjunction with the construction details already provided in the EIAR and in the NIS.

The CEMP is a working document and will be finalised by the Contractor following appointment and prior to commencing works on site. As stated previously, this CEMP must be read in conjunction with the construction details already provided in the EIAR. All of the content provided in this CEMP will be implemented in full by the Contractor and the finalisation of the CEMP by the Contractor will not affect the robustness and adequacy of the information presented here and relied upon in the EIAR and in the NIS.

Some information (such as project details and the schedule of environmental commitments from the EIAR) has already been provided in full in the EIAR and is not repeated in full in this version of the CEMP. Similarly, specific mitigation measures are detailed in the NIS in relation to the protection of European Designated Sites. All of this information will be included in the CEMP which is

finalised by the Contractor. Refer to Chapter 17 (Summary of Mitigation Measures) of the EIAR and refer to Section 7.3 (Avoidance and Mitigation Measures) of the NIS for further details on the schedule of commitments.

In addition to the items listed above, the following information will also be provided by the Contractor when finalising the CEMP:

- Statutory consent - If approval is granted for the proposed development, the entire contents of the planning consent will be included in the CEMP.
- Comprehensively incorporate all Environmental Commitments set out in the Contract documents (in particular the Works Requirements), those presented in the EIAR and NIS and any additional commitments which may arise as part of the conditions to the Minister for Finance and Public Expenditure and Reform (DFPER) statutory confirmation of the Scheme under the Arterial Drainage Acts.
- Relevant Environmental Performance Criteria prescribed in environmental legislation and in Contract documents.
- Register of all applicable legislation, including relevant standards, Codes of Practice and Guidelines.
- Description of the Environmental Management System of the proposed development, which shall be devised according to the criteria of ISO 14001:2004 – Environmental Management Systems. The CEMP will be complemented by General Procedures, Work Procedures and Operations Instructions. These documents will be in place within the site administration offices and appropriate site locations during works.

The CEMP is a dynamic document and the Contractor will ensure that it remains up to date for the duration of the construction period. The CEMP may need to be altered during the lifecycle of the construction period to take account of monitoring results, legislative changes, outcomes of third-party consultations etc. Additional appendices may be added to the CEMP to accommodate monitoring results, permits etc.

All of the content provided in this CEMP will be delivered in full by the Contractor and the finalisation of the CEMP by the Contractor will not affect the robustness and adequacy of the information presented here and relied upon in the EIAR and NIS.

The Employer's Representative will have a construction management team on the project site for the duration of the construction phase. The team will supervise the construction of the scheme including monitoring the contractors' performance to ensure that the proposed construction phase mitigation measures are implemented and that construction impacts and nuisance are minimised. The construction management team will liaise with residents and the general community during the construction phase to ensure that any disturbance is kept to a minimum and to ensure that all anticipated nuisances are minimised and that the construction activity will have the lowest possible impacts on the residents and other properties.

It is also proposed that a Community Liaison Officer will be appointed who will coordinate communications and liaise with the local community during the construction phase.

2 Project Description

Cork County Council, on behalf of and as Agents of the Commissioners of Public Works in Ireland (Office of Public Works), intend to develop the proposed Glashaboy River (Glanmire/Sallybrook) Drainage Scheme in accordance with the provisions of the Arterial Drainage Acts of 1945 and 1995, (as amended).

This scheme is being undertaken for the purpose of preventing or substantially reducing the periodical localised flooding of lands and properties in the area of this watercourse.

The proposed Glashaboy River (Glanmire/Sallybrook) Drainage Scheme will include the construction of direct flood defences and conveyance improvement measures along the Glashaboy River and its tributaries. The direct defences proposed include flood walls and embankments with the conveyance improvements consisting of channel widening, channel deepening and the introduction of or replacement of culverts. The proposed drainage scheme is located within the Glashaboy River Catchment. Specifically, the drainage scheme is proposed to be implemented along the Glashaboy River and its tributaries in Glanmire and Sallybrook, Co. Cork. Construction works will take place in seven separate areas as presented in Error! Reference source not found..1:

- Area 1** Sallybrook Industrial Estate
- Area 2** Hazelwood
- Area 3** Meadowbrook
- Area 4-1** Butlerstown Stream
- Area 4-2** Glenmore Stream
- Area 5** O'Callaghan Park to Glanmire Bridge
- Area 6** Downstream of Glanmire Bridge (Channel maintenance only)

The northern boundary of the proposed scheme area is along the Bleach Hill stream and along the Glashaboy River, north of Sallybrook Industrial Estate. The southern boundary extends as far as downstream of the Glanmire Bridge. Works will be required along a total of approximately 4.76 km of the Glashaboy River. Works are also required along some of the tributaries of the Glashaboy River, within the scheme area including the Butlerstown Stream, Glenmore Stream, Springmount Stream, Cois na Gleann Stream, Bleach Hill Stream, Sallybrook Stream and a number of mill races. (Refer to **Drawings no GR101 – GR503 (Confirmation Drawings)** in **Appendix 3.1 of EIAR**).

Refer to **Drawing No GR_103 Channel Codes in Appendix 3.1** which shows the extent of the proposed development along the Glashaboy River and its tributaries.

