Flooding poses a risk to human health and safety. The OPW document 'The Planning System and Flood Risk Management: Guidelines for Planning Authorities' (OPW, 2009) states that flooding can cause physical injury, illness and loss of life. Deep, fast flowing or rapidly rising flood waters can be particularly dangerous, with increased risk if the floodwater is carrying debris. Some of these impacts may be immediate, the most significant being drowning or physical injury due to being swept away by floods. Floodwater contaminated by sewage or other pollutants (e.g. chemicals stored in garages or commercial properties) can potentially cause illness, either directly as a result of contact with the polluted floodwater or indirectly as a result of sediments left behind. Flood water may also hide other hazards for wading pedestrians, such as manhole openings where the covers have been lifted by flood flows.

The impact on people and communities as a result of the stress and trauma of being flooded, or even of being under the threat of flooding, can be immense. Long-term impacts can arise due to chronic illnesses and the stress associated with being flooded and the lengthy recovery process. The ability of people to respond and recover from a flood can vary. Vulnerable people, such as those who are old, disabled or have a long-term illness, are less able to cope with floods than others. Some people may have difficulty in replacing household items damaged in a flood and may lack the financial means to recover and maintain acceptable living conditions after a flood.

Construction of the proposed development will necessitate the presence of a construction site. Construction sites and the machinery used on them pose a potential health and safety hazard to construction workers if site rules are not properly implemented.

4.4 LIKELY AND SIGNIFICANT IMPACTS AND ASSOCIATED MITIGATION MEASURES

This section deals with the impacts of the proposed development on the population of the Study Area with regard to population, employment and economic activity, land use, services and tourism. As well as these the health and safety, dust, noise and traffic impacts will be dealt with. Noise and traffic impacts will be dealt with in more detail in Chapters 8 and 11 respectively.

4.4.1 'Do-Nothing' Scenario

If the proposed development were not to proceed, the existing river channel would remain as it is, resulting in many of the same potential impacts on human beings as have occurred previously.

There would also be potential for impact on:

- Residential and commercial properties
- Potential public health risk
- Pedestrian walkways
- Roads and Transportation Network
- Wastewater Collection Network
- Surface Water Collection Network
- Water Distribution Network
- Bord Gáis Distribution Network
- Electricity Network
- Telecommunications Network

If the proposed development were not to proceed, the opportunity to protect Blackpool and surrounding areas in Cork City from future flooding events would be lost, as would the opportunity to create employment during the construction phase.

4.4.2 Construction Phase

Employment, Economic and Investment Impacts

Potential Impacts

The construction cost of the project will be in the region of $\in 8.5$ million. The construction phase of the proposed development will last approximately 18 months. Many construction workers and materials will be sourced locally, thereby helping to sustain employment in the construction trade. This will have a short-term significant positive impact.

The injection of money in the form of salaries and wages to those employed during the construction phase of the proposed project has the potential to result in an increase in household spending and demand for goods and services in the local area. This would result in local retailers and businesses experiencing a short-term positive impact on their cash flow. **This will have a short-term slight positive indirect impact**.

The proposed development will result in an influx of skilled people into the area, bringing specialist skills for both the construction and operational phases that could result in the transfer of these skills into the local workforce, thereby having a long-term positive impact on the local skills base. Up-skilling and training of local staff in the particular requirements of flood relief and drainage schemes is likely to lead to additional opportunities for those staff as additional river drainage schemes are implemented in Ireland. **This will have a long-term moderate positive indirect impact**.

There is also the potential for short term disruption to economic activity due to the proposed construction activities. This would predominantly be as a result of traffic and access issues which could have the potential to reduce footfall into local businesses, withnoise and dust from the works adding to this impact on local businesses. This will have a short-term moderate negative indirect impact.

Mitigation Measures

A traffic management plan (such as rolling traffic management) will be prepared and implemented for the duration of the works in order to ensure that any impacts on traffic mobility are minimised. This will also result in a minimised potential impact on local businesses, as traffic managemet will only implement restrictions to local businesses only when necessary and only for the shortest possible time. In addition, works will be limited to normal working hours, and will account for peak business periods, such as the Christmas shopping period. For this period, it is recommended that works would be paused from the beginning of the second week in December until the end of the first week in January. An Environmental Management Plan will be implemented during the construction phase to ensure that environmental nuisances relating to the works are minimised. This will include measures to avoid and reduce noise and dust.

Residual Impacts

The residual impacts will be short term and slight. The implementation of a Traffic Management Plan and Environmental Management Plan to reduce traffic and environmental nuisance impacts on the receiving environment during the construction phase will minimise the impact on local businesses. By ensuring that works account for busy periods for local businesses (e.g. Christmas), the impact on times of peak economic turnover will be greatly minimised.

Significance of Effects

Based on the assessment above there will be no significant effects.

Population

Those working on the construction phase of the proposed development will travel daily to the site from the wider area. The construction phase will have no impact on the population of the Study Area in terms of changes to population trends or density, household size or age structure. There will be no impact on population.

Tourism

Potential Impacts

The proposed works will have little impact on many sectors of the tourism industry in Blackpool. Angling does not form a significant part of the industry in Blackpool. Angling in areas upstream of Blackpool and elsewhere in the catchment is unlikely to be affected by the proposed works and thus the impact is considered to be **imperceptible**. Potential increases in noise and dust levels, traffic issues and temporary impacts on visual amenity related to the works are likely to deter and/or disturb visitors during the construction phase. There could be a potential short-term slight negative impact on tourism.

Mitigation Measures:

Works will be designed to minimise impacts upon the amenity value of the study area during the construction period. Mitigation will include measures to minimise pollution of the river, minimise impacts on fish, limit working hours and prevent un-necessary damage to bankside habitats.

The implementation of a Traffic Management Plan and Environmental Management Plan to reduce traffic and environmental nuisance impacts on the receiving environment during the construction phase will minimise the impact on tourism.

Residual Impacts:

Although upstream stretches of the River Bride will remain unaffected by the works and impacts on the water quality of the river downstream of the works will be minimised through implementation of mitigation measures. The amenity value of the River Bride within sections of the work area will be diminished for tourists for the duration of the works. Therefore, the nature of the impact on tourism overall will remain slight during the construction phase of the scheme.

Significance of Effects

Based on the assessment above there will be no significant effects.

Noise

Potential Impacts

There will be an increase in noise levels in the vicinity of the proposed development site during the construction phase, as a result of machinery and construction work. These impacts will be short-term in duration on any particular day and temporary (for the duration of the construction phase). The primary noise producing activities associated with the proposed works include:

- Embankment construction works, involving use of 1-2 midsized tracked excavators, and possibly a small number of dumpers or dump trucks. Such works are proposed at the Commons Inn, at Blackpool Retail Park, and adjacent to the secluded dwelling near the railway bridge.
- Concrete breaking may be required at several locations, involving either hydraulic breakers on tracked excavators, or handheld pneumatic breakers powered by compressors. Concrete saws may also be required.
- Wall and parapet wall repair and construction works, proposed between North Point Business Park and Blackpool Shopping Centre, and adjacent to the dwelling at the end of the Killeens offramp, are likely to involve a number of activities, including blockwork and concrete pours. Plant such as telescopic handlers and mini-excavators may be required. Various activities are likely to require mobile generators to power equipment, lights and pumps. Larger works areas are likely to be surrounded by temporary hoarding to a height of 2.4 m.
- The construction method for the proposed sediment trap at Sunbeam will involve sheet piling, as will the proposed wall near Commons Inn. While unlikely, sheet piling may also be required at other works zones. The specific requirements for piling, and selection of piling method, will not be determined until site specific investigations are undertaken in due course. Sheet piling may involve use of driven or pressed-in piles, or use of vibro-displacement techniques.
- Removal of excavated material, rubble and spoil, and deliveries of concrete and other materials will require a large number of HGV movements throughout the project. These will be concentrated at specific areas where easements are available.

Construction noise at any given noise sensitive location will be variable throughout the construction project, depending on the activities underway and the distance from the main construction activities to the receiving properties. The potential noise impacts that will occur during the construction phase of the proposed development are further described in Section 8 of this EIAR. This will have a short-term negative slight impact.

Mitigation

Best practice measures for noise control will be adhered to onsite during the construction phase of the proposed development in order to mitigate the slight short-term negative impact associated with this phase of the development. The measures include:

- Sensitive location of equipment, taking account of local topography, existing structures (i.e. walls, buildings, etc.) and natural screening.
- Working methods: construction noise will be controlled by prescribing that standard construction work will be restricted to the specified working hours. Any construction work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance. The phasing of works has also been designed with regard to avoidance of noise impacts.
- Plant will be selected taking account of the characteristics of noise emissions from each item. All
 plant and machinery used on the site shall comply with E.U. and Irish legislation in relation to noise
 emissions. The timing of on- and off-site movements of plant near occupied properties will be
 controlled.

- Operation of plant: all construction operations shall comply with guidelines set out in British Standard documents 'BS 5338: Code of Practice for Noise Control on Construction and Demolition Sites' and 'BS5228: Part 1: 1997: Noise & Vibration Control on Construction and Open Sites'. The correct fitting and proper maintenance of silencers and/or enclosures, the avoidance of excessive and unnecessary revving of vehicle engines, and the parking of equipment in locations that avoid possible effects on noise-sensitive locations will be employed.
- Training and supervision of operatives in proper techniques to reduce site noise, and selfmonitoring of noise levels, if appropriate.

Residual Impacts

The residual impacts will be imperceptible

Significance of Effects

Based on the assessment above there will be no significant effects.

Dust

Potential Impacts

Potential dust emission sources during the construction phase of the proposed development include excavation activites, backfilling with aggregate, and resurfacing works. This may cause nuisance to residents and local businesses as well as road users. These impacts will not be significant given the localised nature of the proposed works and will be relatively short-term in duration. There is the potential to have a short-term slight negative impact.

Mitigation

In periods of extended dry weather, dust suppression (localised wetting of surfaces) may be necessary within and around the site to ensure dust does not cause a nuisance.

Residual Impacts

The residual impacts will be imperceptible

Significance of Effects

Based on the assessment above there will be no significant effects.

Traffic and Transport Infrastructure

The proposed scheme has the potential to impact on the transport infrastructure in the area, most significantly during the construction phase. This impact is likely to occur where four masonry bridges will be replaced, three culverts will be replaced and one new culvert will be constructed.

The construction phase will have a temporary impact on traffic volumes in Blackpool and the immediate surrounds due to the increase in additional traffic movements associated with the site investigation, construction of new infrastructure including bridges, culverts, walls, embankments, parapets etc. However, taking into account the large numbers of vehicles using the road network in and in the vicinity of Blackpool, it is unlikely that traffic generated during the construction phase will have a significant impact on traffic flow in general. It is not anticipated that the construction traffic will significantly affect the flow of traffic through Blackpool and its surrounds

It is likely that temporary road closures will be required during the construction phase of the works at several locations. The partial closures of the Watercourse Road at Blackpool Church and at Maddens Buildings will cause significant disruption to the traffic flow in the Blackpool area.

A complete Traffic and Transportation Assessment (TTA) of the proposed development has been carried out which quantifies and assesse the potential impacts. The full results of the TTA are presented in Section 11 of this EIAR. This is expected to have a short-term moderate negative impact.

Mitigation

Works will be designed and supervised by a suitably qualified and experienced professional who will be supervised to ensure that the works are carried out correctly. This will ensure that the bridges will be constructed safely and ensure the structural integrity of the structure. Excavation and reinstatement of the Watercourse Road and Blackpool Bypass culvert trenches will be carried out in consultation with the Local Authority, and will also follow the Department of Transport, Tourism and Sport published document entitled 'Guidelines for Managing Openings in Public Roads'. These works will be designed and supervised by a suitably qualified and experience professional to ensure they are carried out correctly.

The localised traffic disruptions as a result of other proposed works throughout the scheme will be mitigated through the use of industry standard traffic management measures. These traffic management measures should be designed in accordance with the 'Guidance for the Control and Management of Traffic at Roadworks – Second Edition'.

Construction works in the vicinity of Blackpool Church and Maddens Buildings along Watercourse Road will be planned to take place over the summer in order to minimise traffic disruption. Any road and lane closures will be timed to minimise the impact to the flow of traffic, and if possible work will be carried out at off peak times to reduce the impact, particularly on heavy goods vehicles. All residents and interested parties should be consulted when planning these road closures to optimise the timing of same. A complete schedule of road closures should be published in advance of the works commencing to facilitate residents in making alternative arrangements where necessary.

Residual Impact

Taking into account the abovementioned mitigation measures (and discussed in further detail in Chapter 11 of this EIAR), the residual impact of the proposed scheme on the transport infrastructure will be imperceptible.

The Traffic Management Plan will ensure the impact of traffic disruption resulting from the works is minimised. Relatively short, localised delays are likely to be encountered by motorists at the locations of proposed works in the immediate vicinity of the road network. This impact will be a short term impact and there will be no residual impact on completion of the proposed works.

The closure of the Watercourse Road at Blackpool Church and Maddens Buildings to facilitate the proposed works is likely to cause a moderate to significant temporary impact to the flow of traffic in Blackpool. However, there will be no residual impact once the proposed scheme is completed.

Significance of Effects

Based on the assessment above there will be no significant effects.

Services

The majority of proposed works pertaining to the River Bride (Blackpool) certified drainage scheme, described in detail in Chapter 3, are located in or in the vicinity of the River Bride. As such there is limited interaction between the scheme and existing services in the area. Section 11.3 gives further details on the predicted impacts on services for drainage networks, water, gas, electricity broadband and telecommunications distribution networks. Locations where potential impacts are predicted are discussed in section 11.3. Impacts on each service will vary, but overall the proposed drainage scheme will have a **short-term moderate negative impact** on services.

Mitigation Measures:

The depth of the service networks (e.g. surface water and wastewater collection pipework) close to the proposed works areas will be assessed. Should it be anticipated that any proposed excavations will impact on these networks, this will be taken into consideration at detailed design stage and replaced or deepened prior to foundation excavation if necessary.

Prior to excavation, the Contractor will assess record drawings and the results of the Site Investigation in order to determine the exact depth and location of the existing service networks within the works area. The Contractor will carry out additional site investigation to confirm the location of the existing services. This will reduce the risk of striking them and causing interruption to the systems during the construction phase.

Residual Impact:

Considering the above-mentioned mitigation measures the residual impact of the proposed scheme on the local service networks will be **neutral**.

Significance of Effects

Based on the assessment above there will be no significant effects.

Amenity (including Visual Amenity)

Potential Impacts

During the periods of in-stream works, there will be a significant impact on local amenities related to the use of the Bride River. Riverside walks for residents and visitors alike are of importance to the area, with angling having a minor importance. Although in-stream works will be restricted to two five month periods from May to September inclusive, these months coincide with the period of peak amenity usage of the river. Loss of recreational amenity will be limited to the areas where works re proposed and the area immediately downstream of these works. However as water quality is likely to be adversely affected in the construction phase of the scheme, diminution of the amenity value of the river will occur downstream of the working area also during the construction phase. In addition, the proposed works have the potential to impact negatively on the resident fish stocks and potentially hinder the migration of fish. Indirect impacts may include the smothering of downstream fish gills with suspended solids. The hindrance of migrating fish has the potential to impact on salmonid populations throughout the entire Lee catchment and therefore impact angling not only in the works areas but also on a wider scale. This has the potential to have a **short-term moderate negative impact**.

The impact on visual amenity of the construction phase is assessed in full in Chapter 10 (Landscape) of this EIAR. Overall, the works will have a generally transient nature, lasting only for several weeks (or up to

several months in some instances) in any one location. The areas with the most significant works will have the greatest impact. Overall this has the potential to have a **short-term moderate negative impact**.

Mitigation Measures:

Works will be designed to minimise impacts upon the amenity value of the study area during the construction period. Mitigation will include measures to minimise pollution of the river, minimise impacts on fish, limit working hours and prevent un-necessary damage to bankside habitats. Full details of this mitigation is provided in Chapter 5.

The mitigation measures relating to visual amenity impacts are discussed in Chapter 10 (Landscape) of this EIAR.

Residual Impact:

Although upstream stretches of the River Bride will remain unaffected by the works and impacts on the water quality of the river downstream of the works will be minimised through implementation of mitigation measures, the amenity value of the proposed works areas will be inaccessible to the public within the study area for the duration of the works. Therefore, the nature of the impact will remain moderate within and downstream of the works area for residents and visitors during the construction phase of the scheme.

Provided that the mitigation measures discussed in Chapter 10 of this EIAR are implemented correctly, the residual impact on visual amenity will be a temporary to short term slight negative impact.

Significance of Effects

Based on the assessment above there will be no significant effects.

Human Health and Safety Impacts

Potential Impacts

Construction of the proposed development will necessitate the presence of a construction site. Construction sites and the machinery used on them pose a potential health and safety hazard to construction workers if site rules are not properly implemented. This will have a short-term potential significant negative impact.

Mitigation Measures

During construction of the proposed development, all staff will be made aware of and adhere to the Health & Safety Authority's 'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006'. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan.

Harris fencing will be erected around any excavations to prevent uncontrolled access to this area. Appropriate health and safety signage will also be erected on this fencing and at locations around the site.

Residual Impact:

The implementation of the Health & Safety Plan will ensure any potential risks are minimised.

Significance of Effects

Based on the assessment above there will be no significant effects.

4.4.3 Operational Phase

Human Health and Safety

Flooding poses a risk to human health and safety. The OPW document 'The Planning System and Flood Risk Management: Guidelines for Planning Authorities' (OPW, 2009) states that flooding can cause physical injury, illness and loss of life. Deep, fast flowing or rapidly rising flood waters can be particularly dangerous, with increased risk if the floodwater is carrying debris. Some of these impacts may be immediate, the most significant being drowning or physical injury due to being swept away by floods. Floodwater contaminated by sewage or other pollutants (e.g. chemicals stored in garages or commercial properties) can potentially cause illness, either directly as a result of contact with the polluted floodwater or indirectly as a result of sediments left behind. Flood water may also hide other hazards for wading pedestrians, such as manhole openings where the covers have been lifted by flood flows.

The impact on people and communities as a result of the stress and trauma of being flooded, or even of being under the threat of flooding, can be immense. Long-term impacts can arise due to chronic illnesses and the stress associated with being flooded and the lengthy recovery process. The ability of people to respond and recover from a flood can vary. Vulnerable people, such as those who are old, disabled or have a long-term illness, are less able to cope with floods than others. Some people may have difficulty in replacing household items damaged in a flood and may lack the financial means to recover and maintain acceptable living conditions after a flood. The proposed relief scheme will have a long-term significant positive impact.

Employment and Investment

The flood relief scheme will provide increased protection to residential and commercial premises and businesses in Blackpool and surrounding areas. This will be likely to encourage future inward investment in the area, creating further employment and a stronger local ecomony. The proposed relief scheme will provide a long-term significant positive impact.

Land-use

The construction of culverts over sections of the river will result in increased land area to use for recreational purposes. This will have a long-term slight positive impact.

Tourism

The operational phase of the proposed development will have **no negative impact** on tourism in the area.

Property Values

The flood relief scheme will provide increased protection to residential and commercial premises in Blackpool and surrounding areas. This will be likely to increase the value of properties in the area. **The proposed scheme will provide a long-term significant positive impact**.

4.5 CUMULATIVE IMPACT ASSESSMENT

For the assessment of cumulative impacts, any other existing, permitted or proposed developments have been considered where they had the potential to generate a significant in-combination or cumulative impact with the proposed River Bride (Blackpool) Certified Drainage Scheme. The impacts with the potential to have cumulative impacts on human beings, in particular noise, traffic and visual impacts are addressed in the relevant chapters. Projects that were included in the Cumulative Impact Assessment for Population and Human Health included:

- Proposed Monard residential/commercial development (including the associated proposed infrastructure for water supply, wastewater treatment, transport, etc.)
- Proposed Cork City northern ring road
- Permitted development of the old Sunbeam factory in Blackpool
- Greater Lower Lee (Cork City) Drainage Scheme
- Existing commercial agricultural facilities and practices
- Numerous small scale proposed, permitted and existing developments (e.g. single house, commercial units, agriculture, etc.)

