

3 Description of the Proposed Scheme

3.1 Introduction

As discussed in **Chapter 1 Introduction**, Cork County Council intends to undertake engineering works along the Ballybrack Stream, Grange Stream and Tramore River with the objective of minimising the risk of flooding in the areas of Douglas and Togher in County Cork. Numerous significant flood events have occurred in the Douglas and Togher areas, necessitating the proposal to introduce flood relief works.

The proposed Douglas Flood Relief Scheme (including Togher Culvert) will include the construction of direct flood defences and conveyance improvements along the Ballybrack Stream, Grange Stream and Tramore River. The proposed direct defences include flood walls and embankments with the conveyance improvements consisting of channel widening, channel deepening and the introduction of or replacement of culverts.

For ease of reference, the proposed Douglas Flood Relief Scheme (including Togher Culvert) is referred to as the “proposed scheme” in this chapter and throughout the EIS.

This chapter describes the main aspects of the proposed scheme in detail.

3.2 Main Elements of the Proposed Flood Relief Scheme

As described previously in **Chapter 1 Introduction**, construction works for the proposed scheme will take place in four separate areas along the Tramore River, Ballybrack Stream and Grange Stream in Douglas and Togher as follows:

Area 1: Ballybrack Stream through Douglas.

Area 2: Tramore River through St Patrick’s Mills, Douglas

Area 3: Grange Stream (tributary of Ballybrack Stream) through Donnybrook Commercial Centre

Area 4: Tramore River through Togher

The proposed scheme for Douglas (Areas 1 to 3) is designed to provide protection to properties in the study area from the 1 in 100 year fluvial/1 in 200 year tidal flood events. An allowance for freeboard has also been incorporated into the design. This standard is in line with the OPW’s national standard for constructing flood defence schemes in Ireland.

The proposed scheme for Togher (Area 4) consists of a replacement culvert which has been designed to meet with OPW Section 50 requirements. It is therefore designed to accommodate the 1 in 100 year fluvial flood plus an allowance for climate change and freeboard.

The works will take place over an approximate channel length in each area listed above as follows:

Area 1: 620m

Area 2: 80m

Area 3: 480m

Area 4: 810m

The overall location of the proposed scheme is presented in **Figure 1.1 Site Location – Overview** and in **Figures 1.2a** and **1.2b** in **Chapter 1 Introduction**. The drawings for the proposed scheme are presented in **Appendix 3.1**.

The main aspects of the proposed flood relief scheme comprise construction works entailing the following:

- Construction of new flood defence walls and/or replacement of existing walls with new flood defence walls
- Replacement of and/or extension of existing culverts
- Removal of and/or replacement of bridges
- Removal of existing trash screens and construction of new trash screens
- Local channel widening, deepening, realignment and regrading of river channel and bank stabilisation
- Construction of new earthen flood defence embankments
- Construction of 2 no. underground surface water pumping stations
- Relocation of 2 no ESB substations/kiosks close to their existing locations
- Provision of civil works such as road/footpath re-grading at a number of locations
- Removal of vegetation and trees to facilitate construction works
- Protecting drainage outlets along the line of flood defence works with non-return valves;
- Local diversion of services where necessary to facilitate construction
- Landscaping and tree planting
- Once construction is completed, ongoing maintenance of the river channel, trash screens etc.

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. Landscaping and replanting will also be carried out on completion in agreement with landowners.

As mentioned above, it will be necessary to remove trees within the works footprint to facilitate the construction of the flood relief scheme. The trees in the area were surveyed by an arborist (tree specialist) and by an ecologist for potential bat roosts. Trees which are directly within the footprint of the construction works will be removed and are presented in **Appendix 3.2** of this EIS. There are also some trees whose roots may be indirectly impacted due to the requirement for adjacent works within the root protection area and may subsequently require removal depending on the extent of impact. Every effort will be made to retain these trees where possible. For impact assessment purposes, these trees are assumed to be removed in the EIS.

The drawings **C-000-030** to **C-000-033** (**Appendix 3.2**) indicate the trees to be removed and those which may need to be removed due to indirect impacts. Further details on the proposed scheme in the four areas are presented in the sections below.

The principal design objective of the proposed scheme is:

“to complete these flood defence works to the Floods Directive Standards, including for climate change, and to address Environmental, Social and Health and Safety concerns.”

The design has been developed in such a manner as to support the achievement of this objective. The design flood defence levels have been developed as an output of the Lee Catchment CFRAMS. The defence level corresponds to the modelled 200-year combined event (tidal region), and 100-year flow (fluvial zone) taking account of climate change modelling and freeboard. These conditions represent the requirements of the EU Floods Directive which has been transposed into Irish law, as Statutory Instrument (SI) 122 of 2010.

3.3 Drawing Index

The planning drawings for the proposed flood relief scheme are presented in **Appendix 3.1** of this EIS. Refer to **C-000-002** for the full drawing index. Refer to **C-000-003** for Key Plan.

Drawings No's **C-000-004** to **C-000-006** detail the existing flood extents and proposed flood benefit areas for the proposed scheme. The location of the cross-section drawings (denoted as CXX e.g. C10) and the corresponding drawing number (shown as C-000-0XX e.g. C-000-015) are shown on each plan drawing where relevant.