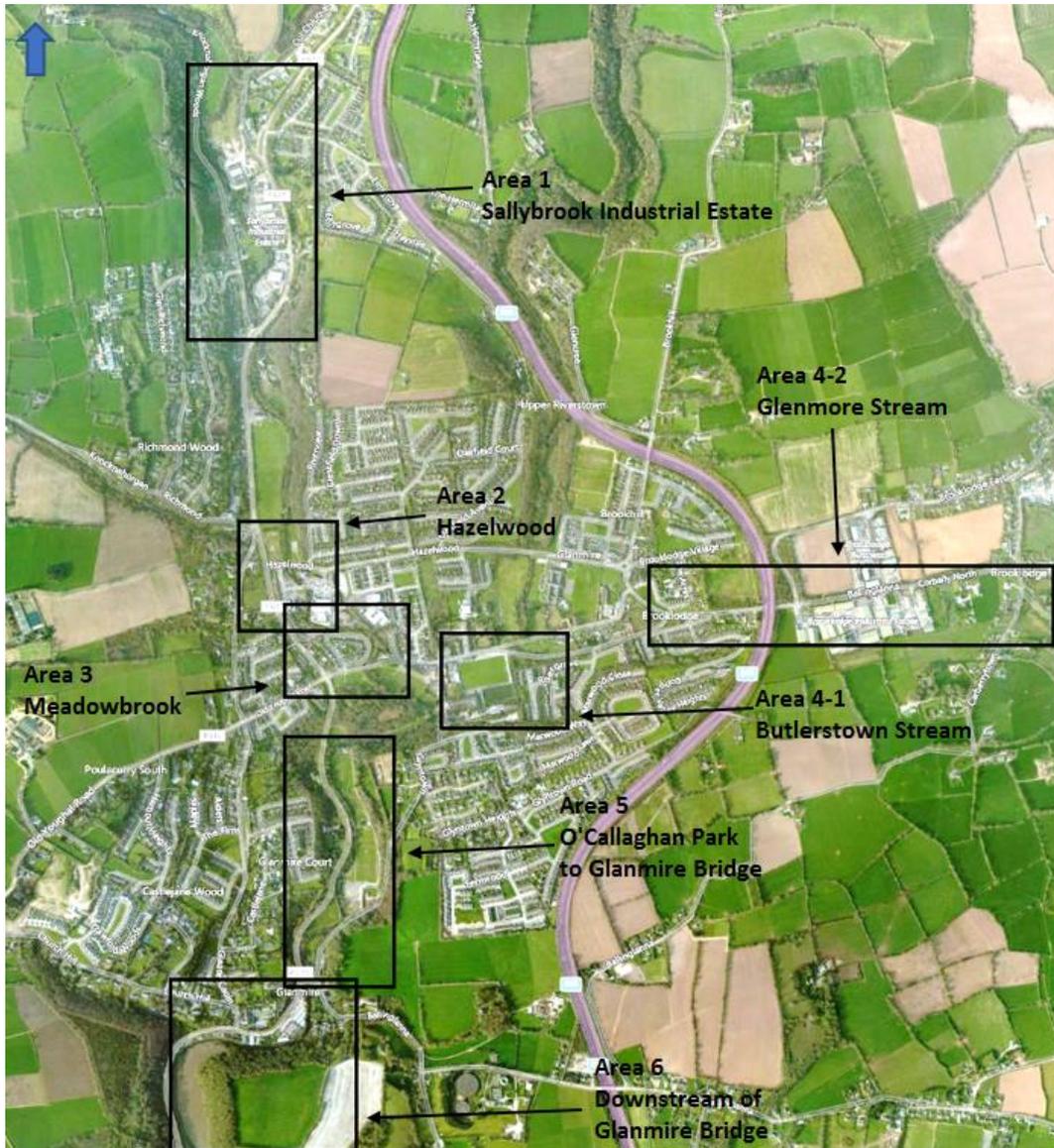


Figure 1.1: Site Location and Drainage Scheme Construction Works Overview (Refer to drawings GR_201 to GR_217 for channel maintenance locations) | not to scale | © Bing maps

The main aspects of the drainage scheme comprise construction works entailing the following:

- Replacement of a number of existing culverts with either new culverts or bridges and culvert extensions;
- Replacement of Hazelwood Shopping Centre bridge;
- New flood relief channel and culvert at Hazelwood Avenue;

- Replacement of existing flood defence walls and construction of new flood defence walls;
- Construction of a new earthen flood defence embankment at Sallybrook;
- New surface water pumping stations and one foul pumping station;
- Localised in-channel conveyance improvements at culvert/bridge structures;
- Local channel widening, deepening, realignment and regrading of river channel;
- Provision of civil works such as road/footpath re-grading at a number of locations;
- Protecting drainage outlets along the line of flood defence works with non-return flap valves;
- Retaining walls;
- Flow control structure on a millrace;
- Removal of vegetation and trees to facilitate construction works;
- Reinstatement of boundary walls and fences and landscaping and replanting of trees on completion in agreement with landowners; and

Once construction is completed, ongoing maintenance of the river channel

3 Construction Activities

3.1 Introduction

This section describes the main activities involved in the construction of the proposed development. As detailed previously, this CEMP must be read in conjunction with the construction details already provided in the EIAR. Refer also to **Chapter 4 Construction Activities** of the EIAR. The CEMP is a working document and will be finalised by the Contractor following appointment and prior to commencing works on site.

3.2 Construction Schedule

Construction works are expected to commence in Quarter 1 of 2019 and the proposed construction period is estimated at circa 18-24 months. The total 18-24 month construction period has been estimated to allow for poor weather over the winter months, mobilisation between sites and seasonal ecological restrictions. The estimated period for individual locations is presented in **Table 3.1** below.

Table 3.1: Estimated Duration of Construction Works. Refer also to Figure 1.1 for location of works areas

Area of Works	General Location	Overview of Works	Estimated construction period (weeks)
1	Sallybrook	Culvert replacement along Bleach Hill stream at Cuil Chluthair, direct defences (embankment & flood walls) along Glashaboy River, Infilling of existing ditch along Sallybrook stream and provision of culvert. Flow control structure at Mill race at Grandons Garage and pumping Station	16 – 20 weeks
2	Hazelwood	Culvert replacements at Cois na Gleann Stream (R615 & R639), flood wall along R639 and curving around onto Hazelwood Avenue, across Hazelwood Avenue bridge. Flood relief channel parallel to river under Hazelwood Avenue, bridge replacement at Hazelwood Shopping Centre and flood wall along Glashaboy River, Road re-grading and pumping stations. Gas main diversion underneath Glashaboy River	32 – 40 weeks
3	Meadowbrook	Flood Walls along Glashaboy River, culvert replacement and extension along Springmount stream (R639) and road re-grading works along Riverstown Bridge and approaches, removal of existing manhole from the bridge arch and pumping stations	16 – 20 weeks
4-1	Butlerstown Stream	Minimal landscaping and re-grading of ground levels, to facilitate overland flow from the Butlerstown stream back into the Glenmore Stream	2-3 weeks
4-2	Copper Valley Vue Brooklodge Grove	Culvert upgrades, road re-grading and new flood defence walls, channel modification flood walls along Glenmore Stream, re-grading of small area of land adjacent to Glenmore stream to facilitate overland flow	12 – 16 weeks
5	The Grove	Flood wall along Glashaboy River (parallel to R369)	4 – 8 weeks

As discussed above, the construction works themselves will last approximately 18 to 24 months and will be subject to the following programme constraints:

- The construction of the drainage scheme will be undertaken using industry standard construction methodologies. The anticipated construction methodology for the major elements of the scheme is described hereunder.
- Traffic management will be set up for the works as required. Temporary road diversions and closures are likely to be required. Alternative access routes will be agreed with Cork County Council and An Garda Síochána. Refer also to the relevant chapters for specific construction details such as construction traffic management (**Chapter 14 Roads and Traffic**).
- There will be a number of trees and vegetation which will require removal to facilitate the works throughout the drainage scheme area. The trees to be

removed are shown in **Figure 1 (Appendix 3.2b)** to **Figure 5 (Appendix 3.2b)**, detailed in **Appendix 3.2** of this EIAR. Where possible, tree roots will not be pulled from the river bank. Silt controls will be put in place to minimise silt generation into the river channel and banks will be stabilised. Further details are presented in **Appendix 4.2**.

- To avoid impacting on bird nesting sites, all vegetation clearance works and site preparatory works will be conducted outside of the bird nesting season (1 March to 31 August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out, and the area proposed for clearance has been approved by suitably qualified and experienced ecologist.
- In-stream works (including preparatory work) on the Glashaboy River and its tributaries will be undertaken in a window from July to September (inclusive) and in consultation with Inland Fisheries Ireland (IFI) to avoid accidental damage or siltation of spawning beds. In-stream works associated with the drainage scheme will be carried out under the supervision of a suitably qualified and experienced ecologist. All in-stream works will be designed and carried out in consultation with Inland Fisheries Ireland (IFI) and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters*
- There are a number of otter holts in the vicinity of Sallybrook, Hazelwood and Meadowbrook on the Glashaboy River. Otter activity has been observed both on the Glashaboy River and on the Glenmore Stream. Consultation is ongoing with the NPWS in relation to a specific otter mitigation strategy in the form of a derogation licence for disturbance, temporary closure of holts, installation of artificial holts and seasonal restrictions of works. A derogation licence for otters from the NPWS is provided in **Appendix 6.3**. A derogation licence for bats from the NPWS is also provided in **Appendix 6.4**. Further details are provided in **Chapter 6 Biodiversity** of the EIAR.
- The co-ordination of people and materials on site will be one of the key activities throughout the construction phase. In order to ensure that construction workers do not create undue disruption, there will be a requirement that the Contractor provide adequate site supervision to co-ordinate, monitor and implement site regulations.
- Normal construction working hours will be observed. These are 08.00 – 19.00 Monday to Friday; 09.00 – 16.00 on Saturday. It may be necessary to work outside these hours, including at weekends and at night, at certain stages. Working outside normal hours may be necessitated through consideration of safety or weather and sub-contractor availability. Heavy or noisy construction activities will be avoided outside normal hours and the amount of work outside normal hours will be strictly controlled. Approval from Cork County Council will be obtained for works outside normal hours.
- It is envisaged that the average number of construction personnel on site will be circa 30 personnel but this will vary depending on the construction

activities required, seasonal constraints and will likely peak during the summer months when up to 50 construction personnel are envisaged.