Employment and Economic Activity

The proposed development in combination with the greater Lower Lee (Cork City) Drainage Scheme will contribute to short term employment during the construction stages and provide the potential for increased long-term employment from existing and future development/activities as a result of the flood protection offered to these areas. This results in a long-term significant positive impact. The other projects as described above also have the potential to provide employment in the short term.

Tourism

As standalone projects or cumulatively, the construction phase of projects will have a short-term slight to moderate negative impact on tourism as nuisance from construction traffic is unavoidable. However, the permanent flood protection offered to tourist attractions in the area will have a long-term slight to moderate positive impact, as they will not need to close down for repairs after flood events. Phased development will be employed to allow for construction traffic to be managed and to minimise the volume of construction traffic using the road network at any one time. There will be a short-term slight negative residual impact on tourism.

Health and Safety

The proposed development, in combination with the greater Lower Lee (Cork City) Drainage Scheme will have a long-term significant positive impact in terms of health and safety for reasons discussed in Section 4.6.3.1 above.

Property Values

The proposed flood relief scheme in combination with the proposed Lower Lee (Cork City) Drainage Scheme will provide increased protection to residential and commercial premises in Blackpool and many other parts of the wider Cork City area. This will be likely to increase the value of properties in the area. A long-term significant positive cumulative impact is anticipated.

5. BIODIVERSITY, FLORA AND FAUNA

5.1 INTRODUCTION

The term biodiversity (Biological diversity) relates to the richness of life and the diverse patterns its forms. The Convention on Biological Diversity (CBD) defines biological diversity as 'the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems'

This section of the Environmental Impact Assessment Report (EIAR) describes the potential impacts of the proposed River Bride (Blackpool) Certified Drainage Scheme on Biodiversity including flora and fauna and has been completed in accordance with the following guidance documents:

- Environmental Protection Agency (2000). Guidelines on Information to be contained in Environmental Impact Statements.
- Environmental Protection Agency (Aug 2017). Guidelines on Information to be contained in Environmental Impact Assessment Reports DRAFT.
- Chartered Institute of Ecology and Environmental Management (CIEEM) (2006). Guidelines for Ecological Impact Assessment.
- Chartered Institute of Ecological and Environmental Management (CIEEM) (2012). Preliminary Ecological Appraisal.
- Fossitt JA (2000). A Guide to Habitats in Ireland.
- The Heritage Council (2011) Habitat Survey Guidelines: A Standard Methodology for Habitat Survey and Mapping in Ireland.

5.2 METHODOLOGY AND LIMITATIONS

5.2.1 Desk Study

The study area for this chapter encompasses three major water courses namely the Bride (North), the Glenamought River and the Glen River (see Figure 5.1) located at Blackpool, Cork City. The total catchment area upstream of Blackpool is c 40km².

A desk study was undertaken to determine the proximity of the project to designated areas of conservation utilising the National Parks and Wildlife Service (NPWS) website database. Site synopses, conservation objectives, conservation management plans, site reports etc. were reviewed to identify qualifying interests of relevant sites. The NPWS database and Biodiversity Ireland database were also consulted regarding the occurrence of protected species of flora and fauna in the vicinity of the proposed scheme. Consultations were carried out with the NPWS and Inland Fisheries Ireland (IFI) requesting information on protected species and habitats within the study area as well as comments on the proposed project in relation to survey, assessment and specific mitigation requirements. A review of aerial photography over the entire study was undertaken to prepare a preliminary habitat map and to identify potential ecologically important habitats. The review also aimed to determine the proximity of the proposed drainage scheme to ecologically important sites in the general vicinity that may be subject to indirect impacts through severance of connecting corridors, pollution run-off during construction, etc. Existing sources of information and records on ecological interests were sourced and reviewed.





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5.2.2 Field Survey

Following on from the desk study, a series of site surveys were undertaken of the study area, during which habitat mapping was undertaken and the suitability of the works area to support plants, animals or habitats of note was considered. All watercourses within 25m of the proposed works areas were examined with a view to determining presence of species of note and potential ecological risks associated with the proposed drainage scheme. The flora was surveyed through direct observation on-site and the habitats were classified initially from aerial photographs and subsequently ground-truthed at the site. Fauna were surveyed through direct observation of bird and mammal species or of their signs and calls.

A number of site specific targeted surveys were carried out following consultation with NPWS and IFI for the following: bats, otter, kingfisher, floating river vegetation, fish species and Japanese knotweed and other invasive plant species. A summary of the field surveys completed to date is presented in Table 5.1 below.

5.2.3 Otter Camera Survey

A detailed walkover survey and subsequent Cameral Survey of Otter was carried out on the River Bride between late June and October 2016 under licence (Section 9 & 23 (6) b of the Wildlife Act 1976 to 2012. Six cameras were positioned at strategic locations along the river (following on from walkover surveys). Cameras were positions in order to assess the potential for impact of the proposed culvert of the lower River Bride. Cameras were typically positioned along identified animal trails, ledges and resting areas. The number of camera triggers indicate the frequency of use of specific zones of the river.

Table 5.1: Targeted surveys undertaken along the River Bride (North) and Glenamought

Survey Type	Dates of Survey
Windshield habitat survey	18 th June 2013
Walkover Survey /Habitat mapping	April/May 2014, April 2015, September 2017
Invasive species survey	August-September 2014
Otter Survey (including camera surveys)	October/November 2014, April-October 2015, November 2016, September 2017
Kingfisher Survey	August — October (end) 2014, May-June 2015, September 2017
Electrofishing Survey	September 2014
Floating River Vegetation Survey	August and September 2014, June 2015.
Fisheries Habitat and Enhancement Suitability Survey	February and April 2016
Otter Survey to inform derogation license	March and April 2018

In addition to the surveys carried out for this scheme an Invasive Species Management Plan was been put in place by the OPW for the Rivers Bride and Glenamought in Blackpool. The information from this management plan has been used to inform this assessment.

5.2.4 Designated Areas in the Vicinity of the Study Area

The NPWS publish synopses of the information regarding areas designated for conservation.

5.2.4.1 Natura 2000 Sites

Screening for Appropriate Assessment (AA) under Article 6(3) of the EU Habitats Directive has been completed and is included in Appendix 5D. The following summarises the information from the AA Screening Document. The nearest Natura 2000 sites (cSAC's or SPA's) are:

- Great Island Channel SAC (Site Code:004219)
- Cork Harbour SPA (Site Code 004030)

These designated areas are located within 15km of the proposed River Bride (Blackpool) Certified Drainage Scheme and therefore require screening for Appropriate Assessment.

Cork Harbour SPA is located >5km downstream of the works area. Cork Harbour is a large, sheltered bay system, with several river estuaries - principally those of the Rivers Lee, Douglas, Owenboy and Owennacurra. The SPA site comprises most of the main intertidal areas of Cork Harbour with the following species designated as conservation interest: Little Grebe, Great Crested Grebe, Cormorant, Grey Heron,

Shelduck, Wigeon, Teal, Pintail, Shoveler, Red-breasted Merganser, Oystercatcher, Golden Plover, Grey Plover, Lapwing, Dunlin, Blacktailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Black-headed Gull, Common Gull, Lesser Black-backed Gull and Common Tern. Cork Harbour is an internationally important wetland site, regularly supporting in excess of 20,000 wintering waterfowl, for which it is amongst the top five sites in the country (NPWS, 2008).

The Great Island Channel SAC is located >10km downstream of the works area. It stretches from Little Island to Middleton, with its southern boundary being formed by Great Island. The site is a Special Area of Conservation (SAC) selected for the following habitats:

- [1140] Tidal Mudflats and Sandflats
- [1330] Atlantic Salt Meadows

The Appropriate Assessment screening concluded that impacts on the Great Channel Island SAC and Cork Harbour SPA could be precluded on the basis of their distance (>5km downstream) from the proposed Drainage Scheme at Blackpool and the nature and scale of the proposed works, its design and mitigation measures.

5.2.4.2 Other Designated Sites

There are no NHAs or pNHAs within the works area. The closest pNHA's are located either downstream at a distance > 5km, i.e. Dunkettle Shore pNHA, Douglas River Estuary pNHA and Glanmire Wood pNHA, are located upstream a distance of >5km, i.e. Lee Valley pNHA or have no surface water links, i.e. Cork Lough pNHA. Given the distance of these pNHAs from the works area and considering the nature and scale of the works, there is no potential pathway for negative impacts on these pNHAs.

5.2.5 Non-Designated Features of Ecological Interest

5.2.5.1 River Lee and Tributaries

The Bride River North is a tributary of the River Lee and the proposed works for the River Bride (Blackpool) Certified Drainage Scheme are located less than 1km upstream of the River Lee. The River Lee with a catchment area of approximately 2000 km², rises in the Shehy Mountains on the western border of County Cork and flows eastwards through Cork City and flows into the sea at Cork Harbour.

Outside of the Gearagh to the west and the coastal transitional habitats of Great Island SAC and Cork Harbour SPA to the east, the aquatic habitats of the River Lee within the Study Area are not designated for nature conservation purposes

The River Lee main channel from source to Cork City waterworks at Lee Road is a designated salmonid fishery under the EC (Quality of Salmonid Waters) Regulations of 1988 (SI 84 of 1988), implementing the Freshwater Fish Directive (78/659/EEC).

In addition to Atlantic salmon, the river and its larger 1st order tributaries, supports a number of other Annex Il water dependant species, Annex I habitats and Annex I bird species and features of ecological interest.

The Lees is known to contain populations of brown trout, lamprey, European eel. While the River Bride (North) is known to have poor water quality and has been extensively culverted it is likely to support some Annex II species which move upstream on the tributaries to more suitable habitats in particular during winter floods.

The entire length of the River Lee and its tributaries including the River Bride (North) provide suitable foraging/commuting corridors for otter. Otter holts are not known from within the environs of the city and its 1st order tributaries. A survey by IWT (2012) to evaluate the Otter population in the inner city and the adjacent suburban areas identified a minimum population of 11 No. otters in the city area.

Ranunculus vegetation which corresponds to the Annex I habitat 'Watercourses of Plain to Montane Levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260]' is also known to present within the River Lee. The largest intact populations of Ranunculus vegetation are present on the River Lee main channel with smaller more localised populations recorded in the smaller 1st order tributaries e.g. the Bride River North, the Glen River, the Glenamought River and the Ballincolly Stream.

Many of the stone walls in Cork City support a diverse array of species including two listed under the Flora (Protection) Order, 1999, i.e. Roundleaved Cranesbill and Little Robin. These are listed as nationally 'Vulnerable' in the Irish Red Data Book. Little Robin is only known from walls and waste ground in Cork City and in Dungarvan Co Waterford. Roundleaved Cranesbill is found in very few sites in Ireland, one of which is waste ground areas around the city, where it has been recorded in greater numbers than at any of its other sites in Dublin and Wexford (Cork City Council, 2009). These species are absent from the River Bride (North) and its tributaries.

According to (Cork City Council, 2009) the River Lee running west from the City to the Lee Fields is an excellent area for bats. Natterer's and Whiskered Bat have also been recorded in the environs the City (e.g. around Glanmire and may also occur in the more wooded areas along the Lee Road, Leemount and along the River Shournagh. There are no records for the River Bride (North) and the associated study area.

The Annex I bird species Kingfisher (Alcedo atthis) is known to occur on the River Lee along with Irish Dipper (Cinclus hibernicus). The River Lee supports a number of bird species of Special Conservation Interest listed for the coastal marine habitats of Cork Harbour SPA e.g. Cormorant (Phalacrocorax carbo) and Grey Heron (Ardea cinerea).

5.2.6 Flora

2.2.6.1 New Flora Atlas

A search was made in the New Atlas of the British & Irish Flora (Preston et al., 2002) to find which rare or unusual plant species had been recorded in the 10 km squares in which the River Bride (Blackpool) Certified Drainage Scheme is located (W67, W77). In addition, the NPWS records of protected species in the area of the proposed development were obtained for the relevant 10 km squares. 7 No. species protected under the Flora Protection Order, were recorded in these 10km squares. These species are listed below together with their record period data (Preston et al., 2002) and habitat requirements (Webb, 2012).

- Meadow Barley (Hordeum secalinum). Records from pre 1970 and 1987-1999. Upper parts of brackish marshes.
- Small Cudweed (Logfia minima). Records from pre 1970 and 1987-1999. Sandy and gravelly places.
- Rough Poppy (Papaver hybridum). Records from pre 1970. Sandy fields.
- Pennyroyal (Mentha pulegium). Records from pre 1970 and 1987-1999. Damp, sandy places. (W76)
- Lesser Snapdragon (Misopates orontium). Records from pre 1970 and 1987-1999. Arable fields.

- Meadow Saxifrage (Saxifraga granulata). Records from pre 1970. Sandhills and pastures.
- Annual Knawel (Scleranthus annuus). Records from pre 1970. Waste places and roadsides on dry, sandy soils

5.2.6.2 NPWS Records of Protected Species

The NPWS records of protected species in the area of the proposed development were obtained for the relevant 10 km squares. There were records for an additional 2 No. species listed under the Flora Protection Order. These species are listed below together with their record period (as listed on the NPWS database) and habitat requirements (Webb, 2012).

- Wood small-reed (Calamagrostis epigejos). Record from 2012. Damp rocky places in west and north.
- Red Hemp Nettle (Galeopsis angustifolia). Record from 1856. Calcareous gravels, especially on eskers.

The NPWS database also contained records for a number of rare plant species not protected under the Flora Protection Order. The species together with their status on the Irish Red Data List of Vascular Plants (Curtis and McGough 1988) are listed below:

- Musk Thistle (Carduus nutans), Data Deficient (dd). Pastures, heaths and roadsides.
- Little Robin (Geranium purpureum) Endangered (E). Formerly protected under 1980 FPO. Rocks and walls.
- Henbane (Hyoscyamus niger). Vulnerable (V). Sandy or stony shores.
- Greater Broomrape (Orobanche rapum-genistae). Vulnerable (V) Rare (R). Formerly protected under 1980 FPO.
- Heath Cudweed (Gnaphalium sylvaticum). Records from 1844 and 1897. Vulnerable (V) Upland pastures and damp, sandy places.

5.2.6.3 Bryophytes

According to the NPWS Rare and Protected Species Records there are 2 No. records for Hasselquist's Hyssop (*Entosthodon fascicularis*), listed as Near Threatened (NT) in the Ireland Red List No. 8: Bryophytes (Lockhart et al. 2012) from the 10km Grid Square W77. There are 3 No. records for Tufted Feather-Moss (*Scleropodium cespitans*), listed as Near Threatened (NT) in the Irish Red List of Bryophytes, from the 10km Grid Square W67.

5.2.7 Fish and Shellfish

5.2.7.1 Freshwater Pearl Mussel

According to the NPWS rare and protected species database there are historical (1903) records for Freshwater Pearl Mussel (Margaritifera margaritifera) from the 10km Grid Squares W67. Post 1987 records are for dead shells only. Freshwater Pearl Mussel is listed on Annex II of the EU Habitats Directive. The works in Blackpool, Ballyvollane and Glenamought are not located within a Margaritifera sensitive area.

5.2.7.2 Lamprey

According to the NPWS Rare and Protected Species Records and the National Biodiversity Data Centre there are records for brook lamprey (*Lampetra planeri*) from the 10km Grid Squares W66 and W67. There

are records for sea lamprey (*Petromyzon marinus*) from the 10km Grid Square W67. Fish stock surveys carried out in the River Lee in 2013 as part of the Water Framework Directive recorded lamprey sp. present in the River Lee. All three-lamprey species are listed on Annex II of the EU Habitats Directive.

5.2.7.3 Atlantic Salmon

According to the NPWS Rare and Protected Species Records there is 1 No. record for Atlantic salmon (Salmo salar) from the 10km Grid Square W67. The River Lee catchment is classified as an important system for Atlantic salmon (Salmo salar). Atlantic salmon was recorded from the River Lee in 2013 during fish stock surveys undertaken as part of the Water Framework Directive. Atlantic salmon is listed on Annex II of the EU Habitats Directive.

5.2.7.4 European Eel

According to the National Biodiversity Data Centre (2014) there are records for European eel (Anguilla anguilla) from the 10km Grid Square W67. European eel was recorded from the River Lee in 2013 during fish stock surveys undertaken as part of the Water Framework Directive.

5.2.7.5 Brown Trout

Brown trout was recorded from the River Lee in 2013 during fish stock surveys undertaken as part of the Water Framework Directive.

5.2.8 Birds

The Atlas of Breeding Birds in Britain and Ireland' (Sharrock, 1976), 'The New Atlas of Breeding Birds in Britain and Ireland: 1988-1991' (Gibbons et al., 1993) and 'The Atlas of Wintering Birds in Britain and Ireland' (Lack, 1986) were consulted for information regarding the distribution of birds in Ireland. These atlases show data for breeding and wintering birds respectively in individual 10 km by 10 km squares. However, it should be noted that, for some species at least, more recent work has been carried out. Table 5.2 shows those species found in the relevant 10 km squares, W67 and W77 that are recorded in the Breeding Birds Atlases and are also protected under the EU Birds Directive or mentioned on the Birds of Conservation Concern in Ireland (BoCCI) red list. Birds listed under Annex I are offered special protection by the EU Birds Directive.

Common Name	Scientific Name	Breeding Atlas 68- 72	Breeding Atlas 88- 91	Annex I	BoCCI red list
Hen Harrier	Circus cyaneus			Yes	No
Peregrine	Falco peregrinus			Yes	No
Corncrake	Crex crex		x	Yes	Yes
Kingfisher	Alcedo atthis			Yes	No
Merlin	Falco columbarius			Yes	No

able 5.2 Breeding	<mark>, Bird Atla</mark> s	Data	(W67,	W77)
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River Bride (Blackpool) Certified Drainage Scheme

RYAN HANLEY in association with

Common Name	Scientific Name	Breeding Atlas 68- 72	Breeding Atlas 88- 91	Annex I	BoCCI red list
Dunlin	Caladris alpina	Х		Yes	No
Common Tern	Sterna hirundo		x	Yes	Yes

Seven species listed in Annex I of the EU Birds Directive have been recorded as breeding within the relevant 10km squares, in the Atlases of Breeding Birds; Hen Harrier (*Circus cyaneus*), Peregrine (*Falco peregrinus*), Corncrake (*Crex crex*), Kingfisher (*Alcedo atthis*), Merlin (*Falco columbarius*), Dunlin (*Calidris alpine*) and Common Tern (*Sterna hirundo*). The River Lee itself is known to support kingfisher throughout its length. There is no data relating to the presence of Kingfisher on the Bride River North.

In terms of wintering birds, Table 5.3 shows those species found in the 10 km squares W67 and W77 that are recorded in the Atlas of Wintering Birds in Britain and Ireland 1988-91 and are also protected under the EU Birds Directive or mentioned on the Birds of Conservation Concern in Ireland (BoCCI) red list.

Common Name	Scientific Name	Annex I	BOCCI red list
Whooper Swan	Cygnus cygnus	Yes	No
Kingfisher	Alcedo atthis	Yes	No
Lapwing	Vanellus vanellus	No	Yes
Curlew	Numenius arquata	No	Yes
Herring Gull	Larus argentatus	No	Yes
Blackheaded Gull	Larus ridibundus	No	Yes
Yellowhammer	Emberiza citrinella	No	Yes
Dunlin	Caladris alpina	Yes	No
Shoveler	Anas clypeata	No	Yes
Pintail	Anas acuta	No	Yes
Knot	Caladris canutus	No	Yes

Table 5.3 Wintering Bird Atlas Data

Three birds recorded as wintering in the relevant 10km square are protected under Annex I of the EU Habitats Directive, namely, Whooper Swan, Dunlin and Kingfisher. Whooper Swan winter on large waterbodies and the surrounding grasslands. They are a Special Interest Feature for The Gearagh SPA and are known to occur at Inniscarra Reservoir and The Gearagh. Their distribution does not extend to the River

Bride (Blackpool) Certified Drainage Scheme. Kingfisher winter in similar habitats to their summer habitats and are also known to occur within the area. Dunlin are common along all coastal areas - especially on tidal mudflats and estuaries.