The proposed construction works will generally be limited to the areas outlined in red on the drawings. Landscaping and reinstatement 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. 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. The access routes will be reinstated to their original condition on completion of the works. For example, access will be temporarily required along the existing cycle path in Ballybrack in order to construct the coarse screen at Ballybrack Woods.

A number of trees will require removal to facilitate the construction of the proposed scheme. These are presented in **Drawings C-000-030 to C-000-033** in **Appendix 3.2** of this EIS. The proposed semi-mature tree replanting is shown on **Drawings C-000-020 to C-000-023** in **Appendix 3.1**. The proposed scheme is described from upstream to downstream where possible. Refer also to the overall location of the proposed scheme in **Figure 1.1 Site Location – Overview** and the Key Plans for Togher and Douglas in **Figures 1.2a and 1.2b respectively** in **Chapter 1**.

The figures presented in this chapter, the plan layout drawings presented in **Appendix 3.1** and the photomontages presented in **Appendix 7.1** are as follows:

Area 1: Ballybrack Stream through Douglas. This area includes Ravensdale through which the Ballybrack Stream flows. Refer to **Figures 3.1 to 3.4** in this chapter, **Drawings C-000-011, C-000-012**, cross-sections in **Drawings C-000-015 to C-000-017**, and the tree replanting areas in **Drawing C-000-022** in **Appendix 3.1** and **Figures 7.1.0, 7.1.3.1, 7.1.3.2, 7.1.4.1, 7.1.4.2, 7.1.5.1 and 7.1.5.2** in **Appendix 7.1**.

Area 2: Tramore River through St Patrick's Mills. Refer to **Figures 3.5 to 3.7** in this chapter, **Drawing C-000-010** the cross-section in **Drawing C-000-015** and the in **Appendix 3.1** and **Figures 7.1.0, 7.1.2.1 and 7.1.2.2** in **Appendix 7.1**.

Area 3: Grange Stream (tributary of Ballybrack Stream) through Donnybrook Commercial Centre. Refer to **Figures 3.8 to 3.10** in this chapter, **Drawings C-000-013, C-000-014**, the cross section in **Drawing C-000-017** and the tree replanting areas in **Drawing C-000-023** in **Appendix 3.1**.

Area 4: (Togher culvert) Tramore River between Lehenaghmore Industrial Estate and Greenwood Estate in Togher. Refer to **Figures 3.11 to 3.13** in this chapter, **Drawings C-000-007 to C-000-009**, the cross section in **Drawing C-000-015** and details in **Drawings C-000-018 and C-000-019** and the tree replanting areas in **Drawing C-000-020 and C-000-021** in **Appendix 3.1** and **Figures 7.1.0, 7.1.1.1 and 7.1.1.2** in **Appendix 7.1**.

3.4 Area 1 – Ballybrack Stream through Douglas

3.4.1 Area 1 - Existing Area

This area comprises the section of Ballybrack stream from between Ballybrack Woods to the south and downstream as far as the culvert beneath Church Street in Douglas village to the north. The Ballybrack Stream passes through the Ballybrack woods and flows northwards through the residential area of Ravensdale. It passes beneath a number of small bridges (Upper, Middle and Lower Ravensdale bridges) which provide access to residences along the western bank of the stream. The stream then flows around the Irish Countrywomen's Association (ICA) hall, beneath the pedestrian access bridge to the ICA hall and beneath the Church Road cycle track bridge. Refer to **Figure 3.1**. In the area of the Ballybrack Woods, the stream is an open channel with relatively natural banks. As it flows northwards, some sections of banks have been replaced with walls or gabions in the residential area of Ravensdale.

Just downstream of the ICA hall, the stream has a concrete base and is culverted beneath Church Road. It then flows via open earthen banks through Douglas Community Park to Church Street where it is culverted until it emerges near St Patricks Mills (Area 2). In the Community Park, the stream is separated from the rest of the park by a high wrought iron fence. Refer to **Figures 1.2a**, and **Figures 3.1 to 3.4**.

While less than 400 metres from Douglas Village, Ballybrack has a quieter and less densely built-up character than Douglas Village, while still having a typical suburban form. The land use of the area is more residential, with an identifiable centre along Church Road including a mix of commercial units, schools and clubs, churches and cemeteries, a nursing home, and large areas of open space including Ballybrack Woods and Douglas Community Park, located opposite one another and joined by a designated cycle/walkway extending into both spaces. Refer to **Figure 3.4**. There is a playground, multi-use playing courts, outdoor gym and community centre within Douglas Community Park. The cycle/walkway runs relatively parallel to the stream in the Community Park and crosses over Church Road via a designated pedestrian/cycle zone (referred to as table top ramp). The cycle/walkway then crosses over the Ballybrack stream via a small bridge (referred to in **Figure 3.1** as Church Road cycle bridge) and then weaves southwards (west of the residential area of Ravensdale) up into the Ballybrack Woods. The cycle/walkway then crosses over the Ballybrack stream again in the woods (referred to as Ballybrack Woods cycle track bridge in **Figure 3.1**).