3.3 Site Preparation Works

Site preparation works will include the 'site establishment' set up by the contractor which will include the following:

- Setting up of access control to the site;
- Erection of site office;
- Site facilities (canteen, toilets, etc.);
- Office for construction management team;
- Secure compound for the storage of all on-site machinery and materials;
- Permanent and temporary fencing;
- Erection of signage.

The proposed scheme will be a linear development along the various watercourses. The proposed access routes and works areas are presented in **Series 5 (Drawing No.'s GR_501 to GR_503)**. In general, the proposed construction works will be limited to these areas however, landscaping and reinstatement works for landowners may take place outside these areas with their agreement. Enabling works will typically consist of the following steps:

- Construction of the temporary site access.
- Once access is achieved the Contractor will install secure hoarding approximately 2.4m high around each of the working areas that will remain in-situ during the construction of the works in each area.
- Vegetation, tree and topsoil removal to take place as necessary.

Refer to Section 3.2 above in relation to vegetation clearance, tree removal and in-stream works in general.

Similar enabling works will be required at each of the areas and are detailed in **Chapter 4** of the EIAR. Works specific to individual working areas are detailed in separately in Chapter 4 where necessary.

Construction compounds will be located within the 'Indicative Extent of Works' areas as shown in Drawings No.'s **GR_501 to GR_503**. Some of the works areas will be used to accommodate site offices and welfare facilities as required.

3.4 Construction Traffic

A detailed construction traffic management plan will be prepared and agreed with Cork County Council by the Main Contractor in advance of any works taking place on site. Refer to **Chapter 14 Roads and Traffic** for further details on same.

As discussed previously, every effort will be made to carry out the works as quickly as possible in order to minimise impacts on the residents in the area. It is envisaged that traffic measures such as a stop-go system, temporary one-way traffic systems or similar will be implemented to allow the construction works and utility diversions to be constructed and at the same time to manage traffic. It is expected that the majority of the intense works on the public road will be programmed to be carried out in the summer months to avoid school traffic etc. It is not anticipated at this stage that full road closures will be required, however, if they are required, they will be for a very short duration only and will take place at night or other suitable times to minimise the impact on traffic in the area.

Traffic movement at the site will be planned to ensure traffic movements to and from site are managed efficiently and in accordance with Health and Safety requirements. In addition, any impacts on the local environment including local residents, road users and pedestrians will be minimised.

The following provisions will be adhered to as a minimum;

- All trucks entering and exiting the site will be covered with tarpaulin;
- Adequate parking will be provided to avoid queuing at the site entrances and prevent disruption to neighbouring businesses;
- Deliveries of materials will be planned and programmed to ensure that the materials are delivered only as they are required on site. Works requiring multiple vehicle deliveries to site, such as concrete pours, will be planned so as to ensure there will no queuing on the public roadways. Deliveries will be limited to outside of peak hours;
- Trucks will not be allowed to park on the public road either outside the site or on any of the approach roads leading to the site;
- All trucks entering the site will be restricted to suitable speed limit and will be directed to the relevant area by the site manager;
- Trucks required to wait on site will switch off engines to avoid unnecessary fuel usage and noise;
- All trucks exiting the site will be required to pass through a wheel wash. All water from the wheel wash will be collected, treated to remove silt or other contaminants, and discharged via an approved discharge licence to a local water course or drainage network. A lance will be provided to clean down the bodies and sides of the truck prior to leaving site; and
- Roads outside the site will be visually inspected on a daily basis and power swept and washed as and when required.

3.5 Construction Compound

A number of potential locations for the construction compounds, in the immediate vicinity of the works, have been considered.

Construction compounds will be located within the ‘Indicative Extent of Works’ areas as shown in **Drawing No.’s GR_501 to GR_503**.and are shown in **Series 5**

(Drawing No.'s GR_501 to GR_503) of Appendix 3.1. The final selection of the compound(s) will be made by the Contractor appointed to construct the works in consultation with the OPW, Cork County Council and the project ecologist. Due to the length of channel involved, the Contractor may choose to move the compound during the construction period, in which case the same selection process shall apply. Site compounds will comply with the mitigation measures identified within this EIAR.

3.6 In-stream works

- Where access to the river channel is required, detailed method statements will be drawn up which deal specifically with the works proposed. Detailed silt control methods will be required for all in-stream works. Most works along the river banks will require effective control of silt and it is expected that a variety of methods may be required i.e. silt curtains, dewatering, silt sumps etc. The method statements will be drawn up in consultation with the supervising ecologist. Consultation will take place with the NPWS and Inland Fisheries Ireland (IFI) prior to the commencement of works.
- All concrete works will be carried out in dry conditions with no in-stream pouring of concrete. It may be necessary therefore to effectively sheet-pile or cofferdam sections of the river and pump out the river water during the construction of the proposed works. If required, fish populations which become isolated, will be salvaged via electrofishing under licence from the Department of Communications, Climate Action and Environment and in consultation with Inland Fisheries Ireland.
- It is expected that most of the equipment used will be standard construction plant for a project of this nature, e.g. mechanical excavators, dump trucks, dewatering pumps, ready mix concrete lorries, pile drivers, rock breakers etc. All machinery will be maintained in good condition to prevent leakage of hydrocarbons. Fuelling and lubrication of equipment will not be carried out within 30m of any watercourse.
- All contractors, sub-contractors and in particular machinery operators will be made aware of the provisions for protecting water quality as outlined in the method statements.
- Where possible excavated material will not be stockpiled within 10m of a watercourse. Where this measure is not implementable, then specific silt control measures will be planned as part of the detailed method statement for site works in each specific area. Precautions will be taken to minimise the run off of soil into watercourses.
- All culverts and walls will be designed to minimise impacts on fish and macroinvertebrate populations. Where possible, gravel substrates and as natural a flow pattern as possible under low water/ low tide conditions will be provided in channels affected by site works. The structure and flow pattern with culverts on minor streams will be designed to allow fish to move through them. The slope of culverts will follow the existing gradient and trash screens are not currently envisaged as part of the Scheme.

- Input from a qualified fisheries/aquatic ecologist with experience in the design of in-stream structures is required for the design of culverts and the post works flow patterns and channel structure. The specialist in conjunction with the supervising ecologist will be required to visit the watercourses prior to the commencement of site works to assess the existing channel structure, fish holding features, substrate composition, flow patterns etc. Where feasible such structures will be incorporated into the channels following completion of work

3.7 Utilities

Temporary planned utility diversions will be required in most of the working areas during the construction phase. The works are in built up areas which are serviced with utilities such as gas, water, electricity, telecoms, foul and surface water drainage etc. In particular, a gas main which currently crosses over the Glashaboy River parallel to Hazelwood Avenue Bridge will need to be buried and installed underneath the Glashaboy River. Refer to Section 4.3.9 above for further details. The most likely impacts on utilities will be during the diversion works. It is possible that a short term disruption to some services may occur when the diversion is being undertaken. However, it is not considered that these disruptions will result in significant negative impacts on customers. All utility diversions will be carried out in consultation with the relevant utility company. The Contractor will be required to submit diversion proposals to the relevant utility company for their approval prior to works being carried out. Refer to **Chapter 15 Material Assets** for further details on utilities.

3.8 Construction of Services

3.8.1 Electrical Connections

Power will be required for the construction compound. It is anticipated that power will be required for temporary lighting and temporary signals during the works. If a connection to the existing network is not available a generator will be used.

3.8.2 Site Lighting

Temporary construction lighting may be required at some locations especially during the winter months where daylight hours are short. Site lighting will generally be provided by tower mounted 1000W metal halide floodlights, which will be angled downwards to minimise spillage of light from the site. These will be powered by mains supplies in general. Lighting will be provided on the exterior of hoarding for walkways for public safety where required. Specific lighting requirements which are close to residential properties will be discussed with the residents in advance.