A further eight birds that are listed on the BoCCI Red list were recorded in the atlas as wintering in the area. These were Lapwing, Pintail, Curlew, Yellowhammer, Knot, Shoveler, Black Headed Gull and Herring Gull. Lapwing winter on farmland and flat coastal areas. Curlew Shoveler and Knot winter on mudflats and adjacent fields. In winter, Pintail form large flocks on brackish coastal lagoons, in estuaries and on large inland lakes. Yellowhammer winter on agricultural land, with adjacent scrub. Black Headed Gull winter on a variety of habitats and Herring Gull winters on lakes, estuaries and open fields. All the above species are potentially found at the locations of the proposed works.

5.2.8.1 NBDC records

In addition to the above bird species, there are also records for Annex I bird species Red-billed Chough (*Pyrrhocorax pyrrhocorax*) and Short-eared Owl (*Asio flammeus*) from the 10km Grid Squares which overlap with the footprint of the proposed works.

5.2.9 Mammals

5.2.9.1 Otter

According to the NPWS Rare and Protected Species Records there are records of the European Otter (*Lutra lutra*) from the 10km Grid Squares W67which overlaps with the footprint of the proposed works.

The Cork Urban Otter Survey was conducted between 2011 and 2012 identified a minimum population of 11 otters in the city area. Otter records are abundant from the County Hall Salmon Weir on the River Lee (Carrigrohane) downstream on both the north and south channels as far as the port of Cork. The majority of the records available are of otter scats recorded during the Cork City Urban Otter Survey while a small number of visual records have also been submitted (NBDC, 2014). Otter scat was recorded on the River Bride (North), scat concentrated from two areas at Blackstone Bridge (north of Fair Hill) and east of Faranree on the Commons road.

5.2.9.2 Bats

According to the National Biodiversity Data Centre (2014) there are records for Common Pipistrelle (*Pipistrellus pipistrellus*), Soprano Pipistrelle (*Pipistrellus pygmaeus*), Daubenton's Bat (Myotis daubentoni), Leisler's Bat (Nyctalus leisleri), Natterer's Bat (Myotis nattereri) and Brown Long-eared Bat (Plecotus auritus) from the 10km Grid Squares overlapping within the footprint of the proposed works.

5.2.9.3 Harbour Seal and Grey Seal

There are records for harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) from the 10km Grid Square W67. The overall conservation status of both species has been assessed as 'Favourable' (NPWS 2013b).

5.2.10 Water Quality

The EPA website, <u>http://gis.epa.ie/Envision</u>, contains information regarding water quality in selected Irish rivers based on surveys carried out by the EPA as part of the Water Framework Directive (WFD) <u>Monitoring Programme</u>. Biological information is provided in the form of Q values. The River Bride (North), the Glenamought River and the Glen River do not have any monitored points within the study area, therefore no EPA monitoring data was available for the Bride (North), Glenamought River or the Glen River.

The closest EPA monitoring point on the River Lee, into which the Bride (North) flows is at Leemount Bridge, > 5km upstream of the confluence of the River Bride (North) and the River Lee. The water quality status at this monitoring point is Q4 "Good" status. The River Lee, approximately 3km upstream of the confluence of the River Lee and the River Bride (North) has "moderate" status under The River Waterbody Water Framework Directive (2010-2012 monitoring results).

The lower reaches of the River Lee, into which the Bride (North) is a transitional coastal waterbody, i.e. the Lee (Cork) Estuary Upper. The Lee (Cork) Estuary Upper Transitional Waterbody and the Lee (Cork) Estuary Lower Transitional WaterTransitional Waterbody, which lies downstream of the confluence both have "moderate" status under the Transitional Waterbody Water Framework Directive Status (2010-2012 monitoring results).

5.3 FIELD SURVEYS

The wider study area was first visited on the 18th June 2013. During this visit, the general habitat types within the Study Area were observed and photographed. The purpose of this was to observe the habitats in the area first hand and to ground truth the findings of the desk study. No detailed floral or faunal surveys were carried out during this visit.

A further and more detailed survey of the River Lee and its tributaries was carried out in April and May 2014 and in April 2015. The survey area included the Bride (North) and a number of smaller rivers including the Glenamought River. The river was systematically walked and each feature (e.g. riffle, pool or glide) was defined visually and mapped using gps technology. These features were then described in terms of substrate conditions, flow path aquatic macrophytes, invertebrate communities and habitat variation and quality. Substrates were classified by particle size and named in accordance with the EPA, Rivers and Streams Ecological Assessment Field Sheet. Surveys of the terrestrial bankside habitats and mammalian and avifaunal activity were also undertaken. Suitability of habitats for Freshwater Pearl Mussel (Margaritifera margaritifera), Lamprey species (Lampetra sp and Petromyzon sp.) and salmonids was also assessed during this survey. A survey of the Glenamought River Bordering Collins residence upstream of Glenamought Bridge was carried out in July 2017 in order to identify biodiversity, habitats and species in the area where additional work was proposed and included in the Scheme.

A number of targeted specialist surveys were carried out between August and November 2014, following consultation with NPWS and again in 2015. Further specialist surveys were carried out to inform fisheries enhancement in 2016 along with otter specific surveys (including camera surveys) in November 2016 and March and April of 2018 (refer to Table 5.1 for details of these surveys). General mammals and bird surveys were included in the July 2017 survey for additional works locations upstream of Glenamought Bridge.

5.3.1 Habitats and Flora

The study area for this drainage scheme is the rivers Bride (North) and Glenamought in the Blackpool area (Figure 5.1) of Cork City. The ecological character of the study is described below in terms the habitats (as per Fossitt, 2000) present within and adjacent to the footprint of the proposed works. Where habitats are found to have links to or correspond to Annex I habitat the habitats are described in accordance with EC (2007). The habitats within the study area along the Bride (North) and the lower reaches of the Glenamought River to just upstream of the Glenamought Bridge are described below.

5.3.1.1 Glenamought River

The Glenamought is rural in nature, a number of works are proposed in the following areas:

Upstream and downstream of the Glenamought Bridge

The Glenamought flows through rural areas for much of its length. Small sections of flood defences are proposed along the Glenamought River.

The scheme commences bordering the Collins residence upstream of Glenamought Bridge on the south bank. Amenity GA1 lawn was the predominant habitat adjoining Collins Residence bordering the Glenamought River and overlapping the proposed works. A large stand of invasive scrub (i.e. Japanese knotweed, *Fallopia japonica*) was present overlapping the proposed reinforced concrete wall. This appears to have been treated with herbicide (summer dieback). The river banks on the property side were bounded by a few scattered grey willow *Salix cinerea sp. oleifolia* and existing retaining wall structures, being largely open particularly on the downstream side of the property. To the south of the property on the valley escarpment, broadleaved woodland of sycamore Acer pseudoplatanus and ash Fraxinus excelsior was present with a dense scrub understory of bramble Rubus fruticosus L. reducing any potential for a diverse ground flora. The woodland was bounded to the south with adjoining improved agricultural grassland and European gorse *Ulex Europaeus* scrub.

The Glenamought River immediately downstream of Glenamought Bridge (in the upper part of the study area) was covered by dense scrub habitat, namely extensive butterbur *Petasites hybridus* and bramble, interspersed with occasional grey willow (sally willow). Further downstream alder *Alnus glutinosa*, ash, grey willow and snowberry *Symphoricarpos albus* were common interspersed with dense scrub vegetation.

Glen Distillery Business Park (O'Sheas Buildings), Kilnap and the Glenamought River on the southern bank

An old stone wall, that extended the full area overlapping the proposed replacement flood retaining walls (2 structures proposed) contained a good diversity of plants. Common species present include ivy leaved toadflax Cymbalaria muralis, ivy Hedera helix, navelwort Umbilicus rupestris, Hart's-tongue Asplenium scolopendrium, sycamore whips and bracken Pteridium aquilinum. Opposite-golden leaved saxifrage Chrysosplenium oppositifolium and the liverwort Marchantia polymorpha were present as defining species near the waterline at the base of the wall. One patch of woodruff Galium odoratum, a species associated with ancient woodlands was also found present on the old stone wall structure adjoining the O' Shea's property.

The north bank of the Glenamought River opposite the Glen Distillery Business Park, contained a parcel of land with ash-alder woodland and open patches of scrub habitat. Ash *Fraxinus excelsior* and lesser amounts of alder were frequent in the canopy of the woodland with smaller quantities of sycamore. Scrub under the canopy and in adjoining open areas. Common laurel *Prunus laurocerasus* encroachment and snowberry *Symphoricarpos albus* were prominent species on the north bank west of the Glen Distillery Business Park. The adjoining scrub habitat contained hemlock water dropwort Oenanthe crocata, yellow flag *Iris pseudacorus,* meadow sweet *Filipendula ulmaria*, false oat grass *Arrhenatherum elatius*, hogweed *Heracleum sphondylium,* bind weed Convolvulus arvensis, cocks foot Dactylis glomerata, bush vetch Vicia sepium and common valerian Valeriana officinalis.

Upstream of Kilnap Bridge

A proposed access track is required to facilitate an instream roughing screen upstream of Kilnap Bridge. The access track traverses through infrequently grazed improved grassland situated on the south bank of the Glenamought River between Kilnap Bridge, Kilnap Viaduct and the Old Mallow Road. The alignment of the access track fringes mixed broad-leaved woodland habitat (located south of the access track on the valley escarpments). To the east of Glenamought Bridge the woodland comprises mainly sycamore, Leylandii cypress *Cupressess x leylandii* and laurel. West of the Glenamought Bridge the broadleaved woodland was more sycamore dominated and west of the nearby Kilnap Viaduct ash became very frequent in the canopy. The understories of the woodland blocks were however, heavily encroached by laurel and bramble scrub. More open areas contained species such as sweet briar *Rosa rubiginosa*, wood avens, ivy *Hedera helix* and enchanter's-nightshade Circaea lutetiana.

In the area between the woodland situated on the southern Glenamought Valley escarpment, and the Glenamought River, a flat area of the valley contained comprises dry grassy meadow areas containing cock's foot, Yorkshire fog *Holcus lanatus*, hogweed, meadow buttercup *Ranunculus acris*, field bindweed and nettle *Urtrica dioica*. The GS2 fields bounding the Glenamought River were fringed with clusters of mature riparian grey willow and ash.

Woodpark

The proposed works at Woodpark include the construction of a reinforced concrete flood wall adjoining two flood defence embankments either side of the residential property situated on the south bank of the river downstream of the Kilnap Viaduct.

The river bank at this location (south bank of the Glenamought River) had a few scattered ash and sycamore trees but was largely open and comprising amenity grassland lawn. Japanese knotweed had been recently sprayed and the species overlapped the works area but growth was much more extensive downstream of the residential property and flood wall. There was evidence of die back of the knotweed stands likely due to Glyphosate spraying as the adjoining grass was burnt off, exposing adjacent bare soil. The south bank of the river was shaded by the presence of mixed broadleaved woodland on the opposite north bank. This woodland included sycamore, ash, wych elm *Ulmus glabra* and very heavy laurel encroachment.

Sweeney's Hill

The Glenamought River immediately north of the North Point Business Park borders amenity gardens associated with domestic properties and is traversed by a small road bridge access point to Woodpark. There are proposals to add a new sewer in this area, in addition to other existing flood relief infrastructural proposals.

The Glenamought river margins contained false oat grass, butterbur, meadowsweet, reed canary grass *Phalaris arundinacea* and hemlock water dropwort. The scrubby margins of the river graded into amenity lawns with perennial rye grass *Lolium perenne* and daisy *Bellis perennis*. Japanese knotweed stands were evident on the riverbanks upstream of the bridge crossing covering a long linear strip of the south bank of the river.

Downstream of Glenamought Viaduct on the Mallow Road

The river downstream of the Glenamought viaduct on the Mallow Road, where the proposed works are located flows through an area of Mixed broadleaved woodland (WD1), Amenity grassland (GA2) and built land categorised as buildings and artificial surfaces (BL3). The mixed broadleaved woodland consists of a

large area alongside the river on the elevated northern bank and is dominated by mature wych elm, ash, sycamore and cherry laurel close to the river margins. The areas of maintained amenity grassland are associated with private dwellings and business parks. Mature Treelines (WL2) consisting of beech, alder, sycamore and ash are present on both banks of the river close to its confluence with the Bride (North) near the Mallow Road. The river is heavily shaded in parts from species including beech (Fagus sylvatica), sycamore, hawthorn, horse chesnut (Aesculus hippocastanum), willow (Salix spp.), buddleja, Cherry laurel (Prunus laurocerasus).

A 100m (approx. length) strip of invasive Japanese knotweed also present along the southern bank of the river in an area of amenity grassland.

5.3.1.2 Bride (North)

The Bride (North) consists of a number of distinct riparian zones, both semi-urban and urban. The habitats present within the footprint of the proposed works within each section are described below.

Confluence with River Glenamought River to Commons Inn

The upper reaches of the Bride (North), close to its confluence with the Glenamought River and within the vicinity of North Point Business Park are the least urbanised sections of the river, in relation to survey efforts. This section of the river is short and features a riparian zone containing Scrub (WS1) dominated by sally willow (Salix cinerea), ash (Fraxinus excelsior), sycamore (Acer pseudoplatanus), buddleja (Buddleja davidii) and bramble (Rubus fruticosus agg.), with more open grassy areas categorised as Dry meadow and grassy verge (GS2). The grassy areas support a wide range of plants including American willowherb (Epilobium ciliatum), reed canary grass (Phalaris arundinacea), dogwood (localised), field bindweed (Convolvulus arvensis), buddleja (occasional), bramble, travellers joy (Clematis vitalba), common knapweed (Centuarea nigra), dandelion (Taraxacum officinale), nettle (Urtica dioica), meadow buttercup (Ranunculus acris), cocksfoot (Dactylis glomerata), false oat grass (Arrhenatherum elatius), yorkshire fog (Holcus lanatus) & wild carrot (Daucus carota). In damper margins adjacent to the river water pepper, water horsetail, marsh woundwort, meadowsweet (Filipendula ulmaria) and marsh willowherb (Epilobium palustre) are present. Other habitats within this area include amenity grassland (GA2), improved agricultural grassland (GA1), hedgerow (WL1) and buildings and artificial surfaces (BL3). Mature treelines (WL2) are present along this stretch of the river, on the east bank of the river consisting predominantly of ash with sally willow, blackthorn (Prunus spinosa) and immature sycamore, with a scrub understory of bramble, American willowherb (ocassional) and nettle, and bordering Commons Inn site (to the North West), with sessile oak (Quercus petraea) sally willow & apsen (Populus tremula).

Common's Inn to Fitz's Boreen

Downstream of Commons Inn, the river flows through a series of operational and derelict industrial areas and is typically retained by flood walls. Riparian species here are more typical of wasteground, such as buddleja and catsear (*Hypochaeris radicata*). Small patches of reed canary grass and water dropwort (*Oenanthe crocata*) are also present.

Further downstream habitats adjacent to the Bride (North) within the works area include recreational parkland including scattered trees and amenity grassland categorised as scattered trees and parkland (WD5). A small section of mixed broadleaved woodland (WD1) is also present on the western bank of the river to the south of Common's Inn. The woodland is located on high ground and the main species include sally willow, downy birch (Betula pubescens), rowan (Sorbus aucuparia) and ash.

Scrub (WS1) is present on the eastern bank of the river. Narrow strips of dry meadow and grassy verge (GS2) with nettle, reed canary grass, American willowherb and meadowsweet, water pepper (*Persicaria hydropiper*), marsh woundwort (*Stachys palustris*) and water horsetail (*Equisetum fluviatile*), and mature treelines (WL2) of sally willow and alder (*Alnus glutinosa*) are also present along the river within this section.

Fitz's Boreen to Blackpool Retail Park

This section of the Bride (North) is heavily industrialised and flows through largely built areas categorised as buildings and artificial surfaces (BL3). A narrow strip of dry meadow and grassy verge (GS2) is present on the river margin of the eastern bank which is bordered by flood walls. Species include nettle, reed canary grass, American willowherb and meadowsweet. Short treelines (WL2) of sally willow and alder are also present along the river banks within this section on the eastern and western banks of the channel. A Japanese knotweed stand (approx 10m long) is present along the treeline on the eastern bank of the river close to Sunbeam Industrial Estate.

The Bride (North) downstream of the culvert at Millfield Industrial Estate flows through and area of scattered trees and parkland (WD5) and amenity grassland (GA2). Narrow strips of amenity grassland within the vicinity of Blackpool Retail Park are interspersed with planted areas of Flower beds and borders (BC4) and ornamental non-native shrub (WS3) along the river banks.

Blackpool Retail Park to Watercourse Road

Downstream of Blackpool retail park the river side habitats consist of mature dense Treelines (WL2) of sally willow, sycamore with ash, alder and occasional cherry laurel, beech, oak, white willow, lime and downy birch ,an area of mown Amenity grassland (GA2), Scattered trees and parkland (WD5) and buildings and artificial surfaces (BL3). Large stands of Japanese knotweed are present along both banks of the river in Orchard Court, close to where the river is culverted underground. The river between Orchard Court and Watercourse Road where the works are located is all culverted underground. This area is largely built land categorised as buildings and artificial surfaces. (BL3)

The full list of habitats within the study area and the works which lie in close proximity to these habitats are listed below. For information on the works refer to Drawings in Appendix 3A, listed in Table 5.4 below.

Habitat	Fossitt Code	Works in close proximity to habitat (refer to Appendix 3A drawings for works details and locations)
Treelines	WL2	C08_L01, C08 E01, C08_B01, C08_B02, C06- E01, C06_L05, C12_L15, C12_L16, C06_B04
Hedgerow	WL1	
Scattered trees and parkland	WD5	C06-E01
Mixed broadleaved woodland	WD1	C08_L02 & C08_L03, C08_R02 C06-C01

Table 5.4 List of habitats within the study area and works in proximity to these habitats

Habitat	Fossitt Code	Works in close proximity to habitat (refer to Appendix 3A drawings for works details and locations)		
Scrub	WS1	C08_L02 & C08_L03 C06-C01		
Dry meadow and grassy verge	GS2	C06_L05, C06_L08, C06_L11, C06_L15, C06_C03		
Amenity grassland	GA2	C08_L01, C08 E01, C08_L04, C08_E02 & C08_E03, C08-B02, C06-E01, C06_E02, C06_L22, C06_LL23, C06_B04		
Agricultural grassland	GA1	C08_R02		
Flower beds and borders	BC4	C06_L22, C06_LL23		
Ornamental non-native shrub	WS3	C06_L22, C06_LL23		
Buildings and artificial surfaces	BL3	All		
Lowland Depositing River	FW2	All, C06-C01(instream), C06_C03 (instream), C06_B04		

A number of non-native species are present along the Glenamought and the Bride (North), including montbretia (Crocosmia x crocosmiiflora), snowberry (Symphoricarpos albus) and the highly invasive Japanese Knotweed. The locations of a number of these species are described in greater detail in Section 5.3.1 below.

No Annex II listed plant species or Flora Protection Order (FPO) species were recorded during the field surveys.