The area in the vicinity of the ICA hall includes a small river amenity/park area and is accessed from the road via the Church Road cycle track/walkway bridge and/or Church Road itself. Refer to **Figure 3.3**. It is surrounded by predominantly mixed broadleaf tree lines with some dispersed conifers. The northern side of the river bank within the ICA curtilage comprises dense and overgrown vegetation and mature trees, before the channel returns to alongside the public cycle/walkway within Ballybrack woods.



Figure 3.1: Key Plan Area 1 upper reaches between Ballybrack Woods, through Ravensdale as far as Church Road. Ballybrack Stream shown in blue. Source: Bing.



Figure 3.2: Key Plan Area 1 lower reach - Douglas Community Park Source: Bing.



Figure 3.3: View of amenity area around Ballybrack Stream at the entrance to Ballybrack woods, with Church Road in the background over existing culvert. Looking east from public car park. ICA hall to the right of the picture.



Figure 3.4: Douglas Community Park, looking southwards. Ballybrack stream is located to the left of the picture (left of the wrought iron fence)

3.4.2 Area 1 – Proposed Works

3.4.2.1 Introduction

Refer to **Figures 3.1 to 3.4** in this chapter, **Drawings C-000-011, C-000-012** and the cross-sections in **Drawings C-000-015 to C-000-017** in **Appendix 3.1** and **Figures 7.1.0, 7.1.3.2, 7.1.4.2** and **7.1.5.2** in **Appendix 7.1**.

The main aspects of the proposed flood relief scheme in Area 1 comprise construction works as detailed below. Further details are provided in the sections following.

- Construction of a new coarse screen in Ballybrack woods in order to capture any large debris;
- Construction of new flood defence walls and/or replacement of existing walls with new flood defence walls in the Ravensdale area. Sections of the flood defence walls in Ravensdale, approximately 120m total channel length will be of concrete u-shape channel construction;
- Upper and Middle Ravensdale bridges to be retained. New bridge parapets (low wall along the bridge) to be constructed on these bridges;
- Local channel widening and channel realignment of the Ballybrack stream in the Ravensdale area;
- Removal of Lower Ravensdale vehicular bridge and replacement with new vehicular bridge and new access road to residences on the western bank. Existing road to be regraded to tie into proposed bridge;
- Removal of ICA pedestrian bridge. Construction of new alternative pedestrian access to the ICA Hall;
- Removal of Church Road cycle track bridge. Construction of new combined cycle/pedestrian track in this area;
- Replacement of Church Road culvert;
- Channel widening and deepening of the Ballybrack stream through the Community Park. Right river bank (eastern side) to be raised slightly in same area (small embankment);
- Local bank stabilisation works of left bank (western side) in Douglas Community Park;
- Relocation of existing c. 2 m X 2 m ESB substation located adjacent to the Ballybrack Stream in the northern part of Douglas Community Park to within 10 m of its current position to facilitate the construction works;
- Relocation of existing c. 1.5 m X 1.5 m ESB substation located adjacent to the left bank channel of the Ballybrack Stream to within 5 m of its current position to facilitate the construction works;
- Existing footpath in Douglas community Park to be realigned and regraded;
- Removal of vegetation and trees to facilitate the construction works;

- Protecting drainage outlets along the line of flood defence works with non-return valves;
- Once construction is completed, ongoing maintenance of the river channel, trash screens etc.
- Local diversion of services where necessary to facilitate construction
- Landscaping and tree planting
- It is proposed that there will be a local underground surface water pumping station, collector drain, manhole and rising main to be installed for operation during a flood event at Church Road in Area 1. All outlets will be fitted with non-return valves. The proposed pumping station will require regular maintenance. Refer to **Drawing C-000-011** in **Appendix 3.1**.

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. Landscaping and replanting will also be carried out on completion in agreement with landowners.

The design includes for the following measures to minimise impacts on aquatic habitats and fisheries.

- Stone slabs (circa 600mm square x 100mm deep) will be tightly packed to form the base of concrete u-channels in the Ballybrack Stream. This will provide a mixed substrate and will diversify flow patterns in areas where gravel would be scoured out by flood events.
- A low flow channel will be established in the area to be widened and deepened within the Ballybrack Stream. Rock armour will be used to define the extent of the low flow channel.
- Rock armour will be placed in front of gabions in the lower section of the Douglas Community Park. Varying the line of rock armour will provide staggered deflectors within the channel
- To maintain the gradient and prevent excessive scouring of the river bed the invert of the proposed culvert at Church Road will be buried between 300mm and 500mm in depth. Large rocks will be incorporated into scour protection at the upstream face of the Church Road culvert and concrete u-channels.
- A natural substrate will be provided within any sections of watercourses impacted by in-stream works where it is feasible to do so. Re-use of the original gravels from the affected watercourse will be incorporated into the works. Large rocks will be incorporated into the river bed to create greater heterogeneity within the channel.