3.8.3 Construction Compound Site Drainage

The construction site drainage within the construction compounds will be designed in such a manner so as to minimise the risk of contamination of the surrounding soil, surface water and groundwater. Rainwater run-off from the

contractor's compounds will be controlled via a temporary surface water control system comprising measures such as swales (ditches) and settlement ponds (or similar system) which will minimise the risk of pollution to soil, surface water or groundwater. The temporary surface water control system will be subject to a daily visual inspection as well as routine maintenance. The inspection frequency will be increased during periods of exceptional high rainfall. Written procedures will be maintained and a log recorded for the inspections.

The contractor facilities will contain toilets, canteen, construction containers and site office. A grease trap will also be installed at the canteen. The disposal of sanitary effluent during construction will be via tankers to a suitable wastewater treatment facility.

Storm water will be managed carefully during construction. Any areas which will involve the storage of fuel will be paved and bunded and hydrocarbon interceptors installed to ensure no spillages will get into the surface water or groundwater.

Daily plant and machinery checks will be carried out as per contract requirements on all construction plant and machinery. Drip trays will be used both for refuelling and overnight parking and spill kits will be on hand at all times. Further details are provided below in **Section 4.7** of **Chapter 4** of the EIAR.

3.8.4 Cranage

Some of the construction works will require the use of standard mobile cranes on site in order to install the pre-cast bridge and culverts.

The cranes will generally be required for the moving of building materials on site such as concrete pipes, formwork for concrete, reinforcement, precast concrete, plant and general building materials. Heavy machinery movements will be restricted to outside of peak hours.

3.8.5 Hoarding

Where possible, a site boundary in the form of hoarding or fencing or similar where appropriate (approx. 2.4m), will be established around working areas before any significant construction activity commences.

Construction site hoarding is used to provide a secure site boundary to what can be a dangerous environment for people who have not received the proper training and are unfamiliar with construction operations.

Hoarding works will be of the same nature as that carried out for similar operations at most construction sites.

Site hoarding also performs an important function in relation to minimising some of the potential environmental impacts associated with construction, namely:

- Noise;
- Visual impact; and
- Dust minimisation.

Excavation for mounting posts for hoarding will be carried out by a mini-digger. The size and nature of the posts and hoarding will be dependent on the requirements for any acoustic mitigation as well as Contractor preference.

3.9 Health and Safety

As required by the Safety, Health and Welfare at Work (Construction) Regulations 2013, a Health and Safety Plan will be prepared which will address health and safety issues from the design stages through to the completion of the construction and maintenance phases. This plan will be reviewed as the scheme progresses. The contents of the Health and Safety Plan will comply with the requirements of the Regulations.

The Regulations require the developer of a project to appoint a “Project Supervisor Design Process” (PSDP) and “Project Supervisor Construction Stage” (PSCS). Cork County Council has appointed Arup as PSDP in accordance with the current legislation.

The PSDP will assemble the Safety File as the project progresses. The Safety File will be incorporated into the overall technical record system at the end of the project.

Safety on site will be of paramount importance. During the selection of the contractors and subcontractors, their safety records will be investigated. Only contractors with high safety standards will be selected.

Prior to working on site, each individual will receive a full safety induction and will be provided with all of the safety equipment relevant to the tasks the individual will be required to perform during employment on site.

Safety briefings will be held regularly and prior to any onerous or special task. ‘Toolbox talks’ will be held to ensure all workers are fully aware of the tasks to be undertaken and the parameters required to ensure the task will be successfully and safely completed.

All visitors will be required to wear appropriate personal protective equipment prior to going on to the site and will undergo a safety briefing by a member of the site safety team.

Regular site safety audits will be carried out throughout the construction and the complied with at all times.

At any time that a potentially unsafe practice is observed, the site safety manager will have the right as well as the responsibility to halt the work in question, until a safe system of working is again put in place.

Appropriate site personnel will be trained as first aiders and fire marshals. In addition, appropriate staff will be trained in environmental issues and spill response procedures. Tanks and drums of potentially polluting materials will be stored in secure containers or compounds which will be locked when not in use.

Secure valves will be provided on oil and fuel storage facilities. Equipment and vehicles will be locked, have keys removed and be stored in secure compounds.

The Main Contractor will be required to maintain an emergency response plan which will cover all risks i.e. fire, flood, collapse etc.

In preparing this plan the Contractor will be required to liaise with the emergency response services.

3.10 Materials – Source and Transportation

In so far as is feasible, all construction materials will be sourced from local suppliers if these are available within the Cork area. The selection and specification of construction materials will be informed by local availability of these materials. Within the necessary constraints of performance, durability and cost, construction materials will be sourced from local suppliers and manufacturers, where possible. The coordination and logistics of construction traffic will be captured within the construction traffic management plan which will be agreed with CCC and An Garda Síochána

4 Construction Environmental Commitments

The environmental commitments are the proposed construction control measures that are provided in **Chapter 17** (Summary of Mitigation Measures) of the EIAR and in Section 7.3 (Avoidance and Mitigation Measures) of the NIS. These mitigation measures will minimise potential environmental impacts during the construction period. Refer to the above sections of the EIAR and NIS for full details of the Environmental Commitments

5 Incident Response Plan

5.1 Introduction

The focus of including all of the stringent measures in this CEMP is on prevention of the incident arising in the first place. However, an Incident Response Plan has been prepared to ensure that in the unlikely event of an incident, response efforts are prompt, efficient, and suitable for particular circumstances. This plan is a working document and will be finalised by the Contractor following appointment and prior to commencing works on site. All of the content provided in this Plan will be delivered in full by the Contractor and its finalisation by the Contractor will not affect the robustness and adequacy of the information presented here and relied upon in the EIAR.

The Incident (Emergency) Response Plan (IRP) describes the procedures, lines of authority and processes that will be followed to ensure that incident response efforts are prompt, efficient, and suitable for particular circumstances. The objective of this IRP will be to:

- Ensure the health and safety of workers and visitors along the site.
- Minimise any impacts to the environment and ensure protection of the water quality and the aquatic species dependent on it.
- Minimise any impacts on properties, services etc.
- Establish procedures that enable personnel to respond to incidents with an integrated multi-departmental effort and in a manner that minimises the possibility of loss and reduces the potential for affecting health, property, and the environment.

The information provided in this section is based on best practice including the following documentation:

CIRIA (C648) *Control of water pollution from linear construction projects, technical guidance* (2006).

CIRIA (C649) *Control of water pollution from linear construction projects, site guide* (2006)

CIRIA (C532) *Control of water pollution from construction sites, guidance for consultants and contractors* (2001).

CIRIA (C741) *Environmental good practice on site guide (fourth edition)* (2015).

5.2 Implementation

The likelihood of an incident or emergency can be minimised by effective planning through development of an IRP. The Plan will be reviewed and updated regularly so that it continues to apply to construction activities. The Plan will identify the on-site risks and appropriate responses.

It will be the responsibility of the Contractor to maintain and change the IRP as required. The Incident Response Plan will be reviewed on an on-going basis and immediately amended, as necessary, when applicable regulations are revised or when amendments are required by a regulatory authority.

The IRP in terms of health and safety will also require updating and submissions from the various contractors and suppliers as the proposed development progresses. The IRP details the initial contact that should be made in case of an emergency incident as well as those responsible for following up once an emergency event is declared.

The emergency services (particularly fire service) will be consulted to establish safe and appropriate access points to site compounds and other areas where there may be a risk of spillage etc. (e.g. outfalls, fuel storage). In an emergency, knowing the relevant people to contact for help can save time and minimise the impacts.

To cover the full length of a route, more than one contact may be needed, so the IRP will indicate which contacts apply to which sections of the site.