5.3.1.3 Floating River Vegetation

Floating River Vegetation (FRV) habitat is widely distributed throughout the River Lee from Inniscarra Dam to Cork City. Smaller more localised stands of *Ranunculus* sp. with very low cover, *Fontanalis* moss with low cover and *Calitriche* sp. with low cover were present on the River Bride (North) and the Glenamought River. No pondweeds were recorded. While these examples of FRV habitat exist, the percentage cover is low and therefore they are not considered good examples of the habitat. Along the middle reaches of the Bride (North), these stands of FRV alternate along the margins of the river. At Oldcourt, where the river is to be culverted the moss species *Fontinalis antipyretica* (more nutrient tolerant moss) occurs. The Glenamought River in the Kilnap area contained small pockets of Ranunculus vegeation typicaaly between 1 - 5% cover per 100m2 of river habitat upstramof the Viaduct but between 5-10% cover per 100m2 of river given light facilitated growth and was limited or absent as the river becomes canopied (typically upstream of the Glen Distillery Business Park and Glenamought Bridge). The generalist moss species *Fontanalis antipyretica* was

present locally on large cobble and boulder habitat and typically covered 1% by surface area per 100m2 of river habitat. Near Sweeneys Hill the river contained moderately clean spawning gravels and localised *Ranunculus* stands instream.

Within the Bride (North) and Glenamought rivers the Floating River Vegetation was not of Annex I habitat quality given the extent of fragmentation.

5.3.1.4 Invasive Plant Species (See also Appendix 5C)

A targeted invasive plant species survey was carried out to establish the distribution of invasive plants within the footprint of the proposed works. The survey targeted the invasive species Japanese Knotweed (Fallopia japonica), Giant Hogweed (Heracleum mantegazzianum), Giant Rhubarb (Gunnera tinctoria) and Himalayan Balsam (Impatiens glandulifera).

Two invasive species, Japanese knotweed and giant rhubarb, were recorded in the works area for the Blackpool.

Japanese Knotweed was the only invasive species recorded along the Glenamought River channel listed above. It was recorded at four locations in 2015 and in a further three locations in 2017. Two of the stands of Japanese Knotweed identified in 2017 had been treated with herbicide prior to field assessment. The distribution of invasive species along the Bride River (North) and the Glenamought River is shown in Figure 5.2 below.

13 No. records for invasive species were documented along the Bride (North). Japanese knotweed accounted for 12 of the 13 No. records for invasive species recorded along the Bride (North) river channel. A single giant rhubarb plant was also present in the amenity park adjacent to Blackpool Retail Park.

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Fig 5.2: Map showing invasive species recorded along the River Bride (North) and Glenamought River, Blackpool, Cork City carried out as part of OPW Management Plan.

5.3.2 Significance of the Flora

The floating river vegetation within the study area is fragmented and occurs in low frequency. Although floating river vegetation further downstream on the River Lee corresponds to the Annex I Habitat 'Watercourses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation (3260)', floating river vegetation within the Rivers Bride (North) and Glenamought is fragmented, occurs in low frequency and does not have strong links with the Annex I habitat 'Watercourses of plain to montane levels with the Annex I habitat 'Watercourses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation (3260)'. The importance of this habitat within the works area lies predominantly in its association with salmonid fish and invertebrates as it acts as both a food source and a resting habitat.

Mature treelines, hedgerows and areas of scrub provide commuting and foraging corridors for mammals and bat species within in the area and nesting sites for bird species.

No protected plant species (Annex II, IV or FPO) were recorded at any of the locations during the field walkover survey.

The habitats most common and with low botanical significance are those which are either highly modified through agriculture, amenity or urbanization. These habitats include Built land (BL3) improved agricultural grassland (GA1) and Amenity grassland (GA2) located throughout the study area at various locations.

5.3.3 Fauna

5.3.3.1 Birds

All bird species seen or heard during the field surveys were recorded and are shown in Table 5.5. The bird species recorded were typical of the habitats found within the study area.

Kingfisher

A series of targeted kingfisher (Alcedo atthis) surveys were carried out on the Bride River (North) and Glenamought Rivers in order to identify the distribution of kingfishers in the catchment of the flood relief works in the Blackpool area and also to highlight any nesting areas if visible. The survey areas included sections of river channel overlapping the proposed works areas.

Bank walkover surveys were conducted to target areas where suitable nesting bank was located, along with areas containing appropriate riparian resting perches and good prey availability and which overlapped with proposed works areas along the relevant river channels.

Kingfisher was recorded along the Glenamought River, during a bank walkover survey, no kingfisher was identified in the Bride (North).

On the Glenamought River a survey was carried out on the River in 2014 One Kingfisher nest (recently active) was identified east of Kilnap Bridge. An active nest site was identified in a section of steep, relatively open bank composed of soft mud and clay situated amongst an area of riparian scrub (WS1) and mixed woodland (WD1). Two sightings of kingfisher were observed during walkover surveys flying upstream under the Glenamought Viaduct (at the commencement of the scheme) and upstream at Kilnap Bridge. In 2016 and 2017 further survey was carried out on the Glenamought River. A kingfisher nest was found present in an open faced steep muddy embankment upstream of Kilnap Business Park during historical surveys. The embankment containing the nest historically now appeared to have collapsed into the river as a result of flooding. No kingfisher activity was recorded in 2017 despite several walks up and down the river channel in early morning. The status of the species remains dubious as future prospects are considered poor following the discovery of a predated nest site downstream of Glenamought Bridge during September 2014 and no further records since that time.

No kingfisher records (i.e. sightings, feeding observations or nest sites) were obtained from the River Bride (North). The absence of multiple nesting sites can be explained by the lack of suitable bank sides for nest excavation along the rivers. Very little of the banks along the Glenamought were deemed suitable for nesting kingfisher and risk of predation was evident in the form of evidence of mink predation on existing nest sites. The failure to record kingfisher nests along the Bride (North) is reflective of no suitably composed or aligned bank in which to burrow and poor prey availability (the Bride (North) shows a low density of small fish which are preferred prey for Kingfisher).

Other bird species

The Glenamought River adjoining the Collins residence was considered a good feeding area for dipper Cinclus cinclus that were seen flying though this section of the river. Dipper feed on instream invertebrates that are attached to cobble and gravel being a characteristic riparian bird species of spate channel rivers such as the Glenamought. Dipper use the riparian corridor frequently at Woodpark and are often seen. An active dipper nest was recorded in an existing culvert. The nest was attached to old pipes inside the culvert adjoining Millfield Industrial Estate. A second active dipper nest and one grey wagtail nest was observed in large crevices in walls of the culvert immediately downstream of Orchard Court.

Grey wagtail Motacilla cineria are frequently seen at Woodpark perched on instream rocks and woody debris.

No species listed on the Birds of Conservation Concern in Ireland (BoCCI) Red List were recorded during the field surveys.

5.3.3.2 Mammals

The study area was searched for signs of mammal activity with dedicated surveys undertaken for Otter (*Lutra lutra*) and Bats. Potential badger (*Meles meles*) habitat was recorded in the Riparian woodland at the Glenamought Storage Area but no signs were recorded within the study area for the lower Glenamought or the Bride (North) river channels. Other species that are likely to occur in the area but were not recorded include Fox (*Vulpes vulpes*), Rat (*Rattus norvegicus*), Stoat (*Mustela ermina*), European Hedgehog (*Erinaceus europaeus*), Pygmy Shrew (Sorex minutus), and Brown Hare (*Lepus europaeus*).

Otter

The entire length of the River Lee and its first order tributaries offers suitable habitat for Otter (*Lutra lutra*) with ample vegetation for cover along the river banks and likely good fishing within the river. The River Lee and its 1st order tributaries within the city environs are also known to support a population of foraging/commuting Otters. Overall Otter records were more localised or absent in the tributaries of the River Lee, i.e. the Bride (North) and Glenamought, than in the River Lee main channel. In 2014 and 2015 surveys two records in the form of spraints were recorded from the River Bride (North) at Kilnap Bridge and behind the Common's Inn on the N20 (see Figure 5.3). In 2017 surveys of the Glenamought river identified further signs of otter. Otter sprant was recorded at two locations just down stream of Glenamought Bridge (adjoining the area with exaggerated meanders). The presence of otter using this area is likely consequential of the good foraging habitat present. Due to disturbance from properties, dogs and people the habitat adjoining the Collins Residence is considered good for transient foraging but not for breeding or resting. An otter spraint was recorded on instream boulders at the location of the proposed structure C08_L02 and C08_ L03. No otter records were seen again until Kilnap Viaduct. Otter spraint were recorded upstream of Kilnap Bridge near the area proposed for the trash screen installation on large instream boulders.

A walkover survey and subsequent Cameral Survey of Otter was carried out on the River Bride between late June and October 2016.

Otter activity was widespread across the Lower River Bride during the summer and early autumn of 2016. The survey area that was located between the North Point Business Park and the Heineken Brewery in Blackpool encountered numerous sprainting sites with 1 holt site and numerous couch sites. One area of special note was a 'dig site' where multiple otter latrines were located. This area of the River Bride immediately south of the West Link Business Park was situated in an area of marsh and willow trees where sand and mud accumulations provided digging substrata for otter. These areas have not been documented widely in the literature as very little is known about them. However, they appear to be used by more than one otter and have much higher densities of marking via latrines and associated spraints given evident accumulations of such otter signs concentrated at 'dig areas'. In association with the dig area two regularly used otter 'couches' or resting areas were identified, indicating that this area is frequently utilised by otter.

Further east (downstream) on the catchment (i.e. east of the Commons Inn), regular otter signs in the form of sprainting and resting areas were identified. The abundant scrub, dry meadow habitat and mature treelines that formed a habitat mosaic in this area provided excellent cover for otter coupled with good salmonid densities as observed from the shoals of fish seen in pools.

Further downstream of the North Point Business Park, through the Sunbeam area the channel of the Bride becomes channelized and held between retaining walls with limited riparian habitat. At the area of the River Bride immediately north and adjacent to the Millfield Industrial Estate two number culvert systems are situated where regular sprainting and otter activity was observed. The existing culverts have built in concrete ledges that provide important trackways for otter. Indeed, further downstream at Dunnes Stores two existing bridge culverts also have concreted ledges that are also regular otter sprainting sites. To the south of this area the river is to be culverted as far downstream as Orchard Court inclusive of the small open area at Blackpool Church. One couch area was identified under scrub adjoining domestic gardens north of Orchard Court with intermittent sprainting sites bordering the area to be culverted. The river in this area is heavily infested with Japanese Knotweed but remains a moderate quality salmonid holding area. In the last open section of the River Bride before it becomes extensively culverted in Blackpool, a known breeding holt exists. An otter couch was also present at the opening of the downstream connecting culvert system. This area has a very high density of brown rat that are known to be an important prey item of otter.

Camera traps were positioned at strategic locations. The frequency of triggers and the animal type responsible for the triggers are summarised on Table 3.1 below. The highest frequency of triggers for otter was captured at Camera 1 at the Millflield Industrial Estate. Here two sub adult otters were frequently utilising a couch site created by a debris dam under the culvert structure. They were identified as sub adults given their relative size comparable to adults captured on the river. These two otters regularly utilised this section of the river and areas upstream. Further downstream an adult male otter was detected frequently at Dunnes Stores.

Occasional triggers were detected in the Orchard Court area but these were animals on the move with no stationary triggers. Interestingly camera C5 in the culvert system immediately downstream of Orhcard court (near Blackpool Church) did not detect any otter activity despite being situated for 12 weeks in the culvert while further downstream at the Heineken Brewery activity was much more heightened with a mother (Female adult) and sub adult otter frequenting this area particularly late in the season. These animals did not appear to venture upstream and moved between the culvert system adjoining the River Lee to the River Bride (refer to camera C8). It is thought that these animals are not crossing into the territory of other otters living upstream (i.e. Orchard Court and further upstream).

The area of the Brewery had a very high density of brown rat and this likely accounted for the mother and sub adult otter foraging in this area given the heavily polluted water at this point with no evident fish stocks. It is likely that the mother otter and sub-adult otter utilise the River Lee as their main habitat given the short area of foraging habitat that they were detected in near the Heineken Brewery. This was considered given the absence of camera triggers in the upstream culverted area near Blackpool Church (i.e. camera C5). It would seem probable that these otters may move between the Lee and the River Bride given their detection in the culvert network connecting the Lee and the River Bride (i.e. last 800m where extensive culverting exists).

Camera Numbers	Area	Number of Camera Triggers	Animal Detected (number of triggers in parenthesis)
Camera 1	Culvert, Millfield Industrial Estate	56	Otter (31); Dipper (5); Grey Wagtail (1); Rat (8); Mouse (11)
Camera 2	Dunnes Stores, Culvert	27	Otter (21); Rat (1); Heron (5)
Camera 3	Orchard Court	14	Otter (5); Mouse (3); Domestic Cat (6)
Camera 4	Orchard Court	6	Otter (6)
Camera 5	Culvert south of Orchard Court	>80	Mallard (30); Rat (>50)
Camera 6	Culvert Heineken Brewery	>100	Otter (18), Rat (>100), Domestic Cat (11)

Table 5.5 – Holt Surve	y Records from tr	ail camera surveillance
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A walkover survey of the Bride and Glenamought was carried out in April 2018 to inform any derogation licence required as part of the proposed Drainage Scheme. The survey confirmed previous works with a high-level activity throughout, a number of spraints, couches and latrines were identified and a potential holt site in the river culvert at the Heineken Brewery with latrine and spraints identified to the south.

Bats

During the walkover survey, potential habitat for foraging bats was recorded at the following locations: in Blackpool along the Bride (North) at Orchard Court and Common's Road, along the Glenamought River. No potential roosting habitat was identified.

5.3.3.3 Fish

A number of fisheries surveys were undertaken on the River Lee and several of its tributaries, to assess the overall fisheries habitat value in the lower River Lee and selected tributaries (i.e. Bride (North) and Glenamought Rivers), particularly in relation to Annex II lamprey and salmonid species. (Appendix 5B).

Electro-fishing surveys of the existing fish stocks at selected sites on the Bride (North) (n=3) and Glenamought (n=1), the results of the surveys outlined below.

River Bride (North) – u/s N20 culvert (site B1)

A low diversity and abundance of fish species was recorded from the River Bride (North) site upstream of the N20 culvert (overpass), with River lamprey transformers (n=2) and single examples of Brown trout and

European eel captured from a low-flow site choked with Apium nodiflorum (>90% cover). A length-frequency plot for each species recorded is presented in Figure 5.3.





River Bride (North) - Commons Inn (site B2)

The Bride (North) on the Commons Road becomes increasingly encroached by industrial development. However it maintains a semi-natural channel and the better quality water from upstream is likely to in maintaining some salmonid habitat. The Bride (North) site in the vicinity of the Commons Inn was found to hold a single species only, namely Brown trout (n=11). A length-frequency plot for the Brown trout recorded is presented in Figure 5.4.







River Bride (North) – Orchard Court, Blackpool (site B3)

Similar to the other surveyed sites on the Bride (North) at Orchard Court contained a low fish diversity. In this area the Bride (North) forms its last natural area of habitat before being heavily culverted in Blackpool. Brown trout were, again, the dominant species, although their abundance was relatively low (n=6). A single large European eel was also recorded. A length-frequency plot for both species recorded is presented in Figure 5.5.





Length (cm)

Glenamought River – d/s Viaduct (site GL1)

Two species were recorded from the single surveyed site on the Glenamought River, a tributary of the River Bride (North). Brown trout were abundant at the site (n=31) and a wide range of size classes was present in the section characterised by a clean cobble substrate, riffle/glide system and a relatively high flow rate. Two River lamprey transformers were also recorded, indicating suitable lamprey spawning habitat upstream of the site. A length-frequency plot for both species recorded is presented in Figure 5.6.

Fig 5.6: Length-frequency distribution plot for all fish species recorded at Glenamought River – d/s Viaduct (site B4) September 2014





Glenamought River 2017

Surveys carried out in 2017 identified the Glenamought River downstream of Glenamought Bridge where the exaggerated meanders are visible to have some of the best brown trout Salmo trutta holding habitat (considered very good) and adjoining very deep pool habitat harbours shoals of adult trout.

The Glenamought River at Woodpark comprised very clean riverine cobble and gravels and was considered a very good brown trout nursery despite extensive gabion basket placement to contain the channel downstream of the Kilnap viaduct, in addition to localised concrete retaining walls. An impassable weir structure was also present downstream of the residential property at Woodpark and likely restricts the movement of fish upstream. However, anadromous Atlantic salmon Salmo salar and European eel Anguilla anguilla are not known from the Glenamought River, likely as a result of the extensive and likely impassable culvert network downstream of Blackpool.

Very good trout habitat existed in the Glenamought River adjoining the Glenamought Bridge area and continued downstream to the nearby Kilnap viaduct. This area of the middle Glenamought had not been significantly altered in the vicinity of the viaduct or from water pollution sources. Consequentially, relatively clean sandstone boulder, cobbles and river gravels exist with more localised pockets of sand and silt (30% boulder, 30% cobble, 20% coarse and medium gravels, 10% sand/ silt). The Glenamought River had an excellent river profile for a peri-urban river habitat containing 30% pool and 30% riffle and 40% glide. These characteristics made the river a good trout holding and spawning habitat and an even better nursery (considered very good). Juvenile trout were observed in all of the pool habitat in the Kilnap area. The

Glenamought in the Kilnap area may be considered as very important for the contribution of juvenile salmonids to parts of the catchment downstream where pollution from surface water drains and locally open sewers is contributing to a decline in viable spawning habitat. Despite historical gabion basket installations downstream of Kilnap Viaduct, the river retained very good trout nursery characteristics, with clean fast flowing water and ample glide and riffle habitat, broken up by abundant instream cobble and localised boulder.

The Glenamought River north of the North Point Business Park is a very good salmonid nursery and also contains lamprey in adjoining riverine silt and sand. Despite evident historical straightening and bankside works (i.e. retaining wall of right hand bank facing d/s and straightened channel), very good numbers of salmonids were recorded here during historical electro-fishing surveys. The river contained moderately clean spawning gravels and localised *Ranunculus* stands instream.

5.3.4 Significance of Fauna

River Lamprey, listed on Annex II of the EU Habitats Directive was recorded in low numbers in both the River Bride (North) and the Glenamought River.

Brown Trout was the most frequently recorded species throughout the Bride (North) and the Glenamought River. Although Brown Trout has no legal protection, it is an important indicator of the ecological status of stream health and remains important in an overall biodiversity, conservation and management context. Removal of Brown trout has consequences for a stream meeting 'good status' under the Water Framework Directive (2000/60/EC).

European eel was recorded in the Bride (North) in low numbers. European eel is critically endangered and has protective status under the European Eel Regulation EC No. 1100/2007 to facilitate the recovery of the eel stocks since a large decline in the 1980's.

In addition, the river and surrounding vegetation provide habitat for two further species that are protected under European legislation. These are Otter (Annex II, Habitats Directive) and Kingfisher (Annex I, Birds Directive). Kingfisher was historically recorded on the Glenamought River, whereas Otter was recorded along both the Glenamought River and the Bride (North).

No evidence of Freshwater Pearl Mussel (Annex II, Habitats Directive) was recorded during the walkover surveys.

All bat species are protected under Annex IV of the EU Habitats Directive and are likely to use the area for foraging.

In addition to the above species, most of which are protected under European Legislation, the study area includes a wide diversity of aquatic and terrestrial habitats. The rivers provide suitable habitat for a range of aquatic species. The woodlands, tree lines and bank side vegetation provide cover and feeding areas for a wide range of mammal and birds.

5.4 IMPACTS AND MITIGATION MEASURES

5.4.1 Do nothing Scenario

In a do-nothing scenario it is likely that the current regime of management and maintenance on the river would continue with the nature of the river being maintained essentially as it is. It is likely that maintenance works would include the removal of debris and build-up of sediments in the town and around the bridges, along with bank protection works where necessary. It is likely that these works would be undertaken in consultation with the IFI to minimise impacts on fisheries.

5.4.2 Impact on Loss of Habitat

Slight to Moderate Negative Impact

5.4.2.1 Instream Habitats

The construction phase will involve works in channel and along the banks of the Bride (North), the Glen and the River Glenamought.