3.4.2.2 Coarse Trash screen

At Ballybrack Woods, it is proposed to construct a new coarse screen. Refer to **Drawing C-000-012** and the cross section **C12** in **Drawing C-000-17** in **Appendix 3.1**. The purpose of the coarse trash screen will be to prevent large debris from flowing downstream, which could cause a blockage in the culverted sections of the watercourse.

The coarse trash screen will be designed in accordance with the UK Environment Agency Trash and Security Screen Guide 2009 and CIRIA C689 “Culvert Design and Operation Guide”. The coarse screen in Ballybrack Woods will consist of galvanised steel posts and will be designed with a bar spacing of 0.3m to stop large debris and allow smaller debris to flow downstream. The coarse screen will be designed to ensure that the stream will overtop the screen without flooding the adjacent area if the screen becomes blocked. On-going maintenance will be part of the operational phase of the scheme. This will include clearing debris from the coarse trash screen.

3.4.2.3 Flood defence walls

Sections of the existing walls/gabions/vegetated banks of the Ballybrack Stream between Ravensdale and Church Road will be replaced with reinforced concrete flood defence walls in order to reduce the risk of flooding to the surrounding area. The walls will generally be constructed to 1.2m above existing ground levels to provide protection to guarding height for pedestrians. Stone cladding will be provided on both sides of the proposed walls.

In general, the walls/gabions/vegetated banks on both banks from upstream of Upper Ravensdale bridge as far as Church Road will be replaced with the exception of a section of the right (eastern) bank upstream of Upper Ravensdale Bridge which does not require replacement. Sections of the flood defence walls in Ravensdale, approximately 120m total channel length will be concrete u-shape channel construction. Refer to **Drawing C-000-012** and the cross sections in **Drawings C-000-015** to **C-000-017** in **Appendix 3.1** and **Figures 7.1.3.2, 7.1.4.2** and **7.1.5.2** in **Appendix 7.1**.

3.4.2.4 Conveyance improvements

Along the length of the Ballybrack Stream, certain sections of the channel constrict the flow and increase upstream flood levels. Also, a number of existing bridges/culverts in the vicinity of Ravensdale have caused blockage issues in the past. Conveyance improvements will result in an appreciable reduction in water levels and blockage risk. The scheme will include conveyance improvements at the following locations:

- Local channel widening and channel realignment of the Ballybrack stream in the Ravensdale area. Refer to **Drawing C-000-012** and the cross sections in **Drawings C-000-016** and **C-000-017** in **Appendix 3.1**.

- Channel widening and deepening of the Ballybrack stream through the Community Park. The right river bank (eastern side) is to be raised slightly in the same area (small embankment). The existing fence located along the right bank of the channel will be relocated to prevent access to the watercourse. The new bank will be constructed at a slope of 1 in 2 (vertical to horizontal). Refer to **Drawing C-000-011** and the cross sections in **Drawings C-000-015** and **C-000-016** in **Appendix 3.1**.
- Removal of ICA pedestrian bridge and Church Road cycle track bridge. A new combined cycle/pedestrian track will be constructed adjacent to the flood defence wall between Church Road and an existing section of the cycle/pedestrian track outside the ICA Hall in order to maintain access. The pedestrian section will extend to the east of the cycle track to provide access to the ICA hall via a proposed pedestrian gate. Refer to **Drawing C-000-012** and the cross sections in **Drawings C-000-016** in **Appendix 3.1**.
- Removal of Lower Ravensdale vehicular bridge and replacement with new reinforced concrete bridge, approximately 13m downstream of the location of the existing bridge. The soffit level of the replacement bridge will be approximately 0.3m above the existing bridge soffit level. The purpose of the bridge replacement is to increase the conveyance capacity of the Ballybrack Stream. The existing road will be regraded to tie into the proposed bridge and a new access road will be constructed. A new turning area will be provided for the houses accessed via Lower Ravensdale Bridge. Refer to **Drawing C-000-012** and the cross sections in **Drawing C-000-016** in **Appendix 3.1**.
- Upper and Middle Ravensdale bridges to be retained. New bridge parapets (low wall along the bridge) are to be constructed on these bridges. Refer to **Drawing C-000-012** and the cross sections in **Drawings C-000-016** and **C-000-017** in **Appendix 3.1**.

3.4.2.5 Culverts

It is proposed to replace the existing culvert at Church Road with a new culvert in order to improve conveyance at this location. The existing tabletop ramp will be extended and a new pedestrian crossing provided. Refer to **Drawing C-000-011** and the cross section in **Drawing C-000-016** in **Appendix 3.1**.

3.4.2.6 Embankments

The existing embankment along the left bank which forms the boundary with the adjacent residential property (at the southern end of the community park) will be reconstructed into a formal flood defence embankment. A low earthen flood defence embankment will be constructed along the right bank (at the northern end of the community park) above existing ground levels. The existing walkway will be reconstructed at the top of this embankment. Refer to the cross sections in **Drawing C-000-015** in **Appendix 3.1**.

The purpose of the flood defence embankments is to minimise the risk of overtopping of the river banks and subsequent flooding that would occur. The height of the embankment has been chosen based on the hydraulic analysis of the Ballybrack Stream for the 1 in 100 year flood event (including an allowance for freeboard).