Numbers will be obtained for the following:

- radio/mobile contacts for site management and trained staff
- out-of-hours contacts
- environmental regulators (hotline or local contact)
- Irish Water (for spills to foul sewer)
- Cork County and City Councils
- Inland Fisheries Ireland and National Parks and Wildlife Service
- Environmental Protection Agency
- North Lee HSE South
- spill response and clean-up contractors

5.3 Resources

Relevant staff, including cover staff, shall be trained in the implementation of the IRP and the use of any spill kit/ control equipment as necessary.

The Contractor shall provide a list of all such staff to the Employer's Site Representative detailing the name, contact number, and training received, and the date of that training.

The Contractor shall provide a full list, including the exact locations, of all pollution control plant and equipment to the Employer's Site Representative. All such plant and equipment shall be maintained in place and in working order for the duration of the works.

5.4 Environmental Emergency Response Procedures

The best way to manage pollution incidents is to prevent them. Emergency procedures will be developed – either project specific, site specific or activity specific and all on site will be required to know these procedures.

An effective pollution IRP relies on the following elements:

- Identification of all possible emergency scenarios.
- Effective planning, e.g. availability of booms, spills kits at appropriate locations.
- Identification of receptors/pathways (e.g. surface water drains/river).
- Identification and dissemination of contact numbers.
- Definition of site-based staff responsibilities.
- Appropriate site-based staff training.
- Exercise of incident scenarios – spill drills.
- Availability of suitable spill kits at appropriate locations on the site.
- Implement lessons learnt from previous incidents.
- Ensure that all appropriate site staff are aware of the site emergency procedure(s) (e.g. spillage, leakage, fire, explosion and flooding), that drain covers and spill kits are available, and they know how to use them.

In terms of pollution spill response procedures, these will vary depending on the sensitive receptor and nature of construction activities but the following information will be included as a minimum and displayed at appropriate locations on the whole site, at river crossings, near outfalls etc.:

- Instruction to stop work and to switch off sources of ignition.
- Contain the spill; location of spill clean-up material.
- Name and contact details of responsible staff (these staff should assess the scale of the incident to determine whether the environmental regulator needs to be called).
- Measures particular to that location or activity (for example, close pond outlet valve).

Emergency equipment will be obtained from a reputable supplier and site staff will be trained in its correct use. Material Safety Data Sheets and best practice assessments will be used for advice on appropriate spill measures. The type of equipment required will depend on the activity taking place. The CIRIA document C648 Control of water pollution from linear construction projects, technical guidance (2006) provides details on the types and applications of emergency equipment. Refer to Table 15.2 of same document.

Every effort will be made to prevent an environmental incident during the construction and operational phase of the project.

The focus of including all of the stringent measures in this CEMP is on prevention of the incident arising in the first place. Oil/Fuel spillages are one of the main environmental risks that will exist on the proposed site which will require an emergency response procedure. The importance of a swift and effective response in the event of such an incident occurring cannot be over emphasised. An example of the steps to follow in the event of a spillage to ensure that the environmental risk is reduced to as low as reasonably practical. This procedure can be tailored to be site/location/activity specific as required:

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill
- If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses or sensitive habitats
- Clean up as much as possible using the spill control materials
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited
- Notify the Site Environmental Manager (SEM) immediately giving information on the location, type and extent of the spill so that they can take appropriate action
- The SEM will inspect the site and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring
- The SEM will notify the appropriate regulatory body such as Cork County Council, NPWS, Department of Communications, Climate Action and Environment (DCCE) and Department of Housing, Planning, and Local Government (DHPLG), if deemed necessary

Environmental incidents are not limited to just fuel spillages. Therefore, any environmental incident will be investigated in accordance with the following steps.

- The SEM must be immediately notified.
- If necessary, the SEM will inform the appropriate regulatory authority. The appropriate regulatory authority will depend on the nature of the incident.
- The details of the incident will be recorded on an Environmental Incident Form which will provide information such as the cause, extent, actions and remedial measures used following the incident. The form will also include any recommendations made to avoid reoccurrence of the incident.

- In the very unlikely event of an incident occurring which may impact on a sensitive receptor, the relevant persons/authorities will immediately be informed (such as the Project Archaeologist, NPWS, IFI, EPA, North Lee HSE South etc.)
- A record of all environmental incidents will be kept on file by the Site Environmental Manager and the Contractor. These records will be made available to the relevant authorities such as Cork County Council, Cork City Council, DCCE and DHPCLG if required.
- The SEM will be responsible for any corrective actions required as a result of the incident e.g. an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the Contractor as appropriate.
- By carrying out the above steps, a proper system will be in place to investigate, record and report any potential accidents or incidents.

5.5 Fire Control Measures

Every effort will be made to prevent the outbreak of a fire during the construction and operational phase of the proposed development. Fire extinguishers and first aid supplies will be available in the work area.

In the event of such an incident, the health and safety of all personnel will be a priority. All relevant legislation and guidance on health and safety of people and in particular fire safety will be complied with.

5.6 Training and Testing

Staff responsible for action in an emergency need to know their responsibilities. Staff will be trained to use the necessary equipment such as spill kits or outlet valves.

Emergency arrangements will need to be reviewed and tested periodically (and always after an incident) to ensure that measures are effective and that the workforce is aware of what to do in the event of an incident. Emergency drills will be recorded and improvements noted and actioned accordingly.

5.7 Corrective Action

When an incident happens, it is important to learn from it and ensure that such an incident does not occur again. This may involve changing the method of work for a particular activity, providing containment or treatment materials, or simply training staff so they are aware of the correct method of work. Similarly, if an audit of planned arrangements indicates that measures are not in place, or those in place need to be improved, action will be taken immediately.

A record of corrective actions and lessons learned will be kept and communicated to all relevant persons, teams, sub-contractors etc. across the proposed development.

5.8 Summary Checklist

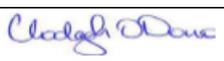
- The focus of including all of the stringent measures in this CEMP is on prevention of the incident arising in the first place.
- The Contractor shall finalise the IRP. This plan is a working document and will be finalised by the Contractor following appointment and prior to commencing works on site. All of the content provided in this Plan will be delivered in full by the Contractor and its finalisation by the Contractor will not affect the robustness and adequacy of the information presented here and relied upon in the EIAR.
- Assess the pollution risks and develop emergency and spill response procedures for site specific activities.
- Obtain details of key people that may need to contact for help.
- Provide equipment for dealing with pollution incidents.
- Train staff to follow procedures and use equipment correctly.
- Audit the emergency plan.
- Take action following an incident to ensure it does not occur again.

Appendix B (NIS)

Outline Invasive Species Management Plan (extracted from EIAR)

Document Verification

ARUP

Job title		Glashaboy River (Glanmire and Sallybrook) Drainage Scheme		Job number		234334-00		
Document title		Outline Invasive Species Management Strategy				File reference		
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Appendices

Appendix A

Results of 2015 Invasive Species Survey - Drawings GR_201 to GR_219

Appendix B

Results of 2017 Japanese Knotweed Survey

1 Introduction

Invasive plant species have been identified and documented within proposed works areas that are included in the Glashaboy River (Glanmire and Sallybrook) Drainage Scheme.

The purpose of this outline non-native invasive species management plan is to present the strategy that will be adopted during the construction and operation of the proposed scheme in order to manage and prevent the spread of the invasive plant species.

This outline plan is intended to be a working document and will be updated during both the construction and operational phases. During construction, it will be updated by the contractor to form the detailed invasive species management plan which will form part of the detailed Construction Environmental Management Plan (CEMP). Following construction, the plan will be updated for the operational phase, taking into account the results of the detailed construction invasive species management plan and operational maintenance requirements etc.