Temporary and permanent loss of instream habitat will result during construction of the works. In general, the study area is of poor quality habitat although occasionally floating river vegetation is present (primarily adjacent Commons Road in small and fragmented sections and the Glenamought). The floating river vegetation is poor in quality and quantity and is considered important not for its links to the Annexed I Habitat namely 'water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' but as a habitat for resting and feeding brown trout.

There will be some loss of this habitat during construction of instream structures: culverts, bridges, winter channel and sediment traps. Construction of bridges will require flow diversions to allow for pier construction. However, flow will be maintained at all times on one side of the river. Post construction river bed gravels will be reinstated at all bridge locations and any floating river vegetation will have opportunity to recover post construction.

Approximately 506m of culverts are proposed at 5 locations throughout the scheme. A 342m long section of reinforced concrete culvert downstream of Blackpool Bypass at Orchard Court and terminating under Old Commons Road to the north of the church is the most significant of these structures which will result in the loss of habitat during construction and in the long term. Additional habitat will be impacted as a result of the construction for 4 other culverts (See Chapter 3 for full details of proposed scheme). For all culverts there will be a requirement for flow diversions or over pumping. There will be limited loss of floating river vegetation habitat during construction of all culverts, with the most significant loss at the Orchard Court Culvert.

A roughing screening is proposed upstream of Kilnap Bridge and a Sediment Trap is proposed at the upstream end of the Sunbeam Industrial Estate.

The sediment controls at Sunbeam will capture fluvial sediments (primarily small cobble sized material), help minimise the risk of large sediments settling downstream and within the Blackpool culvert system. This will affect the hydromorphology of the river by reducing sedimentation.

In addition to the above features, removal of sediment from the river channel will form a key part of the sediment management regime.

Floating River Vegetation will not be directly impacted on the Glenamought River and is generally limited in extent, of poor quality and does not correspond to Annex 1 habitat on the River Bride. However the vegetation provides important shading and protection for brown trout. Impacts are slight negative on this habitat type.

Downstream of the Sunbeam Sediment Trap a 70m long culvert will be removed as part of the scheme. The removal of this culvert will afford the opportunity of new habitats to form in this area. This opportunity is
limited however due to changes in hydromorphology from the upstream sediment trap and the proposed maintenance regime.

Construction of a Winter Channel is proposed on the Bride (North) where sharp bends contribute to elevated flood levels occurring along the Commons Road (N20). A winter channel will help with high flows by cutting a secondary flow route into the existing bank. In normal flow conditions the river will be confined to the main channel and the winter channel will be used only during periods of high flow. The existing main channel (low flow channel) will remain unaltered. There will be no permanent impact on the existing low flow channel with regard to habitats in this location.

Impacts may also arise as a result of silt release and pollution incidents during construction and during routine maintenance which could adversity impact on the river and its habitats, this could result in temporary decline in water quality, increased turbidity, fine sediment redistribution and nutrient enrichment.

The impact on habitats is considered **slight-moderate negative** due to both permanent and temporary loss of floating river vegetation habitat during construction and risk of habitat loss due to sediment and pollution events. Upon completion of works aquatic flora affected by the construction phase impacts will recolonise from upstream sources. Gravel beds will be reinstated at the locations of all four bridges and smaller culverts. There will be a permanent loss of habitat for approximately 342m. Sediment traps and roughing screens will result in reduced sediment and gravel availability resulting in changes to the morphology of the river channel downstream. There will be a potentially positive impact on habitat as a result of the removal of 70m of culvert and regrading of river bed at Sunbeam.

5.4.2.2 Terrestrial Habitat

Terrestrial works are largely confined to the Bride (North), Glen and Glenamought River banks and adjoining areas as well as temporary construction compounds and access routes. Amenity grassland (local importance (lower level) conservation interest) is common along the Glenamought River and the Bride (North) with occasional mature trees lines of Local (higher) level Importance conservation interest. A small area of mixed broadleaved woodland will be lost as a result of the construction of the winter channel (Local (higher) level Importance) while small areas of scrub (Local (higher) level) will also be lost.

Japanese knotweed is frequent along the length of the Bride (North) and within the footprint of the works. The majority of works proposed are located on artificial surfaces with occasional strips of grassy verge. A loss of treelines, woodland and scrub is considered to be the most significant impact on terrestrial habitat resulting in a **slight negative** permanent Impact.

5.4.2.3 Mitigation Measures

- A Project Ecologist will be appointed for the duration of the works.
- The footprint of works will be identified at the onset and will be demarcated to avoid unnecessary disturbance to habitats outside the works area. Method Statements detailing the construction footprint and access routes to the proposed works will be approved prior to construction.
- Upon completion of the works channel vegetation will be allowed to recolonise naturally.
- Introduce spawning gravels at morphologically/hydraulically appropriate locations i.e. where removal of culvert is proposed

- Upon completion of the works the new embankment, and in any other grassland areas disturbed during the construction works, will be re-sown with an appropriate species rich grass and wildflower seed mix.
- Hedgerow/tree line planting will be undertaken to replace the length of hedgerow/treeline lost to
 accommodate the new flood embankment. Hedgerows will be replanted as close to the existing
 alignment and location as possible and will use native, locally sourced species.
- Works will only be undertaken during normal working hours (8:00am 6:00pm).
- All works undertaken on the banks will be fully consolidated to prevent scour and run off of silt. Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and also the sowing of grass seed on bare soil.
- Appropriate mitigation measures will be implemented prior to the construction phase to ensure that water quality is not adversely affected through pollution incidents and silt mobilisation. This mitigation will include:
 - All material including oils, solvents and paints will be stored within temporary bunded areas or dedicated bunded containers;
 - Where possible refuelling will take place in a designated bunded area away from surface water gullies, drains and water bodies, in the event of refuelling outside of this area, fuel will be transported in a mobile double skinned tank;
 - All machinery and plant used will be regularly maintained and serviced and will comply with appropriate standards to ensure that leakage of diesel, oil and lubricants is prevented.
 - Spill kits and hydrocarbon absorbent packs will be available and drip trays will be used during refuelling;
 - All relevant personnel will be fully trained in the use of this equipment;
 - Where soil/made ground and subsoil stripping occur, the resulting excavated soil fractions will be segregated into inert, non-hazardous and /or hazardous fractions (in accordance with Council Decision 2003/33/EC, the EPA water classification criteria at certain licensed landfills in Ireland);
 - The excavation and handling of inert material will be carefully managed in such a way as to prevent any potential negative impact on the receiving water environment;
 - Where possible the excavated spoil would not be stored beyond the working day, however in the event that this is not practical appropriate precautions in relation to the material will be taken. These precautions will include appropriate storage and covering;
 - All associated hazardous construction waste will be stored within temporary bunded storage areas prior to removal by an appropriate EPA or Local Authority approved waste management contractor;
 - The guidelines provided by the Department of the Marine and Natural Resources, with respect to concrete wash waters, CIRIA, the UK Environment Agency and Environment and Heritage Service, the UK Department of the Environment and Inland Fisheries Ireland will be

adhered to in order to ensure that there is a neutral impact on the water environment during the construction phase of the proposed development.

- All cofferdams, or other structure installed within the river channel, to allow working in dry conditions must be designed by a competent person, be constructed of appropriate materials and take account of site conditions (i.e. depth of water, available space, bed substrate, flow velocities, flow patterns, duration of works, accessibility and potential ingress of water). During any working with cofferdams the following will be adhered to:
 - The cofferdam will be inspected daily for any movement, leakage and general deterioration; any defects found will be remedied immediately.
 - The working area will not be de-watered directly into the river; the removed water must receive treatment before discharge.
 - Before removal of the cofferdam at completion of the works all materials, debris, tools, plant and equipment will be removed from the work area and any potential sources of pollution/contamination within the cofferdam will be cleaned up.
 - The de-watered area will be re-watered before the cofferdam is removed to avoid the sudden ingress of water which may cause erosion of the replaced substrate.
 - When re-watering is undertaken, the pump inlets will be screened appropriately to prevent the intake of fish or other aquatic animals.
- During all works the weather forecast will be monitored and a contingency plan developed to prevent damage or pollution during extreme weather and high flow events.

5.4.2.4 Residual Impact

Permanent Sight – Moderate Negative Impact

The proposed mitigation will ensure that habitat diversity is maintained as much as possible within the channel and adjoining terrestrial habitat, however there is unavoidable loss of habitats of conservation interest namely floating river vegetation. While a permanent loss of habitat is anticipated, the quality and quantity is low. The residual impact is therefore remains as Permanent Slight- Moderate Negative Impact.

5.4.3 Impact on Floral Species

Permanent Slight Negative Impact

No protected flora, rare or flora of conservation interest have been identified within the study area, therefore impact on flora is considered negligible.

5.4.3.1 Invasive Species

Construction activities in areas infested with non-native invasive species have the potential result in their spread to locations previously un-infested. The Japanese Knotweed stands recorded on the Glenamought River and in several locations along the Bride (North) within the footprint of the works. Consequently, this species could be spread should appropriate measures not be followed; this could have a negative impact, if the plant is transferred to a habitat of high ecological value.

5.4.3.2 Mitigation

- A survey will be carried out to map the extent of invasive species and an Invasive Species Management Plan will be put in place prior to commencement of construction.
- An eradication programme will be put in place which will also prevent spread during construction.
- Treatment / monitoring will be carried out for a minimum of 3 years.
- Treatment will be carried out by a suitably qualified person and will involve the use of herbicides approved for working in proximity to an aquatic environment.
- A bio-security protocol will be put in place during the construction phase of the development. This
 will ensure that all plant machinery and equipment will be thoroughly cleaned and inspected for any
 fragments of knotweed prior to leaving site.
- All construction staff will receive training in the identification and management of the invasive species, including identification of knotweed rhizomes, to verify the clearance of any area.

5.4.3.3 Residual Impact

Permanent Neutral Impact

With proper mitigation in place for the control and eradication of Japanese knotweed in place, there is a significantly reduced risk of spread of the plant to sensitive environments and there will be eradication of Japanese Knotweed locally. The impact on flora is therefore reclassified as Permanent Neutral Impact.

5.4.4 Impact on Fauna

Terrestrial Animals

Permanent Very Significant Negative Impact

There will be a potential impact on mammals and birds as a result of the proposal and during the construction phase in particular otter and birds.

5.4.4.1 Otter

Otter are known to forage along the Bride (North) and Glenamought River. Spraints were identified in in the Glenamought River, in the vicinity of Kilnap Bridge and at Commons Inn, Millfield Industrial Estate, Dunnes Stores and the Heineken Brewery. Survey suggest that there may be two or more groups of otter utilising the Rivers. Camera Survey suggest that there is some partition between the otter using the river (i.e. upper groups between Orchard Court and the West Link Business Park and a lower group (i.e. between Heineken Brewery and the River Lee).

According to the Ecological Guidance for Local Authorities & Developers, Scott Cawley (2013) key threats to otter as a result of development include the following:

- Loss of and damage to bankside, coastal and in-stream habitats causing loss of shelter and holt sites by drainage, removal of wet areas, removal of vegetation or landscape features and pollution of waterbodies.
- Fragmentation of commuting routes between feeding areas caused by bridge works, roads, weirs and culverts.
- Loss of feeding areas caused by infilling of wetlands or depreciation of water quality.

 Effects of lighting, noise, vibration and human activity during construction and operation near areas used by otter

Specifically, impacts relating to the proposals in the River Bride include disturbance and the removal of habitat. Disturbance relates to both the operational and construction phases of the development. This include large machinery disturbance during site clearance and the build phases. Works will be largely carried out during daylight hours thus minimising disturbance to nocturnal feeding activity. There will be no direct loss of holts as part of the proposed scheme.

Culverting of watercourse (including existing reconstruction and new culverts), introduction of sediment traps and other hard engineering will result in the loss of habitat and consequently the loss of prey items for otters. Given the limited prey availability currently found on the Bride (North) and the extensive territory covered by otters the impact on otters is considered as a Very Significant Negative impact to the local population in the absence of mitigation.

5.4.4.2 Otter Mitigation

- See also mitigation measures for protection of habitats (Section 5.4.2)
- Night-time working be restricted to emergency works only.
- To minimise the potential for Otters becoming trapped, all excavations will be left open for the minimum possible time, and not over-night. If excavations have to be left open over-night they will either be covered securely or fitted with an escape ramp (no more than 45°) to allow accidentally trapped animals to escape. Materials to cover excavations or create escape ramps will be on site at all times so that all excavation areas can be made safe before leaving site.
- In order to compensate for loss of habitat it is proposed to provide artificial holts along the length of the scheme which will enhance suitable habitat available.
 - The artificial holt construction will follow the wooden box type design as utilized by IRD Duhallow given the successful evidence of usage (IRD Duhallow, 2015). The holt design used was that described by the Sussex Otters & Rivers Project.
 - Suitable locations for perspective holts have been identified on the north bank of the River Bride. Much of the south bank is readily accessible by dogs and people making it less suitable. The identified areas offer seclusion, have adjoining scrub, treelines and grassy embankment areas, are not readily accessible by the public and are above typical flood levels. Due to the sensitive nature of otter holts and their need for minimal disturbance the locations have not been identified within this report. In total 3 areas have been identified for the provision of artificial holts.
 - The design of the holt areas will be overseen by an ecologist with significant experience of an Ecological Clerk of Works role and otter ecology. The tailoring of the holt construction will be conducive to maximizing the naturalness and attractiveness of the constructed holts to otter.
 - Monitoring of the success of the holt construction in terms of otter utilization of the newly constructed habitat is essential to evaluate success of the compensatory habitat. This could be achieved by using remote trail cameras overtime. The detailed design of the otter holt constructions inclusive of their final positioning should be agreed in conjunction with the NPWS.

- Otter Ledges will be provided within all culvert designs. The otter ledge will traverse the entire length of the new proposed culverted areas and will follow the specifications of the National Roads Authority Guidance in relation to otters (NRA, 2008). Most significantly, otter ledge will extend from the upstream end of orchard Court to Maddens junction on Watercourse Road. The ledge will tie into the adjoining riverbanks and will be screened with trees to provide seclusion for otter entering and exiting the culvert network. (See Appendix 5E).
- The detailed design of the tie in areas will be undertaken in conjunction with an ecologist with knowledge of otter usage of the area. Furthermore, the detailed design of the final ledge layouts should be agreed in conjunction with the NPWS.
- Light wells will be provided within the culvert at intervals to provide limited natural light within the culvert and to provide as natural a condition as possible.

5.4.4.3 Kingfisher

No nesting kingfisher were found in proximity to the works. Foraging kingfisher were observed in proximity to the works at Glenamought River during early surveys, however these birds were no longer present in 2017 survey periods. In any case these birds are unlikely to be significantly disturbed during construction. Works at the Glenamought River consist of the construction of a roughing screen, flood defence embankments and walls, access road improvement works, and two bridge replacements. Potential impacts are limited to disturbance to foraging habits, loss of instream foraging habitat or impact on water quality and therefore prey item impacts. Given recent survey results disturbance to breeding sites is not considered significant.

In the absence of mitigation impacts on Kingfisher are considered Slight Negative/ Neutral Impact.

5.4.4.4 Other Birds

The impact of the proposed works on the overwintering water bird population which Cork Harbour supports is discussed as part of the Screening for Appropriate Assessment. This section considers impacts on the wider bird population within the study area, including breeding bird populations and non-waterbird populations in winter. By the nature of the construction works involved in this scheme, a degree of disturbance to birds present in the vicinity of the works areas is inevitable. The magnitude of this impact, however, depends on a number of characteristics of the works, including:

- The timing of the construction activities
- The level of disturbance, both spatially and temporally
- The availability of equivalent habitats outside of the influence of disturbance to accommodate displaced birds.

The works proposed in this scheme will be conducted in relatively localised areas where levels of disturbance are already relatively high as result of its urban location. This, in combination with the substantial amounts of similar habitats outside the likely zone of influence, should minimise the potential for long-term population impacts from disturbance throughout the construction phases.

The removal of vegetation, hedgerows, treelines and woodland required prior to construction has the potential to impact on nesting birds as does works to bridges and culverts where nesting dippers and wagtails are known to nest. Impact on nesting birds in the absence of mitigation is Significant Negative Impact.

5.4.4.5 Birds Mitigation

- See also mitigation measures for protection of habitats (Section 5.4.2)
- All vegetation clearance works and site preparatory works will be conducted outside of the bird nesting season (March to September inclusive). If this is not possible, a breeding bird survey will be undertaken in advance of the works to ensure that there will be no impacts on nesting birds. If nests are found, they will be safeguarded, with an appropriate buffer, until the chicks have successfully fledged. Particular regard will be had for nesting dippers and wagtails that are currently known to use the system.
- Artificial Nesting boxes will be provided for dipper and wagtail to replace any lost habitat;
- Hedgerow /treeline planting will be undertaken to replace the length of hedgerow/treeline lost.
 Hedgerows/treeline will be replanted as close to the existing alignment and location as possible and will use native, locally sourced species appropriate to the locality.

5.4.4.6 Bats

Bats are not expected to use the study area in significant numbers. However, it is expected that bats would be found in low densities in the Blackpool area and Glenamought. There are no potential bats roosts in existing bridge or culvert structure along the Bride (North) and Glenamought River. There is no bat roosting potential along the existing flood protection walls in Blackpool. There is potential roosting opportunity for bats in mature trees along the length of the scheme although none were identified as part of the survey. There is potential impact for loss of bats roosting in mature trees as a result of the scheme. In addition, all treelines, woodland and scrub is likely to provide commuting or forging habitat for bats. The potential impact of site clearance on bats is considered slight negative.

5.4.4.7 Bats Mitigation

- See also mitigation measures for protection of habitats (Section 5.4.2)
- Outside of emergency works, there will be no night working during the construction phase.
- Any new lighting required as part of the project will be of as low a wattage as possible and will be directed away from the surface of the water.
- Prior to the commencement of site clearance, tree surveys will be carried out on trees identified as potential for bat roosts. If roosts are found or their potential cannon be ruled out, an appropriate mitigation strategy will need to be devised and a derogation licence will need applied from NPWS.
- Removal of trees with bat roost potential will be carried out in September/ October and under the supervision of a bat ecologist.
- A Bat box scheme will be put in place to mitigate for loss of trees and suitable foraging habitat for bats. Approximately 4 bat boxes will be provided for on stone walls faces or mature trees (as deemed appropriate). Bat boxes will be woodcrete bat boxes such as those manufactured by Schwelger and will be put in place as per the recommendations identified in NPWS Irish Wildlife Manual (2006) Bat Mitigation Guidelines for Ireland.

5.4.4.8 Residual Impacts on Terrestrial Fauna

Permanent Moderate / Significant Negative impact

With mitigation measures in place there is no significant risk to bats, birds, or other mammal populations (excluding otters) within the study area. Loss of foraging habitat and prey species will result in some loss of terrestrial species using the area. During construction, there will be temporary disturbance to dipper and wagtail nesting habitat where they currently use culverts/bridges and seasonal restrictions to the works may apply. In the long term and the impact is considered moderate.

However, there is a significant level of otter activity within the study area. Therefore, there is potential for loss of foraging habitat for otter. The introduction of a new culvert at Blackpool has the potential to result in increased risk of severance of this species from the River Lee and the River Bride (although it is considered that the two-populations identified on the Bride may not cross over). This extension of culverted river may result in reduced success of otters in an already urbanised system. Mitigation in the form of artificial holts, ledges and fisheries enhancement will minimise as much as possible the impact on otters. The residual impact on Otters is considered Significant.

5.4.5 Impact on Fisheries

Permanent Significant Negative Impact

The habitat suitability and water quality is generally poor along the River Bride (North) for fish species. However Brown trout nursery and holding habitat is generally good to moderate although spawning substrata has been degraded due to siltation. Brown trout are the most common fish found here in relatively low abundance with occasional lamprey and eel. The most significant populations of Brown trout is within the Glenamought both upstream and downstream of the viaduct where trout are abundant. Salmon are not known in the Bride (North) as their movement is significantly impeded by the culverting of the lower Bride (North) from Watercourse Road to its outfall to the River Lee.