3.4.2.7 Bank stabilisation works

Considerable scour is evident along the existing banks of the Ballybrack Stream in Douglas Community Park. To improve the stability of the banks, approximately 180m of gabions are to be constructed along the left bank where the existing bank consists of a sections of steep vegetated slope and dry loose stone walls. Upstream of this section where the existing left bank is comprised of a concrete wall, localised scour protection will be provided as required.

The right bank of the stream, downstream of the proposed channel widening, will be stabilised by regrading the existing bank to a slope of 1 in 2 (vertical to horizontal) over a distance of approximately 90m. Erosion protection measures will be provided to the base of the channel slope.

3.5 Area 2 – Tramore River through St Patrick’s Mills

3.5.1 Area 2 – Existing Area

The study area comprises an open channel of the Tramore River running alongside a car park boundary of the former St Patrick’s Mills building (also referred to as Douglas Woollen Mills). Refer to **Figure 1.2a** and **Figure 3.5**. At this point, the Tramore River has just emerged from a bridge under the N40 and N40 slip road. The banks on both sides of the river are highly modified with concrete retaining walls on both sides. The river passes under the West Douglas Road (R851) bridge before flowing parallel to the N40 and Douglas Village Shopping Centre. Refer to **Figure 3.6**. Immediately upstream of the bridge, a building directly adjoins the bank. Refer to **Figure 3.7**.

The mills and car park are set within a tight complex of small former light industrial type units (reminiscent of the area’s textile industries), with an entrance to the Woollen Mills on West Douglas Road (R851) opposite Douglas Village Shopping Centre in the centre of Douglas Village. The units are occupied by a wide variety of uses, predominantly mixed retail, service and light industry. The complex is bordered by the N40 to the north-east and the West Douglas Road (R851) to the east, and lies adjacent to a busy junction between the two roads. Refer to **Figures 3.6** and **3.7** below.

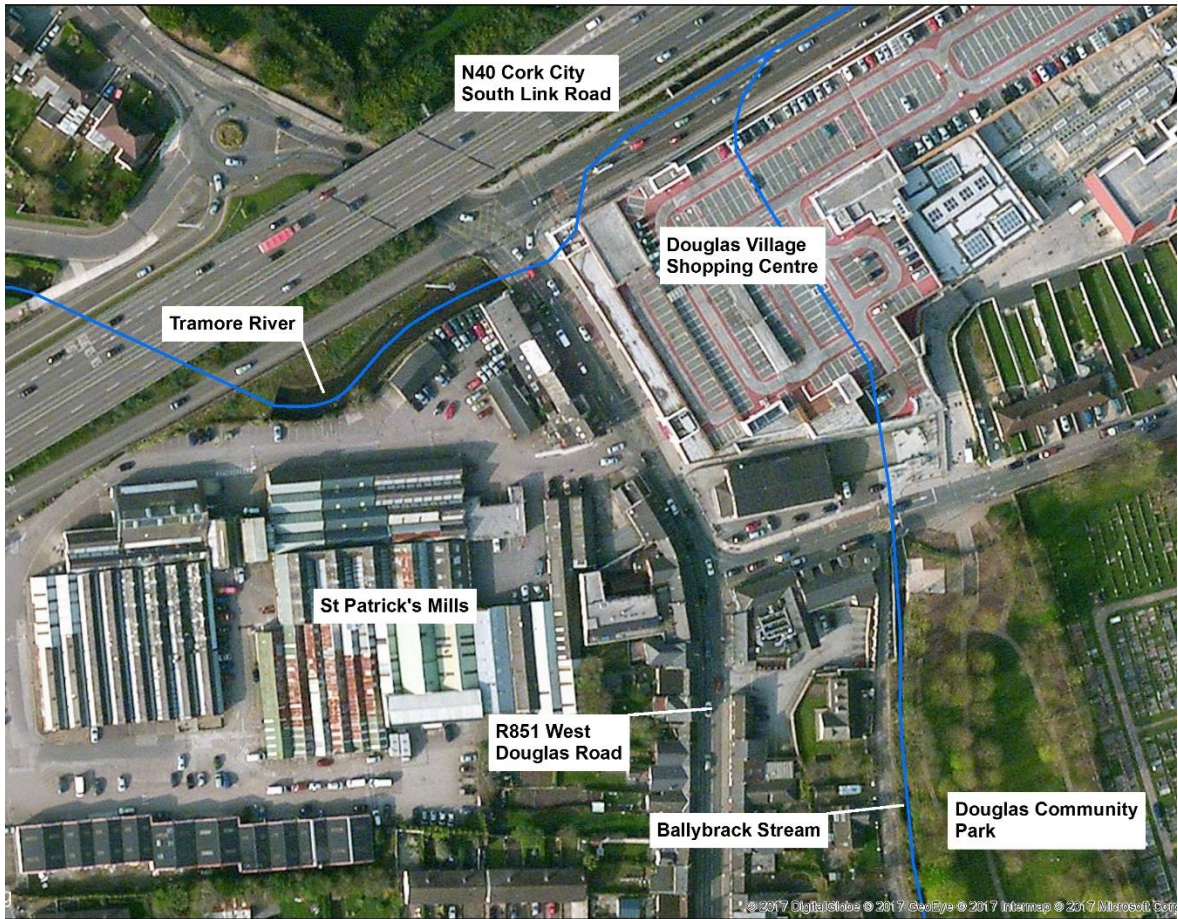


Figure 3.5: Area 2 – St Patrick’s Mills in Douglas village.