Construction (and potentially operational maintenance works) could potentially disturb stands of invasive plants and/or soils contaminated with invasive plant material. In addition to lands within the proposed works areas, there is an identified risk of invasive plant species being spread onto neighbouring lands and onto public roads and other locations.

Invasive plant species which have been identified in the proposed works areas include Himalayan Balsam (*Impatiens glandulifera*), White Heliotrope (*Petasites fragrans*) and Japanese knotweed species. While other invasive plant species have also been identified in the area, Japanese knotweed is of primary concern for the structural integrity of these proposed flood works and for the designated sites downstream, therefore the focus of this report is on the prevention of the spread of knotweed. However, the same principles will apply to other invasive species.

This report outlines the strategy that will be adopted during the construction and operation of the flood relief scheme in order to prevent the spread of invasive plant species.

The main objective of the invasive species management strategy for the scheme will be to:

- Prevent the spread of invasive plant species during the construction phase;
- Manage the growth of invasive plant species adjacent to flood defences so as to protect the integrity of the structures from the impacts of these species;
- Prevent the spread of invasive plant species during channel maintenance works in the future.

2 Methodology

This report applies the most relevant and current guidance in relation to the treatment and management of non-native invasive plant species in construction projects. The following literature was referred to in preparation of this report.

- NRA Guidelines on The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (2008)
- Managing Japanese knotweed on development sites - The Knotweed Code of Practice produced by the Environmental Agency (2013)¹
- Managing Invasive Non-native Plants in or near Freshwater, Environment Agency (2010)
- Best Practice Management Guidelines Japanese knotweed *Fallopia japonica*, Invasive Species Ireland (2015).

3 Legislation

The control of invasive species in Ireland comes under the Wildlife (Amendment) Act 2000 where it states that

‘Any person who— [...] plants or otherwise causes to grow in a wild state in any place in the State any species of flora, or the flowers, roots, seeds or spores of flora, [‘refers only to exotic species thereof’][...] otherwise than under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence.’

Under the European legislation, the Birds and Natural Habitats Regulations 2011 (SI 477 of 2011) , Section 49(2) prohibit the introduction and dispersal of species listed in the Third Schedule (including Japanese knotweed) whereby “*any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow [...] shall be guilty of an offence.*”

The implementation of the management measures set out in this plan have been informed by the above legislation.

4 Non-Native Invasive Species in the Study Area

Non-native invasive species have been identified in a number of areas where the proposed construction works and also throughout the Glashaboy catchment and throughout the Glanmire/Sallybrook area. Invasive plant species which have been

¹ This document was officially withdrawn by the UK Environment Agency as a guidance document in July 2016 but contains relevant, practical advice and is included here for that reason.

identified include Himalayan Balsam (*Impatiens glandulifera*), Winter Heliotrope (*Petasites fragrans*), Buddleia (*Buddleja davidii*) and Japanese knotweed species. Although these non-native invasive species are present throughout the study area, for the purposes of this scheme, a non-native invasive species management plan will only be put in place within the footprint of the construction works.

A number of surveys have been carried out in the study area in the last number of years. In 2015, a survey was carried out by Dixon Brosnan. Chemical treatment of knotweed infested areas was carried out by Cork County Council following this survey. In 2017, a survey was carried out by Japanese Knotweed Ireland and chemical treatment in the infested areas was also carried out in the same year.

The drawings appended to the end of this report show the locations of invasive species, including Japanese Knotweed. Refer to Drawings GR_201 to GR_219 in **Appendix A** for details of the locations of invasive species identified in September 2016. Refer also to **Appendix B** for details of the infestations identified and treated in 2017. It should be noted that the invasive species drawings were compiled in September 2016 and the design of the drainage scheme had not been finalised at that stage. Therefore, the design details shown on the invasive species drawings should not be relied upon. Refer to the Confirmation Drawings for details of the finalised design.

5 Management Options

5.1 General measures to avoid spreading invasive species during construction or soil movement

Many of the species noted above are highly invasive, and can easily spread to new areas. Most are particularly effective at colonising disturbed ground (e.g. construction sites). Some species spread by the re-growth of cut fragments or root material such as Japanese Knotweed, so if they are broken up during site clearance or other earthworks they can readily re-grow in new areas to which soil is moved.

The unintentional spread of invasive species during construction works is a significant issue, and if not managed in the correct manner, species like Japanese Knotweed could be spread to uninfested areas, which would increase the future cost and effort required to control the species, and could pose further public health and safety risks (Knotweed species can cause damage to buildings and infrastructure).

The most common ways that these species can be spread are:

- Site and vegetation clearance, mowing, hedge-cutting or other landscaping activities
- Spread of seeds or plant fragments during the movement or transport of soil
- Spread of seeds or plant fragments through the local surface water and drainage network

- Contamination of vehicles or equipment with seeds or plant fragments which are then transported to other areas
- Importation of soil from off-site sources contaminated with invasive species plant material

Depending on the timescale for the construction of the proposed scheme it may be possible to eradicate some species prior to the onset of construction on the site via an advance treatment contract (refer to Section 5.2 below); this would be preferable. However if control programmes have not been achieved before construction begins, then site hygiene measures will need to be put in place to ensure that the further spread of invasive species is avoided. Refer to the Section 5.4 below on site hygiene below for further details on same.

5.2 Advance Treatment

As mentioned previously, advance chemical treatment works on knotweed species have commenced. At least two rounds of treatment have been carried out so far and it is expected that further treatment will be carried out if deemed necessary and feasible. The specific treatment method is decided on a site by site basis. Details on the advance treatment (such as treatment locations, treatment methodologies etc) will be made available to the main contractor before the construction works commence.

5.3 Pre-construction Survey

As species may have spread, or their distribution may have changed, between the surveys and subsequent advance treatment carried out in 2017 and the commencement of the main construction works, the implementation of this Outline Invasive Species Management Plan will require a pre-construction re-survey by a suitably qualified person within the proposed scheme boundary and any additional areas where construction works are required (e.g. temporary construction compounds, haul routes etc.). In accordance with the TII guidance this survey will produce accurate 1:5,000 scale mapping for the precise location of invasive species. The pre-construction surveys will be undertaken by suitable experts with competence in identifying the species concerned having regard to any seasonal constraint.

5.4 Site Hygiene

Maintaining site hygiene at all times in an area where invasive non-native species are present is essential to prevent further spread. It is also necessary on sites where invasive non-native species are not present but where there is risk of contaminated material being brought to site, for example, site machinery being used on multiple site, construction staff travelling between infested and not infested sites. Preventative measures must be taken. Construction equipment, vehicles and footwear may provide a vector for the spread of invasive non-native species.

The following site hygiene measures shall be taken for each site where applicable:

- In relation to knotweed plant species - understand the possible extent of the rhizome (root) system underground – up to 7m horizontally and 3 meters vertically.
- Fence off the infested areas prior to and during construction works where possible in order to avoid spreading seeds or plant fragments around or off the construction site. In relation to knotweed plant species, allow for a 10m buffer around the area.
- Clearly identify and mark out infested areas. Erect signs to inform Contractors of the risk.
- Avoid if possible using machinery with tracks in infested areas.
- Clearly identify and mark out areas where contaminated soil is to be stockpiled on site and cannot be within 50m of any watercourse or within a flood zone.
- Create designated entry and exit points for operators on foot and for small mobile equipment. A delineated access track to be maintained free of non-native invasive species to be established through the site to avoid the spread of Japanese knotweed by permitted vehicles accessing the site.
- Installation of a dedicated footwear and vehicular wheel wash down facility into a contained area within each works site.
- Vehicles leaving the site to be inspected for any plant material and washed down into a contained area.
- Vehicles used in the transport of contaminated material will need to be visually checked and washed down into a contained area before being used for any other work, either on the same site or at a different site.
- Material gathered in dedicated wash down contained areas will need to be appropriately treated along with other contaminated soil on site. Refer to sections below in relation to treatment methods.
- If soil is imported to the site for landscaping, infilling or embankments, the contractor shall gain documentation from suppliers that it is free from invasive species.
- Ensure all site users are aware of measures to be taken and alert them to the presence of the Invasive Species Management Plan.
- Erection of adequate site hygiene signage in relation to the management of non-native invasive material.