During construction phase works will be required within the channel for bridge replacement and culvert construction, culvert removal and construction of sediment traps and winter channels. These works can potentially result in disturbance including noise, visual and vibrations which would displace fish from the works area and result in a temporary impediment to fish passage along the Bride (North) and Glenamought rivers. There is also potential for direct fish mortalities as a result of in-channel works, though entrapment over pumping etc. for stream diversions during works. Should in channel works be carried out during spawning then the impact may be particularly severe and while any disturbance impact will be temporary it can potentially result in reduction in spawning success and result in loss of a year class. The magnitude of the impacts due to construction activities is considered to be low resulting in a minor negative impact.

In addition to disturbance impacts, the construction works may directly impact upon fish habitats within the river, including areas identified as potential spawning habitat. In particular there is risk to habitat on the lower reaches of the Glenamought River where two bridges will be constructed. All other in channel works are located outside of those are identified as good fisheries habitat. The majority of instream works will be concentrated at the River Bride (North) which is identified as being of poor fisheries quality.

Instream works on the Bride (North) will have a significant impact on brown trout during the construction and operational phase (albeit in low numbers). Construction of 503m length of culvert (both new and existing rehabilitation) will result in the permanent loss of habitat at these locations.

in association wit

A Sediment Trap is proposed on the upstream end of the Sunbeam Industrial Estate. The sediment controls at Sunbeam will capture fluvial sediments (primarily small cobble sized material) and help minimise the risk of large sediments settling downstream and within the Blackpool culvert system. This will affect the hydromorphology of the river by reducing sedimentation. In addition to the above features, removal of sediment from the river channel will form a key part of the sediment management regime.

The sediment control will affect the hydromorphology of the river most significantly between the sediment trap and the existing culvert at Old Commons Road, limiting sediment deposition over a distance of approximately 1km incorporating culverts and open channel. The currently engineered existing river channel through Blackpool Retail Park currently displays patterns of natural sedimentation, with typically 40% riffle, 40% glide and 20% pool. The river has moderate nursery habitat and moderate spawning habitat. The riverbed at this location suffers from moderate siltation. The changes to morphology of the river bed has therefore the potential to result in a Permanent significant negative impact on fisheries.

To the north of Sunbeam Industrial Estate, the proposed removal of a 70m long culvert and instream rehabilitation works will be carried out. The removal of this works will result in a positive impact for fisheries locally.

A very low density of lamprey transformers has been identified within the study area given the significant impact of existing culverting of the Bride (North) between the River Lee and Watercourse Road. However, the presence of River Lamprey demonstrates that unlike salmon they can bypass the Blackpool culvert which under low flow conditions is very shallow. There will be loss of habitat, as a result of the works, on lamprey, in addition the provision of a newly culverted section of the river at Old Commons Road will potentially result in the River Bride (North) becoming impassable by lamprey.

As for Lamprey, European eel have been found in very low densities along the Bride (North). This is due to significant impediments of movement of migratory fish in the extensively culverted sections of the river. There will be an extension to the sterilisation of these habitats with the extension of culverting of the Bride (North) potentially resulting in the Permanent exclusion of European eel to the River Bride (North).

Construction impacts may also arise on the fish populations through silt mobilisation and pollution incidents which could impact upon water quality, turbidity levels and could also result in the smothering of spawning gravels. Declines in water quality and the smothering of spawning gravels could potentially impact upon the ability of fish populations to survive within the river over the short to medium term.

The impact of the works on fisheries overall is a **Permanent Significant Negative** Impact.

5.4.5.1 Fisheries Mitigation

- See also Fisheries Enhancement Proposals North Bride in Appendix 5E of this EIAR.
- See also mitigation measures for protection of habitats (Section 5.4.2).
- All works will be carried out in consultation with Inland Fisheries Ireland, in particular the design of a sediment trap upstream of Commons Inn Hotel (if required) will be designed in consultation with IFI.
- In channel working will be minimised, where possible, method statements will identify access routes and works areas prior to commencement in consultation with the Project Ecologist.
- In-channel working during the salmonid spawning season will not be permitted (November to March inclusive).

- During the construction phase, fish passage will be maintained in areas of in-channel working.
- Any pumps used for over-pumping must be 'fish-friendly' and fitted with appropriate screens.
- Avoid working in areas identified as being suitable for fish spawning, where practicable.
- The removal of the culvert near Sunbeam will include the regrading of the river to ensure removal of the existing weirs.
- Works will introduce spawning gravels upstream of Sunbeam Industrial Estate where culvert is to be removed (assuming morphologically/hydraulically conditions are appropriate).
- The winter channel will be constructed as such that there is no risk of fish being retained in the channel as flood water subsides. This will be ensured out by appropriate grading of the channel.
- Ensure that the proposed trash screens have an appropriate mesh size to allow for movement of salmonid species and that culverts and trash screen are designed and installed in line with published best practice (e.g. Armstrong et al 2010; Turnpenny & O'Keefe 2005).
- Compensation measures for permanent loss of riverine habitat will be carried out in agreement with Inland Fisheries Ireland. Enhancement measures have been identified for the Bride and the recommendation of O'Grady (2016) Draft Fisheries Enhancement Proposals will be carried out as part of the scheme. The proposal includes rehabilitation of the River Bride immediately downstream of McDonalds to the location of the proposed trash screen adjacent to Blackpool Shopping Centre. It is the opinion of the author (O'Grady that the works will significantly improve the rivers capacity to support a brown trout population and the net gain in fish stock terms will more than offset the permanent loss caused by culverting in the lower reaches of the proposed drainage scheme.

5.4.5.2 Residual Impact

Permanent Significant Negative Impact

Mitigation measures will minimise the impact on fisheries from the construction phase, however the permanent loss of habitat cannot be mitigated in the context of this assessment. While compensatory measures will be carried out in agreement with IFI with regard to salmonid habitat, impact on Fisheries within the Bride (North) catchment remains a Permanent Significant Negative Impact.

5.5 ASSESSMENT OF CUMULATIVE IMPACTS

A search in relation to plans and projects that may have the potential to result in cumulative impact on the environment was carried out as part of the EIAR. Data sources included the following:

- Cork County Development Plan 2014
- Cork City Development Plan 2015
- Relevant Local Area Plans
- South Western River Basin Management Plan
- Lee CFRAMS including the Lower Lee Flood Relief Scheme
- An Bord Pleanála Website (Planning Searches)
- Myplan.ie
- Web search for major infrastructure projects in Cork City and County

A synopsis of the search results is provided in Table 5.6. In addition to the plans and projects listed in Table 5.6 a number of small scale development of dwelling house/extensions were identified from the wider area

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surrounding the proposed flood relief scheme. Given their small size and scale and their location on existing residential and made ground the potential for cumulative impact is not considered significant and therefore not considered further in this assessment.



Table 5.6 Potential Impact in combination with other Plans and Projects

Plans and Projects	Description and Key Issues / Policies/ Objectives Related to the zone of influence	Potential impact on Biodiversity	In-combination Impact
Existing activities: discharges and agricultural practices upstream.	Risk to water quality, Glenamought River has an unpolluted, good status water quality (Q4) while the River Bride has moderate status of slightly polluted water where urban encroachment and storm drain sources of pollution are evident.	Water quality impacts are resultant of agricultural practices upstream and the existing discharges into the Rivers Glenamought and Bride (North).	None The proposed Drainage scheme does not increase the risk of nutrient enrichment or water quality issues. There will be no increase in discharge to river or changes to natural attenuation in adjoining areas.
Existing activities: Dulux Paints	Production of paint, IPC licence for Solvent Use. SW discharges to the River Bride. Non-compliances recorded with regards to discharge of waste paint to River, non- certified bunds.	Pollution to watercourse from SW discharge as a result of spills and accidents. Bunds not certified: risk of discharge of material stored into River.	Potential impact on river water quality and fish health from un authorised discharges. Flood Scheme may exacerbate risk in the absence of proper pollution control mitigation that are outlined in Section 5.4.
Lee CFRAMS Examines and aims to solve risk of flooding, now and in the future, from rivers and tidal waters.	For the Lee Catchment "Seek to minimise the level of exposure to flood damages through the identification and management of existing, and particularly potential future, flood risks in an integrated, proactive and river basin- based manner". The following areas are considered:	The SEA for lee CFRAMS predicted that there will be no additional negative in- combination effects between all related components of the CFRAM (including the River Bride) taking into account the	None

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River Bride (Blackpool) Certified Drainage Scheme

	The River Lee & its main tributaries (including Rivers Bride, Curragheen Dripsey, Glasheen, Laney, Kiln, Shournagh, Sullane,) and estuary; Other main rivers flowing into Cork Harbour – Rivers Tramore, Owenboy, Glashaboy and Owennacurra and their estuaries; and Cork Harbour.	interrelationships between environmental topics.	
Cork County Development plan 2014	Policy for protection designated sites protection (NHAs, SAC and SPAs); Protected Plant and Animal Species; wetlands, trees and woodlands (TPOs and general tree cover); invasive species; and Biodiversity outside of Protected areas (retain areas of local biodiversity value, ecological corridors and habitats)	Potential Positive Impact	None
Cork City Development Plan 2015 – 2021	Overall Natural Heritage and Biodiversity Objectives are too protect, enhance and conserve designated areas of natural heritage, biodiversity and protected species.; To ensure that sites and species of natural heritage and biodiversity importance in non-designated areas are identified, conserved and managed appropriately; To protect and maintain the integrity and maximise the potential of the River Lee and its associated watercourses; To protect and enhance the city's trees and urban woodlands; To promote best practice guidelines for management, control and eradication of invasive alien species; and to acknowledge and adhere	Potential Positive Impact	None



River Bride (Blackpool) Certified Drainage Scheme

	to all relevant biodiversity and natural heritage legislation.		
North Blackpool Local Area Plan 2011 To transform the area into mixed use with retail, residential and employment both sides of the River Bride and Gleanamought	Policies and Objectives include to provide and protect the open spaces along the River Bride for recreational needs and to preserve and enhance the biodiversity of the area and provide for recreational uses, open space and amenity.	Potential Neutral Impacts. Protection from development that is planned, potential impact from amenity must be assessed prior to development.	None
Farranferris Local Area Plan 2009 – 2015 (as extended) To promote the social, economic, cultural and physical development of the plan area and create an integrated, vibrant and sustainable living, working and recreational environment.	Policy to protect and promote the conservation of biodiversity in areas of natural heritage importance, outside of designated areas and to encourage the management of features which are important for wild flora and fauna such as rivers, tree groups and hedgerows. The City Council shall seek to assess, manage and protect the Urban-Sylvian character of the Farranferris Ridge by requiring detailed site surveys and appropriate protection measures as part of any development proposals. The local area plan states that it shall seek to protect and strengthen all significant trees and tree groups on site through the use of Tree Preservation orders. All development proposals shall include measures to protect and enhance existing trees and tree groups.	Potential Positive Impact	None
South Western River Basin Management Plan	In order to meet the requirements of the EU Water Framework directive, it sets specific standards for the	Potential Positive Impact	None

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RYAN HANLEY in association with O'Sullivan					
	maintenance and improvement of the ecology and chemical water quality of water bodies in the Lee Catchment.				
Proposed Projects	Planning permission granted but currently under appeal consisting of: Demolition of industrial buildings and construction of residential units (approx. 81 dwelling) at Sunbeam	Brownfield site, no loss of habitat. Silt runoff may pose a direct potential impact on the River Bride if carried out at the same time as the scheme these impact by be cumulative. Potential impact from runoff during construction phase. No potential impact during operational phase, waste water will be sent to city WWTP.	Silt runoff. Mitigation is provided for potential impact during construction phase on water quality for which strict adherence is required.		



5.5.1 Conclusion of Cumulative Impact Assessment

It is considered that the design of the proposed River Bride (Blackpool) Certified Drainage Scheme, the scale of the works and the implementation of effective mitigation and best practice will ensure that the proposed development, when considered on its own, will minimise as much as possible significant impacts on Biodiversity, flora and fauna. The proposed project has been considered also, in combination with a number of plans and projects. Following a detailed assessment of the receiving environment, the potential for any further impact when considered in combination with any or all of the above plans and projects. It was found that there was no potential for significant cumulative impacts on Biodiversity as a result of the proposed works.

6 LAND USE, GEOLOGY AND SOILS IN THE EXISTING ENVIRONMENT

The Study Area is located to the north of Cork City and comprises of the Bride (North) catchment area. The Bride (North) catchment area includes the area surrounding the Bride (North)/ Kiln river, the Glenamought stream and the Glen River.

This chapter of the EIS presents available information on the soils and geology of the Study Area along and in the vicinity of the proposed Drainage Scheme. It investigates how the existing soil and geological environment may be altered in both the short and long-term by the construction and operation of the proposed scheme. Should significant impacts be identified on the soil and geology, mitigation measures will be proposed insofar as practicable.

The River Bride (Blackpool) Certified Drainage Scheme construction phase will include the following works relevant to soils and geology;

- detailed site investigation;
- site preparation;
- replacement and construction of culverts;
- construction of reinforced concrete walls;
- construction of earthen embankments;
- construction of sedimentation trap;
- services and utility diversions;
- re-instatement of footpaths / roadways / green areas.

6.1 METHODOLOGY AND LIMITATIONS

This chapter was compiled in accordance with the EPA publication entitled 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' (DRAFT August 2017) along with 'Advice Notes on Current Practice in the preparation of Environmental Impact Statements'. The Institute of Geologists of Ireland also published a guidance that was consulted during the preparation of this Chapter, entitled 'Geology in Environmental Impact Statement – A Guide'.

A desktop study was carried out in order to ascertain a comprehensive baseline for the Study Area and give a description of the existing environment. This information was then used in assessing the potential impact the Drainage Scheme will have on the geology and soils within the Study Area. It was then possible to propose practicable mitigation measures to ensure that any potential impacts identified will not have a significant impact on the environment during the construction and operational phase.

No significant difficulties were encountered in the compilation of this Chapter.

Published Material

The baseline study of the existing soil and geological environment throughout the proposed Study Area was prepared using the Geological Survey of Ireland's (GSI) online database and the GSI publication; 'Geology of South Cork' (1994), along with additional source material. A comprehensive list is included below;

• The Geology of South Cork (Sleeman and Pracht, GSI, 1994)

- The GSI online database
- Cork City Development Plan (2015 2021)
- Cork County Council Development Plan (2014)
- Cork City Council Planning and Development (Applications for Registration of Quarries under Section 261, Planning and Development Act 2000)
- Cork County Council Planning and Development (Applications for Registration of Quarries under Section 261, Planning and Development Act 2000)
- Concrete Products Directory (Irish Concrete Federation)
- Aerial Photography
- ENVision Mines Site, the EPA's online Historic Mines Inventory
- General Soil Map of Ireland
- Explanatory Bulletin to Soil Map of Ireland 1980

A ground investigation contract was carried out which consisted of boreholes, trial pits and slit trench excavations spread throughout the Study Area. The recorded data was used to confirm and verify information obtained from the above sources.

A study carried out by JBA Consulting entitled 'Lower Lee Flood Relief Scheme Blackpool Hydraulic Modelling Report' was also consulted.

Definitions

Land is introduced into the Environmental Impact Assessment as per the 2014 Directive as a prescribed factor addressing the issues of land take. Environmental and agricultural scientists generally understand the word 'soil' to refer to the fertile, organic rich layer which occurs on the surface of the Earth and the underlying layers which interact with it in terms of nutrient, ion, water and heat exchange. Using this definition, the depth of the soil layer is typically 0.3m to 1.0m thick. Geologists and engineers, on the other hand, generally understand the word 'soil' to refer to all unconsolidated (non-lithified) organic and inorganic deposits which occur above bedrock.

For the purpose of this EIS, the term 'soil' refers to the unconsolidated, organic rich material closest to the Earth's surface ('topsoil), while the term 'subsoil' (Quaternary Geology) is used to refer to all other unconsolidated (non-lithified) materials which occur above bedrock.

6.2 LAND

The assessment of land use generally considers land take or acquisition and changes in land use. The CORINE (Co-ordinated Information on the Environment) data series was established by the European Community (EC) as a means of compiling geo-spatial environmental information in a standardised and comparable manner across the European continent. The land in the Study Area is classified as follows:

- Glennamought and upper Bride Heterogeneous agricultural area principally occupied by agriculture with significant areas of natural vegetation in the form of riparian habitat.
- Remainder of Study Area Artificial Surfaces comprising land used for industrial and commercial purposes.

Potential Impact – Agricultural Land

The land in Glennamought is made up of a wooded area adjacent to the river and river access points. There will be a loss of approximately $445m^2$ of agricultural lands as a result of embankment construction. This loss represents an 11% loss in area to the effected farmer and is not significant regionally. It is expected that this impact will constitute a Permanent Imperceptible Negative Impact.

Potential Impact – Industry and Commercial

The proposed scheme will provide protection to industry lands from flooding. The proposed land take is insignificant tt is expected that this impact will constitute a Permanent Slight Positive Impact. There will be no direct impact on properties as a result of the scheme.

6.3 GEOLOGY

Geomorphology

The topography of the South Cork region is controlled by its geological structure, with the anticlines forming upland areas and the synclines occupied by valleys. These valleys were formed during the Pleistocene glaciations, which occurred 2 million to 10 thousand years ago. Prior to this, the regional topography sloped southwards and the region was drained by southerly flowing rivers. This Tertiary drainage was truncated by glaciers advancing outwards from the mountainous regions of western Ireland, preferentially exploiting the weaker shales resulting in the development of a large number of broad u-shaped valleys, where previously there has only been north-south drainage patterns. Superimposed on these u-shaped valleys are a number of buried valleys infilled with sand and gravel.

At the peak of the last glaciation, 15,000 years ago, when much of Europe was covered in ice, sea levels fell to approximately 130m lower than present day. As a result, the rivers eroded down to the new base level cutting new steep sided gorges. When temperatures subsequently improved the ice sheets receded, sea levels rose and the gorges rapidly became infilled with fluvioglacial sand and gravels as the rivers responded again to the changing base level. The south of Ireland continues to sink and so sea levels are still rising. Milenic & Allen, 2002, estimate this rise as being 16m over the past 8,000 years.

Bedrock Geology

The bedrock of South Cork is much less varied than in many parts of the country. With one exception all the rocks exposed are sedimentary and were deposited during the late Devonian and Carboniferous Periods, between about 310 to 370 million years ago.

Sedimentary rocks are deposited in beds or strata. For the purposes of description and mapping related beds of rocks are commonly grouped together into formations. These formations can then be sub-divided into members, which usually represent a distinctive feature or local variations.

The Geology of South Cork (Sleeman and Pracht, GSI, 1994) and the 'Geological Survey of Ireland Online Database' (shown in Appendix 6B of this document) indicates that the majority of the Study Area is underlain by Devonian "Old Red Sandstone" rocks which comprises the Ballytrasna Formation purple mudstone and sandstone and Gyleen Formation sandstone with mudstone and siltstone.

A portion of the Study Area to the north of Blackpool is underlain by Old Head Sandstone Formation which comprises flaser-bedded sandstone and minor mudstone. Another portion of the study area to the south is underlain by Cuskinny Member which comprises flaser-bedded sandstone and mudstone. The findings of the ground investigation, which was carried throughout the proposed Study Area are broadly in line with the bedrock as described above. Bedrock encountered in rotary core boreholes in the study area comprised purple/brown Mudstone and purple Siltstone and Sandstone with quartz veining.

Geological Heritage

Geological heritage encompasses the earth science component of nature conservation. This includes both bedrock and unconsolidated (soil) deposits close to the surface and processes (past and present) that shaped the land surface. The identification of geological heritage is achieved by finding sites or areas that best demonstrate particular types of geology, processes or phenomena that rank as noteworthy. A site selection process is being undertaken by the Geological Survey of Ireland (GSI), through the Irish Geological Heritage (IGH) Programme.