Figure 3.6: View of Tramore River from R851 (West Douglas Road) taken from the R851 bridge over the river (looking upstream and southwest), adjacent to St Patrick’s Mills on the left and a slip road to the N40 on the right.



Figure 3.7: View of R851 bridge over the Tramore River and view of right bank. Note location of building directly on the river bank.

3.5.2 Area 2 – Proposed Works

Refer to **Figures 3.5 to 3.7** in this chapter, **Drawing C-000-010** and the cross-section in **Drawing C-000-015** in **Appendix 3.1** and **Figures 7.1.0 and 7.1.2.2** in **Appendix 7.1**.

The main aspects of the proposed flood relief scheme in Area 2 St Patrick's Mills comprise construction works entailing the following.

- New flood defence wall on the right bank of the Tramore River in order to reduce the risk of flooding in the surrounding area. The proposed reinforced concrete wall will have a limestone masonry finish on the dry side (St Patrick's Mills side).
- Construction of a new parapet wall over the R851 (West Douglas Street) bridge in order to reduce the risk of overtopping of flood waters at that location. The works to the R851 bridge parapet will include the removal of the existing metal railing and the construction of a new reinforced concrete parapet to a height of 1.2m above the level of the existing footpath. These works are required to ensure that flood waters remain in the channel at this location. Refer to **Drawing C-000-010** and the cross section in **Drawing C-000-015** in **Appendix 3.1**.
- It is proposed that there will be a local underground surface water pumping station, collector drain, manhole and rising main to be installed for operation during a flood event at St. Patrick's Mills in Area 2. All outlets will be fitted with non-return valves. The proposed pumping station will require regular maintenance. Refer to **Drawing C-000-010** in **Appendix 3.1**.
- Local diversion of services where necessary to facilitate construction.

3.6 Area 3 – Grange Stream (tributary of Ballybrack Stream) through Donnybrook Commercial Centre

3.6.1 Area 3 – Existing Area

The Grange Stream passes through Donnybrook Commercial Centre. Refer to **Figure 1.2a** and **Figure 3.8**. The stream runs through an area of dense trees and vegetation just upstream of the commercial centre. As it enters the commercial centre, there is an old trash screen within the river channel. Considerable amounts of sediment have deposited just upstream of the trash screen whilst just downstream, the water level drops significantly. Refer to **Figure 3.8**. Within the commercial centre itself, the Grange stream is highly modified and mostly culverted. The open sections are linear with either vertical concrete walls or steep grassy banks. There is a coarse trash screen just upstream of the culvert. The commercial centre site is very contained and largely hidden from view apart from the imposing mill structure that can be seen from the main road. A mix of commercial units, a day care centre and religious facilities are located within the complex and along the length of the Grange Stream in this area.

The commercial centre site is surrounded by dense clusters of mature deciduous trees, adding to the sense of enclosure and restricted views from within and towards the site. Refer to **Figures 3.8** to **3.10**.



Figure 3.8: Donnybrook Commercial Centre (Area 3) showing the Grange Stream.



Figure 3.9: View of existing coarse trash screen at northern end of the Commercial Centre. There is a considerable difference in levels upstream and downstream of the screen



Figure 3.10: View north-east through Donnybrook Commercial Centre and Grange Stream.

Figure 3.10 shows the north-eastern view through Donnybrook Commercial Centre, with the existing open channel (Grange Stream) running down the central car park area of the complex, the mixed use units visible on the left, and the protected red brick mill structure in the distance.

3.6.2 Area 3 – Proposed Works

Refer to **Figures 3.8 to 3.10** in this chapter, **Drawings C-000-013, C-000-014** and the cross section in **Drawing C-000-017** in **Appendix 3.1**.

The main aspects of the proposed flood relief scheme in Area 3 Grange Stream through Donnybrook Commercial Centre comprises construction works entailing the following:

- Permanent removal of one existing trash screen upstream of commercial centre;
- Replacement of a second existing trash screen within commercial centre;
- Replacement of existing section of culvert with new culvert;
- Regrading and removal of sediment and reinforcement of channel banks.
- Local diversion of services where necessary to facilitate construction.

The proposed works will consist of the removal of the existing trash screen upstream of the commercial centre and regrading the existing open channel for a distance of approximately 100m upstream of the centre. A new coarse screen is proposed at this location (steel posts at 300mm centres). The channel banks will be reinforced with rock armour/gabions/similar as required.

The existing trash screen within the commercial centre, in the section of open channel between the existing culverts, will be removed and the channel regraded upstream. The channel banks will be reinforced with rock armour/gabions as required.

Further downstream, an existing section of the culvert will be replaced with a new 2.4m wide by 1.8m high reinforced concrete culvert in order to improve conveyance in the culvert. Refer to **Drawings C-00-0013** and cross sections in **C-00-017**.