5.5 Treatment Methods

In addition to the advance treatment works (if implemented) and pre-construction survey, when the works areas becomes available to the contractor for fencing and commencement of site clearance, areas identified as requiring specific treatment will be demarcated and the designated control measures implemented at the earliest possible stage to reduce the risk of spread along the proposed scheme or beyond the land take.

There are a number of management options that may be implemented to control and prevent the spread of invasive species. These are presented in the sections below. It is also noted that it may not be possible to completely eradicate the invasive species before or during the construction phase. For example, where structures are proposed at sites that contain Japanese knotweed, root barrier membranes may require to be installed to protect the structures from the plant. The design of these membranes will form part of the detailed design stage.

It should be noted that those involved in the application of herbicides/pesticides must be competent to do so and, consequently, must have sufficient training, experience and knowledge in the area of herbicides/pesticides application. It is important that all staff involved in the application of herbicides/pesticides have received appropriate training, which may include achieving competency certification in the safe use of herbicides/pesticides through a National Proficiency Tests Council registered assessment centre or achieving an appropriate FETAC award in this area.

5.5.1 Chemical Treatment

The control of some species will require the use of herbicides (if not buried), which can pose a risk to human health, to non-target plants or to wildlife. In order to ensure the safety of herbicide applicators and of other public users of the site, a qualified and experienced Contractor will be employed to carry out all work.

It is advised that contractor refer to the following documents, which provides detailed recommendations for the control of invasive species and noxious weeds:

- Chapter 7 and Appendix 3 of the TII Publication The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (NRA, 2008)
- Invasive Species Ireland Best Practice Management Guidelines for Japanese Knotweed (2015)
- The Knotweed Code of Practice: Managing Japanese knotweed on development sites (UK Environment Agency, 2013)

These documents include measures to aid the identification of relevant species, with details for the timing, chemicals and methodology for chemical control, and for measures to avoid environmental damage during the use of herbicides.

Chemical treatment involves the application of a herbicide to invasive species plant such as Japanese Knotweed stands without any excavation or removal of the plant material. The preferred types of herbicides to be used in the treatment of Knotweed are Glyphosate and 2,4-D Amine. Generally, if herbicide is applied as the treatment option, it will need to be reapplied for up to five years after the first application to ensure the plant control measures have been effective, or monitored for a minimum of two years during which no regrowth is recorded.

Glyphosate is non-persistent and can be used near water but it is not selective (i.e. it is a broad spectrum chemical - will impact all plant species) whereas 2-4-Amine, can be persistent for up to one month, can also be used near water but is more selective on certain plants. The selection of chemical will depend on the site conditions, proximity to water, surrounding habitats etc.

The most effective time to apply Glyphosate is from July to September (or before cold weather causes leaves to discolour and fall). The majority of herbicides are not effective during the winter dormant stage because they require living foliage to take up the active ingredient. It is essential that a competent and qualified person carries out the herbicide treatment. Reapplication rates will depend on site specific considerations including the extent of the infestation, its location, and the time of year treatment commences. Details of the proposed chemical treatment plan will be required in the site-specific invasive species management plan.

Chemical control of Himalayan balsam is readily achieved with the use of glyphosate or 2,4-D amine, which should be applied during active growth in late spring but late enough to ensure that germinating seedlings have grown sufficiently to be covered by the spray. Repeat treatments or other means of controlling seedling germination will be required for a period of five or more years. Monitoring of the site will be required in mid-spring and mid-summer to assess the occurrence of seedlings and determine appropriate control.

In relation to winter heliotrope, an application of a glyphosate-based herbicide after flowering in February to March is recommended by Cornwall Nature Reserves (2008), though the Royal Horticultural Society (2008) recommends spraying in midsummer or later but before the foliage begins to die back.

In relation to buddleia, recommended practice for the application of herbicides requires cutting back of plants to a basal stump during active growth (late spring to early summer) which is then treated (brushed on) immediately with a systemic weed killer mix (Starr et al, 2003). Foliar application of triclopyr or glyphosate may be adequate for limited infestations of younger plants, but should be followed up at 6 monthly intervals.

Foliar treatment (spraying) is usually applied with a sprayer such as a knapsack sprayer or a larger spray system. It is important to use a treatment dye to identify clearly all areas treated. It is an efficient way to treat large monocultures of invasive plants, or to spot-treat individual plants that are difficult to remove mechanically such as Japanese knotweed.

In the case of knotweed, depending on weather and temperatures in the days following the initial treatment, and to ensure optimal uptake of herbicide into the rhizome system, a second similar treatment will be required usually within ten days, before the internal vascular system is no longer capable of translocating the herbicide to the root system. While the upper surface of the leaves will be easier to treat, it is also important to treat the leaf under surface as knotweed possesses many stomata openings on the leaf under surface. Dead stems should be cut, removed and burned on/off site in accordance with the Waste Management Acts 1996 as amended and the Waste Management (Prohibition of Waste disposal by burning) Regulations 2009 (SI 286).

The stem injection method is sometimes used for Japanese knotweed control. This treatment requires a higher concentration of the active ingredient than is used in foliar applications. It involves the use of a specialist herbicide injection tool whereby the injection tool injects the herbicide directly into each of the canes approximately 20-30cms from the base of each cane (between the 1st and 2nd nodule).

Subsequently approximately 10 mls of herbicide mix is injected into each cane at a ratio of 5:1 through the use of a specialist stem injection tool. The application of glyphosate based products, are most effective when applied in the early Autumn (mid to late Sept). Regrowth will occur in subsequent years, albeit much less vigorously, which will require follow up treatment at the appropriate time of year. Spot treatment will be required each year until no regrowth is observed.

In order to ensure that the use of herbicides does not contravene legislation, the contractor must comply with Circular Letter NPWS 2/08 dealing with the application on to non-target areas from the National Parks and Wildlife Service.

5.5.2 Excavation and Chemical Treatment

This option employs both physical and chemical methods of treatment. This method is employed in situations where treatment of invasive species in particular knotweed is required to be completed in a shorter timeframe. The Environment Agency suggest that by digging up the rhizomes and recultivating it stimulates plant growth and will result in more successful herbicide application and management.

In summary this management method requires cutting and killing of the surface plant. The cut material must be left on top of plastic sheeting until dried out and subsequently monitored for any sign of regrowth (this is not recommended for a river bank habitat where there is the possibility of flooding occurring). They should not be placed in a green waste recycling bin. Once dried out, the material should be burned on site in accordance with the Waste Management Acts 1996 as amended and the Waste Management (Prohibition of Waste disposal by burning) Regulations 2009 (SI 286). The surface of the affected area should be raked with tines to remove crowns and surface material, and in order to break up the rhizomes, bringing them to the surface, which will stimulate leaf production. This will make the plant more vulnerable to herbicide treatment. The more rhizomes that are brought to the surface, the more growth will occur and allowing for a more successful treatment. An excavator can be used to scrape the surface crowns and rhizomes into a pile and then cultivate the ground to stimulate rhizomes to produce higher density of stems for treatment. Reapplication of herbicide may be required for up to five years after initially application, subject to the site specific management plan.