The IGH programme is a partnership between GSI and the National Parks and Wildlife Service (NPWS) and aims to identify, document the wealth of geological heritage, and protect and conserve it against threats through local authority planning and promote its value with landowners and the public. The primary national site designation for geological heritage (and nature conservation in general) is the Natural Heritage Area (NHA) designation. Designation of national sites is the responsibility of the National Parks and Wildlife Service (NPWS), working in partnership with the IGH programme. The second tier designation is that of County Geological Site (CGS). While a County Geological Site is not statutorily protected, the designation is intended to provide recognition for the site and protection through inclusion within the County/ City Development Plan Policy and Objectives.

The Cork City Development Plan (2015 - 2021) states that the Council 'recognises the need to maintain and preserve important features of geological interest in the city and will work with the Geological Survey of Ireland, as appropriate, to conserve the sites identified as being of geological interest.

The Cork City Development Plan identifies 7 sites of geological and geomorphological interest in the county as proposed Natural Heritage Areas (pNHAs). None of the 7 sites are located within the Study Area.

Economic Geology

The term 'economic geology' refers to commercial activities involving soil and bedrock. The activities involved principally comprise aggregate extraction (sand and gravel pits and quarries) and mining. A number of sources were examined for information on such commercial activities within the Study Area, including:

- Cork City Council Planning Department (Application for Registration of Quarries under Section 261, Planning and Development Act 2000)
- Cork County Council Planning Department (Application for Registration of Quarries under Section 261, Planning and Development Act 2000)
- Cork City Development Plan (2015 2021)
- Cork County Council Development Plan (2014)
- Concrete Products Directory (Irish Concrete Federation)
- Aerial Photographs (2005)
- ENVision Mines Site, the EPA's online Historic Mines Inventory

EPA Map Viewer

The sources consulted above indicate that there are no active quarries within the Study Area. The nearest active quarries are presented on Table 6.1:

Table 6.1 Quarries in close proximity to the Study Area

Location	Status	Operators
Classic Pit, c. 15km outside Study Area	Active	Roadstone Ltd.
Garryhesta Pit, c. 17km outside Study	Active	Roadstone Ltd.
Area		

The locations of these quarries are shown on Drawing SG001 in Appendix 6A.

As the abovementioned quarries are outside the Study Area, it is not envisaged that there will be any impact on these facilities from the proposed Drainage Scheme.

Geohazards

Upon consultation with the GSI National Landslide Database for Ireland, it was found that there are no recorded landslides in the area. There are no known geohazards within or in the immediate vicinity of the Study Area.

Quaternary Geology (Subsoil)

The Quaternary Period, which extended from the beginning of the lce Age to the present day, is the final one of geological time scale. Most of the surface deposits of this area were deposited during the Quaternary Period, largely during the lce Age itself. They were deposited either directly by glacier ice or by glacial meltwater. As the ice flowed over the underlying rock surface, pieces of protruding and loose rock became attached to its base. As these were carried along they both abraded the underlying rock and were ground down themselves. The rock that was picked up by the ice and partly ground down was later deposited either directly from the base or margin of the ice, or by meltwater flowing from the ice. In the former case it became till and in the latter case it was separated out and deposited as gravel, sand, silt or clay. The composition of these sediments reflects the type of rock or substrate over which the ice flowed.

Subsoils deposited since the end of the last glaciation are typically referred to as 'recent deposits'. The most widespread recent deposits in Ireland is peat, which occurs both as upland blanket peat and lowland raised bog. Other recent deposits include silt and clay rich alluvium, typically deposited by and along rivers.

According to the 'Geological Survey of Ireland Online Database' the Study Area is comprised of the following subsoils (Extract from GSI Database presented in Appendix 6B);

- Made Ground
- Till derived from mixed Devonian Sandstones
- Alluvium

There are also a number of bedrock outcrops to the north of the Study Area.

6.3.1 Made Ground

Made Ground is defined as material, including soil, which has been deposited on land and/or altered by anthropogenic (human) activity. Made Ground is shown in the urbanised areas of the Study Area.

The key risk associated with made ground is its uncertain origin and potential for contamination. However, no evidence of historical activities which could potentially have contributed to soil contamination was identified along or in the vicinity of the proposed scheme.

6.3.2 Glacial Till

Glacial till is a generic term which applies to glacially derived and/or transported soil which is deposited beneath or on the margins of a glacier or ice sheet. The Teagasc subsoil map, as presented on the Geological Survey of Ireland Online Database, indicates that glacial till is the predominant subsoil occurring in the north of the Study Area and is principally derived from Devonian sandstones.

It is unlikely that the proposed scheme will impact on this Glacial Till.

6.3.3 Alluvium

Alluvium is a young sediment that was recently eroded and carried off the hill side by a surface watercourse. It is ground into finer and finer grains each time it moves downstream, a process that can take thousands of years.

Alluvium soils are typically found at or in the vicinity of a surface watercourse and as such, a large stretch of the Shournagh River within the Study Area is situated within Alluvium subsoils. As these subsoils are located in the immediate vicinity proposed works, it is likely that there will be an interaction with the proposed Drainage Scheme.

Potential Impacts on Geology

The key impact associated with the construction phase of the River Bride (Blackpool) Certified Drainage Scheme is the excavation, handling, storage, processing and transport of earthworks materials. The estimated volume of excavation anticipated during the construction phase is presented on Table 6.2.

Origin of Excavation	Volume of Material
Wall Foundations	2,200m ³
Embankment Foundations	910m ³
Culverts	6,675m ³
Pipeline Trenches	600m ³
Other (Pumping Stations, bridge	e 4,550m ³
upgrades, sediment trap, winter channel)	
ΤΟΤΑ	14,935m ³

Table 6.2 Volumes of Excavated Material

There are a number of potentially negative environmental impacts associated with the handling of excavated materials. These impacts can arise directly as a result of on-site excavation and embankment construction activities or indirectly, due to placement of excess unsuitable materials at off-site locations.

Detailed site investigation works will also be carried out prior to the construction stage. These works will include intermittent coring of the bedrock, but impact is predicted to be imperceptible and as such has not been assessed below.

6.3.4 Loss of Bedrock

Potential Permanent Slight Negative Impact

The vast majority of the Study Area is underlain by Devonian "Old Red Sandstone" rocks which comprises the Ballytrasna Formation purple mudstone and sandstone and Gyleen Formation sandstone with mudstone and siltstone, as described above in Section 6.2.2.

As the type of bedrock that will be excavated is abundant throughout the Study Area the portion to be removed will be imperceptible in comparison to the volumes retained and as such will not have a significant impact on the bedrock of the Study Area. In addition, the preliminary site investigation indicates that rock is present at significant depths and will therefore not be impacted by the scheme.

Mitigation Measures

Where it is necessary to remove bedrock to facilitate construction of the proposed scheme, suitable material will be reused elsewhere where possible. Material removed from site will be transported to the closest suitably licensed facility to be processed and used on other construction projects in the vicinity, where possible.

Residual Impact – Potential Permanent Imperceptible Negative Impact

It is likely that, with the mitigation in place this impact will constitute a Permanent Imperceptible Negative Impact. This residual impact will be fully identified as the works method statement become finalised.

6.3.5 Loss of Geological Heritage

Neutral Impact

There are no sites in the vicinity of the proposed works of sufficient geological or geomorphological importance on a national or county scale to merit consideration for designation as a Natural Heritage Area (NHA) or designated as a County Geological Site. Due to possible exposure of bedrock as a result of proposed excavation works it is just as likely that the impact will be positive as negative.

Should there be exposure of new geological surfaces, especially in bedrock, it may serve to facilitate greater understanding and appreciation of local geological heritage and earth science.

6.3.6 Loss of Quaternary Geology

Potential Permanent Slight Negative Impact

As described in Section 6.2.6, the Study Area is predominantly underlain by Made Ground, till derived from mixed Devonian Sandstone and Alluvium. It is likely that excavations for flood defences are to be in Made Ground. The site investigation recorded that gravels are also present.

The impact of the removal of excavated material from the proposed works will be minimal as these subsoils are in abundance throughout the Study Area.

A large portion of the proposed flood defence measures are underlain by made ground and therefore there is a risk that contaminated material may be encountered. No evidence of historic activities which could potentially have contributed to soil contamination were identified in the immediate vicinity of the proposed scheme. Although the key risk with Made Ground is its uncertain origin, on the basis of available evidence and taking into consideration the small volume of made ground to be excavated, the potential impact is regarded as being imperceptible.

Mitigation Measures

Excavated subsoils will be reused as fill, or for the construction of flood defence embankments where possible. Any remaining volumes of unsuitable materials will be transported to the closest suitably licensed facility to be processed and reused in other construction projects in the vicinity, where possible.

Residual Impact – Potential Permanent Imperceptible Negative Impact

It is likely that, with the mitigation in place this impact will constitute a Permanent Imperceptible Negative Impact. This residual impact will be fully identified as the works method statement become finalised.

6.4 SOILS

Soil is the top layer of the earths crust. It is formed by mineral particles, organic matter, water, air and living organisms. It is an extremely complex, variable and living medium and its characteristics are a function of parent subsoil or bedrock materials, climate, relief and the actions of living organisms over time.

Soil can take thousands of years to evolve and is essentially a non-renewable resource. Soil performs many vital functions. It supports food and other biomass production (for example forestry and biofuels) by providing anchorage for vegetation and storing water and nutrients long enough for plant to absorb them. Soil also stores, filters and transforms other substances including carbon and nitrogen. It has a role supporting habitats and serves as a platform for human activity, landscape and archaeology.

Soil Formation

There are three principal soil formation processes that take place in Ireland, leaching, gleisation and calcification.

Through the *leaching* process, soluble constituents are carried down through the soil profile, the soil becomes progressively more acidic until relatively insoluble constitutes such as iron, aluminium and humus are washed deeper into the soil. Organic matter may accumulate on the surface and an iron pan may be formed at a lower level in the soil. At this point the leaching process may be referred to as podzolisation.

Gleisation is the soil-forming process resulting from the water-logging, possibly due to high water tables, or the impermeable nature of the soil itself. The movement of water through the soil is highly restricted and as a result leaching is very limited. Due to anaerobic conditions many soil constituents are converted by chemical processes into reduced forms. The soil usually takes a grey or blue colour as a result of the reoxidation processes.

Calcification is a process resulting in the redistribution of calcium carbonate in the soil profile without complete removal of it. Regions where rainfall is typically 750mm or less are affected by this process. Since the rainfall is low, the percolation of water through the profile is not sufficient to completely remove the calcium carbonate that existed in the parent material or that was produced by reaction between carbonic acid and the calcium hydrolysed from silicate minerals. Accumulation of carbonates at some point in the profile is typical of calcification. Calcium also tends to keep fine clay in a granular condition resulting in very little downward clay movement.

Due to the climate in Ireland, Leaching and Gleisation are the two most common soil formation processes.

Soil Associations

The General Soil Map of Ireland classifies the Study Area as Rolling Lowland. These lands have slopes between 2 and 6 degrees with soils typically derived from shales, sandstone, granite or mica schist.

The Study Area comprises principally of Brown Podzolic soil (60%). Associated soil classifications are defined as Acid Brown Earths (20%) and Gleys (20%). These soils have been derived from sandstone and Lower Avonian Shale glacial till which is consistent with ground conditions as recorded in boreholes carried out as part of the site investigation. Site Investigation records suggest that the soils in the area are shallow, with the deepest level recorded being 1.2 metres below ground level. Made Ground from the surface was recorded in a number of locations.

Brown Podzolic soils have been formed through the leaching process as described above. They are less depleted than other soils formed through this process, and the profile usually consists of a surface in which organic matter is mixed with mineral matter. This overlies a reddish-brown layer in which iron, aluminium and sometimes humus have accumulated and there is no iron pan. Brown Podzolics have desirable physical characteristics and as a result are often devoted to cultivated cropping and pasture production. The low nutrient levels are easily overcome with the addition of lime and fertiliser.

Brown Earths are relatively mature, well drained, mineral soil with a relatively uniform profile. These soils have not been extensively leached with the result that there are no obvious signs of removal and deposition of iron oxides, humus or clays. In many cases a certain degree of leaching has taken place resulting in the translocation of soluble constituents, notably calcium and magnesium. The majority of Brown Earths result from lime deficient parent minerals and are therefore acid in nature. The desirable structure and drainage characteristics results in these soils being the most extensively cultivated soils, making up for a relatively low nutrient status by responding well to manorial amendments.

Gleys are soils in which the effects of poor drainage dominate and which have developed under the influence of waterlogging, characterised by the Gleisation process described above. Most gleys have poor physical conditions which make them unsuitable for cultivation or for intensive grassland farming. Their productive capacity is also affected by restricted growth in spring and autumn.

Potential Impacts on Soil

6.4.1 Loss of Soil

Potential Permanent Imperceptible Negative Impact

As the proposed scheme does not traverse large tracts of agricultural land, and soil was not encountered in all boreholes carried out to date, it is unlikely that the scheme will have a significant impact on the soil in the area. Considering that the majority of the proposed works are to be carried out to existing structures or in urban areas the loss of soil will be minimal.

Any loss of soil, or other potential impacts will be during the construction phase and likely to be associated with excavation, handling, storage, processing and transport of earthworks materials. Where soils are disturbed, excavated and/or stored for re-use during construction, they are prone to erosion by surface water run-off. In-situ soils may be compacted by construction machinery, reducing their ability to store water, which in turn may lead to increased run-off and soil erosion.

As any soils underlying the proposed works are abundant on a local and regional scale, they are of relatively low environmental and/or ecological value. The volume of soils encountered throughout the construction phase will be also be relatively small in comparison to the volume of excavated material generated.

Mitigation Measures

The construction and operation of the River Bride (Blackpool) Certified Drainage Scheme is not likely to have a significant impact on the soil in the area due to the small volumes, if any, of undisturbed soils that are likely to be encountered. Any excavated topsoil is likely to be reused in the construction of the flood defence embankments. It is necessary however to put in place mitigation measures in order to maximise the preservation of soil throughout the scheme.

In order to control the potential loss of soils as a result of erosion due to surface water run-off, a surface water management system will be put in place where necessary. As well as minimising soil erosion, a surface water management system will also minimise the volume of suspended solids transported by surface water run-off and discharged into local watercourses. The following measures will be implemented during the construction phase where applicable;

- Vegetation and soil will be left in place for as long as possible prior to excavation and stockpiling of soil to be minimised during wet weather periods.
- Soil stockpiles will be shaped so as to shed water.
- Surface water run-off from exposed soil surface will be intercepted and channelled to sumps and to silt traps thereafter.
- Granular materials will be placed over bare soil, particularly in the vicinity of watercourses, to prevent erosion of fines and/or rutting by construction machinery.

Residual Impact – Neutral Impact

Taking into account the relatively small volume of soil anticipated to be encountered throughout the construction phase, in conjunction with the mitigation measures as outlined above, the residual impact of the proposed scheme on the soil in the area is insignificant. This impact will constitute a **Neutral Impact**.

6.4.2 Contaminated Land

Potential Temporary Moderate Negative Impact

Potential impacts that may result from the improper management, storage and handling of fuels and lubricants for plant and machinery and of non-hazardous or hazardous liquid and solid wastes during the construction phase of the proposed scheme. Localised contamination of soils could result from an accident, spill or leak.

Mitigation Measures

In order to reduce the risk of soil contamination as a result of accidents spill or leaks the following measures will be implemented;

- Fuels, chemicals, liquids and solid wastes will be stored on impermeable surfaces
- Plant refuelling shall be undertaken on impermeable surfaces within a suitably constructed bund in accordance with best practice guidelines. No refuelling will be permitted in or near soil or rock cuttings.
- All hydrocarbons and other potential contaminants will be stored within suitably constructed bunds in accordance with best practice guidelines.
- Spill kits will be provided at refuelling areas and at high risk/sensitive sites.

Residual Impact – Potential Temporary Slight Negative Impact

It is likely that, with the mitigation in place this impact will constitute a **Potential Temporary Slight Negative Impact**. This residual impact will be fully identified as the works method statements become finalised.

6.5 HYDROMORPHOLOGY

Hydro morphology is similar to geomorphology in that it is the study of the structure, evolution and continued morphology of water courses over time.

The material in this section is based on a report prepared by JBA Consulting entitled 'Hydromorphic audit of the Lower Lee watercourse'.

Hydromorphological Characteristics

The watercourses of the Lower Lee are a mixture of semi-natural and heavily modified water bodies. The upper reaches of the Bride channel contain a mixture of pool-riffle-point bar morphology interspersed between impacted reaches where impoundments and historic channel modifications have created extended ponded pool and glide biotopes. Large culverts have been construction on the Bride River, influencing the channel processes and modifying the natural course of the channel. Fine and coarse sediment supply is low and comes from sources such as bank erosion and glacial sediment re-working. Sediment accumulation issues in the channel are a result of modification to the channel processes including impoundment disrupting the downstream transport of sediment, over widening which increases sedimentation due to reduced channel velocity, narrowing which decreases sediment due to increased channel velocity and poor placement of channel features and structures.

The Bride River flows through a confined urban area in which the channel's natural corridor has been reduced and confined by concrete walls in several sections, reducing connectivity to the floodplain. Restoration works such as re-profiling banks have been carried out in a number of areas to improve the channel morphology within the constrained environment. Despite being heavily modified, the channel continues to exhibit a gravel bed with a pool - riffle - run morphology.

The channel is predominantly narrow within the modified sections. The channel remains confined at the Blackpool shopping centre. The channel at Blackpool is heavily modified and enters a series of culverts before reaching the River Lee.

Potential Impacts on Hydromorphology

Potential Permanent Significant Negative Impact

The proposed works include culverting an open section of river channel between Old Commons Road and the existing culvert under the Commons Road (N20), local channel widening (winter channel) and the construction of a sediment trap at Sunbeam Industrial Estate, both on the River Bride.

It is envisaged that the winter channel will increase the channel capacity by providing a secondary route into the existing bank during high flow conditions. The existing channel will be undisturbed apart from cutting back vegetation and, during normal flow conditions, the river is confined to the existing channel. Therefore, it is envisaged that the impact on the channel hydromorphology as a result of the winter channel will be imperceptible.

The purpose of the sediment trap at the Sunbeam Industrial Estate is to capture fluvial sediments (primarily small cobble sized material), to help minimise the risk of large sediments settling in the Blackpool culvert

system, which would reduce hydraulic capacity. The river channel along the route of the proposed culvert will be constructed, currently contains natural sediment deposits, but will cease to do so following construction of the proposed scheme and successful implementation of the sediment control measures proposed as part of the scheme upstream of the culvert.

In addition to the above features, removal of sediment from the river channel will form a key part of the sediment management regime.

Mitigation Measures

It has been observed that stone, silt and sand accumulate at hydraulically sensitive locations in the existing culvert system. If left unchecked, sediment has the potential to collect and accumulate at culvert inlets, bridge piers, channel bends etc, increasing the risk of flooding. Therefore, in order to maximize hydraulic capacity and minimize defence height upstream, it is necessary to ensure that the culvert system is maintained as clean as possible.

Sediment management and sediment control will be an ongoing issue and will form a fundamental part of the scheme.

Sediment removal and sediment controls upstream of Sunbeam Industrial Estate will be carried out in consultation with Inland Fisheries Ireland, so as to minimise the volumes of sediment removed and the resultant impact on the morphological diversity upstream of the sediment trap at Sunbeam, while not compromising on the function of sediment control as a fundamental element of the proposed scheme.