3.7 Area 4 – Tramore River through Togher (Togher Culvert)

Refer to **Figures 3.11 to 3.13** in this chapter, **Drawings C-000-007 to C-000-009** and the cross section in **Drawing C-000-015** in **Appendix 3.1** and **Figures 7.1.0, 7.1.1.1** and **7.1.1.2** in **Appendix 7.1**.

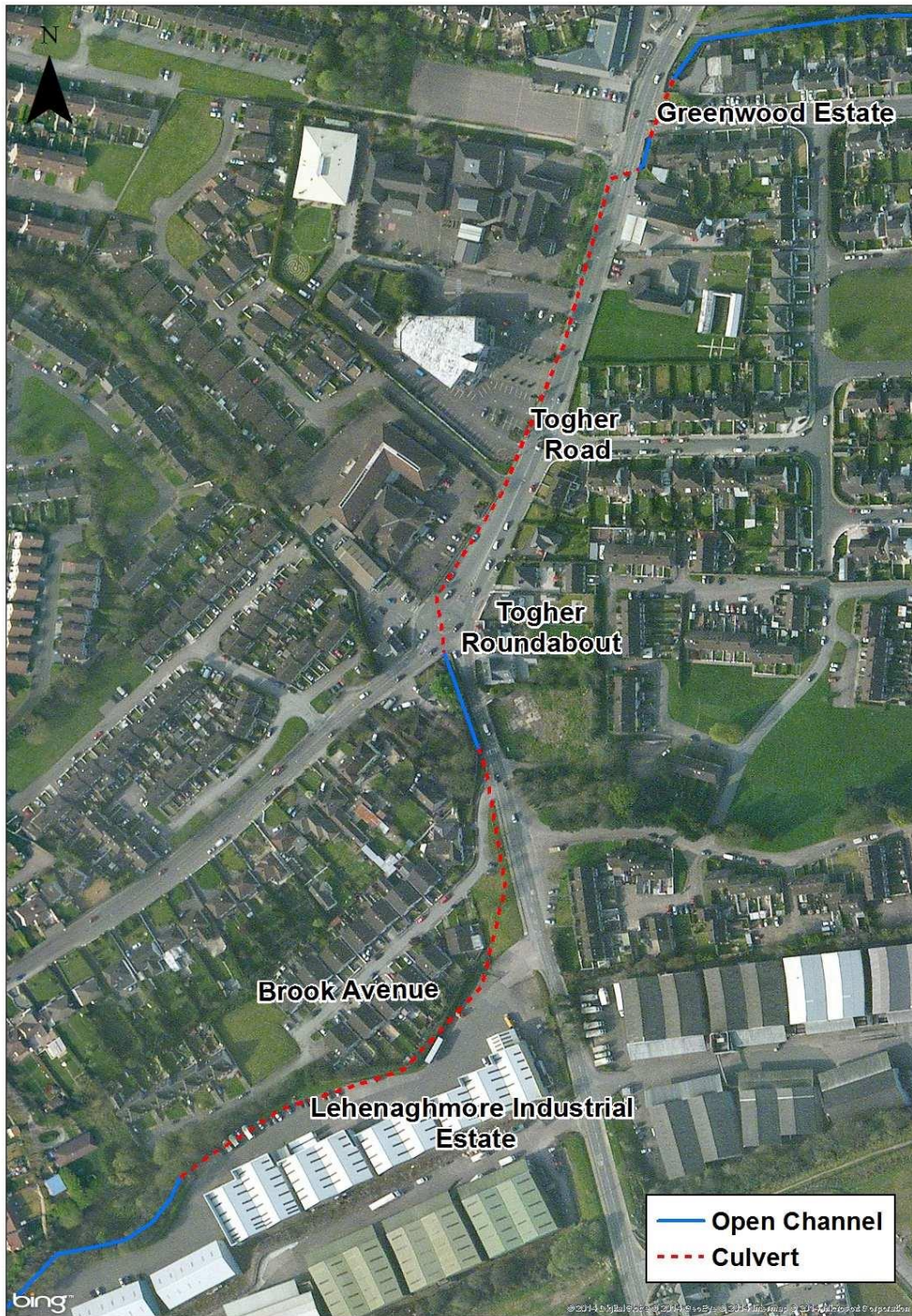


Figure 3.11: Area 4 Togher showing existing culvert.

3.7.1 Area 4 – Existing Area

This area comprises the Tramore River between Lehenaghmore Industrial Estate and Greenwood Estate in Togher, refer to **Figure 3.11**. The surrounding area is mixed residential and industrial development. The residential area of Brook Avenue is located adjacent to Lehenaghmore Industrial Estate whilst Greenwood Estate is located off the Togher Road south of the N40.

There are a number of residential, educational, commercial and religious facilities adjacent to or in the vicinity of the Togher road. The area has a typical suburban form; open and with low-density settlement patterns. Refer to **Figure 3.11**.