5.5.3 Excavation and Burial

Excavated material containing knotweed can also be buried on site. This will require burying the material at a depth of at least five metres. The contaminated material must be covered with a root barrier membrane before being backfilled with topsoil or other suitable fill material. The membrane must stay intact for at least 50 years. A manufacturer's guarantee is required. Accurately map and record the location of the burial site to prevent any future accidental disturbance. Inform future owners of its position. If soil containing Japanese knotweed is stockpiled, the material must be stored in a manner that will not harm health or the environment. The stockpile should be on an area of the site that will remain undisturbed. The area should be clearly fenced and signed, and should be regularly treated with herbicide to prevent any regrowth or reinfestation.

As a precaution, the stockpiled material should be laid on a root barrier membrane and covered to avoid contaminating the site further.

5.5.4 Excavation and Root Barrier Cell Method

Excavated material containing knotweed can also be buried on site within a root barrier membrane cell. Similar procedure to above. This will require burying the material at a depth of at least two metres. The contaminated material must be within a contained cell consisting of a root barrier membrane before being backfilled with topsoil or other suitable fill material. The membrane must stay intact for at least 50 years. A manufacturer's guarantee is required. Stockpiling method as above.

5.5.5 Excavation and Bund Method

Where there is not sufficient depth on a site for deep burial the EA Guidelines set out another option whereby such excavated material is placed in a structured bund. The bund will comprise a raised area above ground level or a shallow excavation, no more than 0.5m deep, and lined with a root barrier membrane. The membrane must stay intact for at least 50 years and a manufacturer's guarantee is required. This method of treatment can also be used where knotweed material needs to be moved from a location and there is another ideal area of the site available to contain it.

The aim of this method is to concentrate the rhizome material into the upper surface of the bund, where it will grow and be controlled by herbicide. If the rhizome is buried deep, it will become dormant when inside the bund and regrow when the apparently clean soil is used for landscaping on the site. The bund location needs to be clearly signed and protected from potential accidental damage.

Reapplication of herbicide may be required for up to five years after the initial application, subject to the site-specific management plan.

5.5.6 Excavation and Removal from Site

Where the above treatment options are not possible (site is too small to contain excavated material, too shallow for burial, or where there is lack of space or where the infestation simply cannot be avoided by the construction works) removal of excavated material may be the only option. Where there are small amounts of Knotweed material to be removed it is possible to double bag the material and send to a fully licenced waste facility for disposal (i.e. landfill). Where the amount of material is larger in volume it will be necessary to haul from site to a suitably licenced waste facility. It should also be noted that in the process of excavating the knotweed if it has been treated with a persistent herbicide, the excavated material will need to be classified as hazardous waste and there will need to be disposed of to a hazardous waste facility

If any invasive species plant material is collected (e.g. by hand-pulling or mowing), it is important that its disposal will not lead to a risk of further spread. The movement of invasive plant material requires a licence from the National Parks and

Wildlife Service (NPWS) under Section 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended).

Invasive species (particularly roots, flower heads or seeds) will be disposed of at licensed waste facilities or composting sites, appropriately buried, or incinerated having regard to relevant legislation. For example Section 32 of the Waste Management Act, 1996 to 2008; Section 4 of the Air Pollution Act, 1987; relevant local authority byelaws and any other relevant legislation). All disposals will be carried out in accordance with the relevant Waste Management legislation (as per guidance from NRA, 2008). It should be noted that some invasive species plant material or soil containing residual herbicides may be classified as either ‘hazardous waste’ or ‘non-hazardous waste’ under the terms of the Waste Management Acts, and both categories may require special disposal procedures or permissions. Advice will be sought from a suitably qualified waste expert regarding the classification of waste and the suitability of different disposal measures. As noted above, additional specific measures for the management of Japanese Knotweed cuttings or contaminated soil can be found in the UK Environment Agency document *The Knotweed Code of Practice: Managing Japanese knotweed on development sites* (UK Environment Agency, 2013).

5.5.7 Hand pulling/mowing or cutting

Control measures for Himalayan balsam should aim to prevent flowering and are therefore essentially undertaken before the commencement of flowering in June. Where flower production can be prevented, eradication may still take over 5 years.

Mechanical control is only likely to be effective where good access is available and the ground smooth enough to permit either mowing or cutting back. Where accessible plants can be cut, mown or trimmed back to ground level before flowering in June. Do not cut earlier as this promotes greater seed production in any re-growth. Unless the plant is cut to below the lowest node, it will re-sprout. Regular mowing will control the plant provided the frequency of mowing is regular enough to prevent sprouting and flower formation. Repeat annually until complete control is attained. As plants are very shallow rooted, they can also be easily pulled by hand. Hand pulling will require a follow up pull in August due to new seeds sprouting. Vegetative material can be disposed of by composting unless seeds are present, in which case the material should be disposed of to a licensed landfill or burnt.

Due to the extensive rhizome network, physical removal of winter heliotrope is really only practical on a limited scale. Where mechanical means can be employed, it should be possible to deal with larger infestations but due to the potential for regeneration from fragments of roots, it may be best to tackle its control using a combination of excavation with follow-up treatment by herbicides. As with other plants with the potential to spread from small root fragments, disposal of material should be undertaken with due caution to prevent accidental spread of the plant.

Other means of disposal include burial of material at a depth of at least 2m, incineration or disposal to licensed landfill. There is no evidence that the material would withstand composting though this approach would probably only be suitable for limited infestations.

In relation to buddleia, management methods such as digging it out are applicable only to minor infestations at the initial stage of invasion. Hand-picking of young plants is feasible but should be undertaken with care to avoid soil disturbance which can give rise to a flush of new seedling. Grubbing of mature stands as a sole attempt at control is not recommended for the same reason. After uprooting, it is essential to plant the ground in order to prevent a flush of new seedling growth. When it is cut, Buddleia grows back from the stump very vigorously. Mowing of young plants does not provide control as they re-sprout with vigour. Where removal of mature plants is not feasible in the short term, the flower heads should be cut off in June before seed set.

Mowing and cutting is not effective, this potentially increases the spread as fragments of viable stem are displaced to unaffected areas.

6 Management during the Operational Phase

6.1.1 Protecting Flood Defence Structures

As part of the operation phase there will need to be on-going treatment of non-native invasive species. A management plan for the operational phase will need to be formulated in consultation with the relevant bodies i.e. NPWS, IFI, OPW and Cork County Council.

Site hygiene protocols will need to be implemented.

6.1.2 Channel Maintenance Works

During channel maintenance works, a management plan will need to be put in place to prevent the spread of non-native invasive species downstream during those works.

Site hygiene protocols will need to be implemented.

As discussed above, the management plan for the operational phase will need to be formulated in consultation with the NPWS, IFI, OPW and Cork County Council.

7 Conclusion

The presence of non-native invasive species along the works areas of the proposed scheme requires the need for an Invasive Species Management Plan to be finalised prior to construction commencing. This Plan shall be written by a qualified ecologist.

Given the nature of the species and the rate of growth, each proposed works site will need to be re-surveyed prior to works. Site hygiene will be particularly

important on sites where invasive species are present but also ‘clean’ sites. Incoming vehicles, and equipment (including footwear worn by all site visitors) will need to be cleaned and inspected before coming on site and upon leaving, to prevent the further spread of the plant.

Where possible material will remain on site and be reused. Any material that must be removed off site to landfill or other suitable facility will require a licence from the National Parks and Wildlife Service.

The Plan must be clearly communicated to all site staff and must be adhered to if it is to be implemented successfully.

8 References

Managing Japanese knotweed on development sites - The Knotweed Code of Practice produced by the Environmental Agency (2013)

Invasive Species Ireland (2015) Best Practice Management Guidelines Japanese knotweed *Fallopia japonica*

Managing Japanese knotweed on development sites - The Knotweed Code of Practice produced by the Environmental Agency (2013)

Managing Invasive Non-native Plants in or near Freshwater, Environment Agency (2010)

NRA Guidelines on The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (2008)

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Appendix A

Results of 2015 Invasive Species
Survey - Drawings GR_201 to
GR_219