The majority of the Tramore River is culverted in this area and extends from the Lehenaghmore Industrial Estate to Greenwood Estate. Refer to **Figure 3.11**. The culvert consists of three lengths of culvert (approximately 300m and 263m and 30m long respectively). There are two open sections between the culvert lengths; the first (approximately 50m in length) is south of Brook Avenue, parallel to the road as far as the Togher Cross roundabout and the second (approximately 15m in length) is just upstream of Greenwood Estate, parallel to the Togher Road. The Tramore River exits the culvert at Greenwood Estate, just south of the N40. From here, it flows westwards along an open channel, parallel to the N40. There is a trash screen located just upstream of the culvert at Lehenaghmore Industrial Estate. Refer to **Figure 3.11**.

3.7.2 Area 4 – Proposed Works

Refer to **Figures 3.11 to 3.13** in this chapter, Drawings **C-000-007 to C-000-009** and the cross sections in **Drawings C-000-015 and C-000-019** in **Appendix 3.1** and **Figures 7.1.0 and 7.1.1.2** in **Appendix 7.1**.

The main aspects of the proposed flood relief scheme in Area 4 Togher comprises construction works entailing the following:

- Replacement of existing trash screen with new trash screen at Lehenaghmore Industrial Estate
- Realignment of a section of river channel immediately upstream of the proposed new trash screen to facilitate tie-in with new culvert.
- Replacement and extension of existing culvert with new culvert between Lehenaghmore Industrial Estate and downstream of Greenwood Estate.
- Regrading of Lehenaghmore Road to divert overland flow towards the Tramore River.
- Localised regrading of the existing footpath and ramp in the vicinity of the entrance to the Greenwood Estate to divert overland flow towards the Tramore River.
- Local diversion of services where necessary to facilitate construction.

3.7.2.1 Trash screen replacement

The new trash screen at Lehenaghmore Industrial Estate will be designed in accordance with the UK Environment Agency Trash and Security Screen Guide 2009 and CIRIA C689 “Culvert Design and Operation Guide”. The trash screen will have minimum bar spacing of no less than 150mm in accordance with the Environment Agency guidance document. A screen bypass will be incorporated into the design to ensure that out of bank flow does not occur should the screen become blocked. On-going maintenance will be part of the operational phase of the scheme. This will include clearing debris from the coarse trash screen. Refer to **Drawing C-000-019** in **Appendix 3.1**.



Figure 3.12: View of Togher Road (looking north), including the Church of the Way of the Cross. The proposed flood defence scheme culvert runs under and along the western pavement of Togher Road.



Figure 3.13: Existing trash screen at Lehenaghmore Industrial Estate

3.7.2.2 Conveyance improvements

Conveyance improvements will result in an appreciable reduction in water levels and blockage risk. The most upstream point of the proposed flood relief scheme works on the Tramore River will be in the Lehenaghmore Industrial Estate. Refer to **Drawing C-000-007** in **Appendix 3.1**. A section of the Tramore River that leads into the proposed trash screen will be realigned in order to tie in with the new trash screen. It will also be necessary to remove some trees along certain sections of the Togher culvert in Area 4.

The Lehenaghmore Road will undergo regrading to fall to the west from the entrance to the Lehenaghmore Industrial estate to the Togher Cross roundabout. This is to facilitate capturing pluvial flows on the road and directing them into the new culvert via gullies.

It is proposed to construct a new boundary wall on the left hand side of the new culvert (where the existing open channel is located) on Lehenaghmore Road over a distance of approximately 30m to the Togher Cross roundabout as the existing open channel currently forms a boundary between the road and the properties at this location. The existing footpath will also be regraded to tie into the proposed road regrading at this location.

Regrading is also proposed on Togher Road, adjacent to the existing sections of open channel at the entrance to the Greenwood Estate. The footpaths will be regraded to drain towards the river with the existing kerbs lowered to create an overland flow route from Togher Road to the Tramore River. The height of the existing ramp at the entrance to the estate will be increased to divert overland flow away from the estate.

Downstream of Griffin Pianos on the Togher Road, it is proposed to widen the left bank of the Tramore River channel by 1m. Refer to **Drawing C-000-008**. The widening will be achieved by constructing a new channel wall 1m behind the existing channel wall. This widening is to ensure flow remains in the channel. A 1.2m high pedestrian guardrail will be constructed on top of the wall to protect against pedestrians entering the channel.

3.7.2.3 Culverts

It is proposed to replace and extend the existing culvert in Togher between Lehenaghmore Industrial Estate and downstream of Greenwood Estate. The following culvert works are proposed along the Tramore River in Togher:

- Replacement section of existing culvert at Lehenaghmore Industrial Estate and Lehenaghmore Road with a new reinforced concrete culvert (internal dimensions 3m wide x 1.4m high);
- Replacement of existing open channel at Lehenaghmore Road with a new reinforced concrete culvert (internal dimensions 3m wide x 1.4m high);
- Replacement of existing culvert at Togher Road from Togher Cross to Griffin Pianos with a new reinforced concrete culvert (internal dimensions 3m wide x 1.4m high);
- Replacement of existing open channel at Griffins Pianos on Togher Road with a new reinforced concrete culvert (internal dimensions 3m wide x 1.4m high).