Residual Impact – Potential Permanent Significant Negative Impact

The sediment controls will affect the hydromorphology of the river most significantly between the sediment trap and the existing culvert at Old Commons Road, limiting sediment deposition over a distance of approximately 1km incorporating culverts and open channel. Although the existing river channel through Blackpool Retail Park has been engineered, the river channel through Orchard Court along which the culvert is proposed currently displays patterns of natural sedimentation, with typically 40% riffle, 40% glide and 20% pool. Therefore, it is envisaged that the impact on the channel hydromorphology over this 1km stretch as a result of the sediment controls at the Sunbeam Industrial Estate will have a **Permanent significant negative impact**. It is noted however that the significant negative impact is localised to this section of channel.

In addition, the proposed sediment controls will reduce the sediment contribution from the catchment of the River Bride to the intertidal zone of the River Lee downstream of the point of confluence at Christy Ring Bridge (N20). It is also noted that the river channel is dredged downstream of Custom House, so the channel affected is less than 1km in length. The reduction in sediment volumes may therefore have a **Permanent moderate negative impact**.

6.6 ASSESSMENT OF CUMULATIVE IMPACTS

A search in relation to plans and projects that may have the potential to result in cumulative impact on the environment was carried out as part of the EIAR. Data sources included the following:

- Cork County Development Plan 2014
- Cork City Development Plan 2015
- Relevant Local Area Plans
- South Western River Basin Management Plan
- Lower Lee CFRAMS including the Lower Lee Flood Relief Scheme
- An Bord Pleanála Website (Planning Searches)
- Myplan.ie
- Web search for major infrastructure projects in Cork City and County

A synopsis of the search results is provided in Table 6.6. In addition to the plans and projects listed in Table 6.6 a number of small scale development of dwelling house/extensions were identified from the wider area surrounding the proposed flood relief scheme. Given their small size and scale and their location on existing residential and made ground the potential for cumulative impact is not considered significant and therefore not considered further in this assessment.

River Bride (Blackpool) Certified Drainage Scheme



Table 6.6 Potential Impact in combination with other Plans and Projects

Plans and Projects	Description and Key Issues / Policies/ Objectives	Potential impact on Biodiversity	In-combination Impact
	Related to the zone of influence		
Lee CFRAMS	For the Lee Catchment "Seek to minimise the level of	There is potential for impact on lands	None
Examines and aims to solve risk of	exposure to flood damages through the identification	use as a result of some options for Lee	
flooding, now and in the future,	and management of existing, and particularly potential	CFRAMs however impacts are limited	
from rivers and tidal waters.	future, flood risks in an integrated, proactive and river	to the local area. Positive impact as a	
	basin-based manner".	result of lands impacted by flooding	
	The following areas are considered:	River Bride has no significant impact on	
	The River Lee & its main tributaries (including Rivers	soils, geology or land use.	
	Bride, Curragheen Dripsey, Glasheen, Laney, Kiln,		
	Shournagh, Sullane,) and estuary;		
	Other main rivers flowing into Cork Harbour – Rivers		
	Tramore, Owenboy, Glashaboy and Owennacurra and		
	their estuaries; and		
	Cork Harbour.		
Cork County Development plan	Policy for protection of greenfield land by maximising	Potential Positive Impact	None
2014	the use of brownfield sites. Encourage sustainable		
	extraction of non-renewable resources.		
Cork City Development Plan 2015	Development of regions using where possible existing	Potential Positive Impact	None
– 2021 (including LAPS for	urban and brownfield sites.		
Blackpool, Farranferris and North			
west Cork)			
Proposed Projects	Planning permission granted but currently under appeal	Brownfield site, no significant changes	None
	consisting of: Demolition of industrial buildings and	in land use. Soils and geology: no	
	construction of residential units (approx. 81 dwelling) at	significant impact.	
	Sunbeam		

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Conclusion of Cumulative Impact Assessment

It is considered that the design of the proposed River Bride (Blackpool) Certified Drainage Scheme, the scale of the works and the implementation of effective mitigation and best practice will ensure that the proposed development, when considered on its own, will minimise as much as possible significant impacts on land use, soils and geology. Overall, the reduced risk of flooding will have a positive impact on land use in the Blackpoll area. The proposed project has been considered also, in combination with a number of plans and projects. Following a detailed assessment of the receiving environment, the potential for any further impact when considered in combination with any or all of the above plans and projects. It was found that there was no potential for significant cumulative impacts on Lands, soils and geology as a result of the proposed works.

7 WATER - HYDROLOGY & HYDROGEOLOGY

7.1 INTRODUCTION

This Chapter of the Environmental Impact Statement covers the potential impact of the proposed River Bride (Blackpool) Certified Drainage Scheme on the Water Environment. The chapter discusses the existing aquatic environment, the potential impacts of the scheme and remedial measures on both surface water and groundwater along with the hydrological and hydrogeological regimes of the Study Area. Impacts on Water: Hydrology and Hydrology are broken down into the following sections:

- Surface Water Quality;
- Hydrogeology;
- Flooding and Hydrology.

7.2 SURFACE WATER QUALITY

7.2.1 Legislative Review

7.2.1.1 Water Framework Directive

The EU Water Framework Directive (WFD) was adopted on the 23rd of October 2000 came into effect on the 22nd December 2000. It is the most significant piece of water legislation to be introduced by the European Commission in twenty years.

The Directive takes a broad approach to the protection, enhancement and restoration of all coastal waters, rivers, lakes, estuaries and groundwaters in Europe. It requires all countries to control, manage and protect their water resources from all impacts – physical, polluting or otherwise. Under the Directive, all waters within Europe must achieve at least 'Good' status by December 2015 unless otherwise agreed upon by the relevant authority and the European Commission and the status of any waters must not deteriorate.

7.2.1.2 The European Communities Environmental Objectives (Surface Water) Regulations, 2009 and Amendment Regulations 2012

The European Communities Environmental Objectives (Surface Waters) Regulations, 2009 came into effect on the 30th July 2009. They have a significant effect on the Water Framework Directive and also the Dangerous Substances and Priority Substances Directives.

The Directive, similar to the requirements of the Water Framework Directive, requires that all waters must be maintained at or improved to at least 'Good Status' by 22 December 2015. No deterioration in quality is permitted.

'Status' is a descriptor term that incorporates ecological and hydrochemical data and facilitates catchment comparisons on an EU scale. The catchment scale is referred to as the 'macro-scale'. Its status cannot be used to assess the potential impacts at a micro-scale i.e. a point discharge on a river, without there first being validation by monitoring data at the source of the point discharge. The EPA is responsible for assigning Status.

The European Communities Environmental Objectives (Surface Waters) Regulation, 2009, specify the conditions and physico-chemical concentrations that should be considered in the assessment of Status.

The 2012 Regulations set standards for a range of pesticide, herbicide and heavy metals in surface waters. It clarifies the role of public authorities in the protection of surface waters, include standards and sets limits for priority hazardous substances.

Table 7.1 below shows the surface water quality standards applied across a range of relevant legislation.

Parameter	Units	European	European	European	Salmonid
		Communities (Quality	Communities	Communities	Water
		of Surface Water	Environmental	Drinking	Regulations
		Intended for the	Objectives (Surface	Water	(Mandatory
		Abstraction of	Water) Regulations	Regulations	Level) (S.I. No.
		Drinking Water)	(S.I. No. 272 of	S.I. 106 of	293 of 1988)
		Regulations, 1989	2009)	2007	
		(S.I. No. 294/1989)*			
BOD	mg/l	5 –A1 & A2	High status ≤1.3	N/A	≤ 5
		7 – A3	(mean) or ≤ 2.2		
			(95%ile)		
			Good status ≤1.5		
			(mean) or ≤ 2.6		
			(95%ile)		
Suspended	mg/l	50	N/A	N/A	≤ 25
Solids					
рН	-	5.5-8.5 – A1	4.5-9.5 (Soft Water)	\geq 6.5 & \leq	\geq 6 & \leq 9
		5.5-9.0 – A2 & A3	6.0-9.0 (Hard	9.5	
			Water)		
Conductivity	μ S/cm	1,000	N/A	2,500	N/A
Phosphates	mg/I P2O5	0.5 – A1 & A2 0.7 A3	N/A	N/A	N/A
Molybdate	mg/IP	N/A	High status ≤0.025	N/A	N/A
Reactive	-,		(mean) or ≤0.045		,
Phosphorus			(95%ile)		
(MRP)					
			Good status ≤0.035		
			(mean) or ≤ 0.075		
			(95%ile)		
Chloride	mg/I Cl	250	N/A	250	N/A
Ammonium	mg∕l NH₄	0.2 – A1	N/A	N/A	≤ 1.0
		1.5 – A2			
		4 – A3			

Table 7.1	Mandatory	levels for	physiochemical	parameters for	r specific	legislation
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River Bride (Blackpool) Certified Drainage Scheme

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Parameter	Units	European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989 (S.I. No. 294/1989)*	European Communities Environmental Objectives (Surface Water) Regulations (S.I. No. 272 of 2009)	European Communities Drinking Water Regulations S.I. 106 of 2007	Salmonid Water Regulations (Mandatory Level) (S.I. No. 293 of 1988)
Total Ammonia	mg/l N	N/A	High status ≤0.040 (mean) or ≤0.090 (95%ile) Good status ≤0.065 (mean) or ≤0.140 (95%ile)	N/A	N/A
Nitrate	mg/I NO ₃	50	N/A	50	N/A
Nitrite	mg/I NO ₂	N/A	N/A	0.5	≤ 0.05
Dissolved Oxygen	-	>60% - A1 >50% - A2 >30% - A3	Lowerlimit:95%ile>80%saturationUpperlimit:95%ile<120	N/A	50% ≥ 9 mg/l
Total Hardness	mg∕l CaCO₃	N/A	N/A	N/A	N/A
Copper	mg/I Cu	0.05 –A1 0.1– A2 1.0 – A3	5 - water hardness ≤100mg/I CaCO ₃ 30 - water hardness >100mg/I CaCO ₃	2.0	$\leq 0.005 [1, 6]$ $\leq 0.022 [2, 6]$ $\leq 0.04 [3, 6]$ $\leq 0.112 [4, 6]$
Zinc	mg/l Zn	3–A1 5- A2 & A3	0.008 - water hardness ≤10mg/l CaCO3 0.05 - water hardness>10 ≤100mg/l CaCO3 0.1- water hardness >100mg/l CaCO3	N/A	 ≤ 0.03 [1, 6] ≤ 0.2 [2, 6] ≤ 0.3 [3, 6] ≤ 0.5 [5, 6]
Total	no /100	5 000 41	NI / A		
coliforms	no/ 100ml	25,000 – A1 25,000 – A2 100,000 – A3	N/A	IN/A	N/A
Faecal coliforms	no/100ml	1,000 – A1 5,000 – A2 40,000 – A3	N/A	0	N/A

[1] At water hardness 10 mg/l CaCO3; [2] At water hardness 50 mg/l CaCO3.; [3] At water hardness 100 mg/l CaCO3; [4] At water hardness 300 mg/l CaCO3; [5] At water hardness 500 mg/l CaCO3; [6] To be conformed with by 95% of samples over a period of 12 months where sampling is carried out at least once a month; where sampling is less frequent, to be conformed with by all samples.

*S.I. No. 294/1989 is superseded by S.I. No. 272 of 2009. If a particular parameter is not found in SI 272 of 2009 then the 1989 value applies.

7.2.2 Methodology

7.2.2.1 Desk Study

A desk study of relevant hydrological data was conducted. The following documentation and sources were reviewed:

- Environmental Protection Area (EPA) water quality database and maps (http://gis.epa.ie/Envision)
- Cork City Council Surface Water Results for the River Lee
- South Western River Basin District Management Plan (2009 2015)
- The Water Framework Directive website www.WFD.ie

7.2.2.2 Field Assessment

Q Values were determined for the River Bride (North) and Glenamought in order to determine the baseline biological water quality for the study area.

Q Values are biotic indices used to express biological water quality and are based on changes in the macro invertebrate communities of riffle areas brought about by organic pollution. Q1 indicates a seriously polluted water body and Q5 indicates unpolluted water of high quality. A value of Q3 indicates moderately polluted water. These Q value ratings are shown in Table 7.2. In addition, various chemical parameters are also tested by the EPA and are available for some of the monitoring points.

Quality Ratings	Quality Class	Pollution Status	Condition
			(re beneficial uses)
Q5, Q4-5, Q4	Class A	Unpolluted	Satisfactory
Q3-4	Class B	Slightly Polluted	Unsatisfactory
Q3, Q2-3	Class C	Moderately Polluted	Unsatisfactory
Q2, Q1-2, Q1	Class D	Seriously Polluted	Unsatisfactory

Table 7.2 Q value classification

Kick samples of aquatic macro-invertebrates were collected on the Bride River (North) and the Glenamought River between the 2nd and 5th May 2015. Where possible the macro-invertebrate sampling stations were situated in the vicinity upstream or downstream of the works areas, given the selection of the sampling sites also depended on the presence of riffle/ glide habitat from which samples could be collected. Kick sampling was carried out at 4 locations in the River Bride (North) and the Glenamought River. Kick sampling was performed for 2.5 minutes in the faster flowing areas (riffles) of the river. The kick sample was taken moving across the riffle zone and also involved washing large rocks from the riffle zone to ensure a full representation of the species composition from this micro-habitat type. Collected samples were elutriated, refrigerated and identified live within 24 hours of each site visit. The samples were identified using a Nikon

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SMZ 1000 stereo microscope and numerous Freshwater Biological Association invertebrate keys. Invertebrate taxa were identified to species level where possible. The relative proportions of taxonomic groups were recorded based on the EPA categories (i.e. 8 categories ranging from present to excessive) (Appendix I of Toner et al., 2005). Biological water quality data as prescribed by the Environmental Protection Agency (EPA; Toner et al. 2005), group invertebrates into classes whereby very pollution intolerant species are denoted class A, and species with greater pollution tolerance fall into successive classes (B through E respectively). As such the presence or absence of these groups and their relative abundances facilitates an assessment of biological river health. Using Appendix 1 of the Environmental Protection Agency publication Water Quality in Ireland, Q values were determined for all sites sampled, based on the faunal assemblage found at each sampling location.

7.2.3 Description of the Study Area

The Study Area consists of the of the River Bride (Blackpool) Certified Drainage Scheme which will alleviate flooding in the Blackpool area on the River Bride (North) of Cork City. The study area encompasses three major water courses: the Bride (North), the Glenamought and the Glen. The total catchment area upstream of Blackpool Village is 41.7km2.

The Bride (North) rises in the townland of Ballycannon, near Healy's Bridge, before flowing in an easterly direction towards Cork City. It is the most easterly tributary of the River Lee joining it east of Ovens. The Glenamought River rises in Whitechurch and flows in a southerly direction before making an abrupt rightturn in the townland of Ballincrokig. The Bride (North) and the Glenamought meet each other in a culverted system at the North Point Business Park on the N20. The Glen River flows in a westerly direction from Mayfield, through the Glen River Park, before entering a culvert under Spring Lane. It then merges with the Bride (North) in a large culvert junction under Madden's Buildings, 100m downstream of Blackpool Church. Downstream of the confluence of the Bride (North) and the Glen, the watercourse has traditionally been known as the Kiln River. The Kiln River discharges to the River Lee at Christy Ring Bridge. The culverted system in Blackpool has been incrementally constructed since the early the 1980s as part of the Glen-Bride-Kiln River Improvement Scheme which was commissioned by Cork Corporation in 1981. The topography of the entire catchment varies between 188mOD at Whitechurch and 25mOD in the Blackpool river valley.




7.2.3.1 EPA Water Quality Data

The EPA website, <u>http://gis.epa.ie/Envision</u>, contains information regarding water quality in selected Irish rivers based on surveys carried out by the EPA as part of the Water Framework Directive (WFD) Monitoring Programme. Biological information is provided in the form of Q values. The River Bride (North), the Glenamought River and the Glen River do not have any monitored points within the study area, therefore no EPA monitoring data was available for the River Bride (North), Glenamought River or the Glen River.

The closest EPA monitoring point on the River Lee, into which the Bride (North) flows is at Leemount Bridge, > 5km upstream of the confluence of the River Bride (North) and the River Lee. The water quality status at this monitoring point is Q4 "Good" status. The River Lee, approximately 3km upstream of the confluence of the River Lee and the River Bride (North) has "moderate" status under The River Waterbody Water Framework Directive (2010-2012 monitoring results).

The lower reaches of the River Lee, into which the River Bride (North) is a transitional coastal waterbody, i.e. the Lee (Cork) Estuary upper. The Lee (Cork) Estuary Upper Transitional Waterbody and the Lee (Cork) Estuary Lower Transitional WaterTransitional Waterbody, which lies downstream of the confluence both have "moderate" status under the Transitional Waterbody Water Framework Directive Status (2010-2012 monitoring results).

Water Framework Directive Operational Monitoring Data

Water quality monitoring, as required under the terms of the Water Framework Directive (WFD), is one of the functions of the Environment Section of Cork County Council and Cork City Council. The most recent

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physico-chemical data from monitoring points within and close to the Study Area taken by Cork City Council are presented in Table 7.3.

Parameter	Unit	River: Bride North. Station name and reference: Blackstone Bridge RS19B140110					
		13/01/2015	14/04/2015	18/08/2015	06/10/2015		
Temperature	°C	6.4	11.07	14.7	13.1		
Dissolved Oxygen	mg/l	9.06	10.65	6.47	7.43		
рН	pH units	7.8	8.1	7.5	7.8		
Conductivity @20°C	μS/cm	303	307	319	311		
Biochemical Oxygen	mg/I O ₂	1.0	1.0	2.9	1.0		
Ammonia	mg/I N	0.010	0.050	0.040	0.010		
Nitrogen	mg/I N	4.74	5.13	4.23	2.40		
Ortho-phosphate	mg/I P	0.047	0.023	0.060	0.033		
Suspended solids	mg/I	3.0	4.0	17.0	2.5		
Parameter	Unit	River: Br	ride North. Station RS19G	name and referenc 880990	e: Kilnap		
		13/01/2015	14/04/2015	01/07/2015	06/10/2015		
Temperature	°C	6.5	11.2	15.8	13.3		
Dissolved Oxygen	mg/l	10.01	11.02	8.19	8.48		
рН	pH units	7.8	8.3	8.0	7.8		
Conductivity @20°C	μS/cm	268	288	301	284		
Biochemical Oxygen	mg/I O ₂	1.7	2.3	1.1	1.2		
Ammonia	mg/I N	0.030	0.040	0.060	<0.01		
Nitrogen	mg/I N	3.21	5.36	3.19	3.21		
Ortho-phosphate	mg/I P	0.047	0.092	0.080	0.125		
Suspended solids	mg/I	4.0	19.0	3.0	4.0		
Parameter	Unit	River: Bride	e North. Station nan	ne and reference: I	-itz's Boreen		
			RS19B	140300			
		13/01/2015	14/04/2015	01/07/2015	06/10/2015		
Temperature	°C	6.8	11.8	15.9	13.9		
Dissolved Oxygen	mg/l	9.77	10.65	7.60	8.79		
рН	pH units	7.9	7.9	8.1	7.8		
Conductivity @20°C	μS/cm	285	299	313	296		
Biochemical Oxygen	mg/I O ₂	1.2	1.1	1.2	1.0		
Ammonia	mg/I N	0.040	0.060	0.070	0.020		
Nitrogen	mg/I N	4.34	5.91	3.01	5.21		
Ortho-phosphate	mg/I P	0.082	0.060	0.115	0.098		
Suspended solids	mg/I	4.8	6.0	2.4	3.2		
Parameter	Unit	River: Bric	de North. Station no RS19B	ame and reference: 140800	Blackpool		
		13/01/2015	14/04/2015	01/07/2015	06/10/2015		
Temperature	°C	6.8	1.05	15.4	13.7		
Dissolved Oxygen	mg/I	9.89	10.05	7.32	8.33		
рН	pH units	7.4	7.4	8.0	7.3		
Conductivity @20°C	μS/cm	310	317	342	310		

Table 7.3 Cork City Council Physico-chemical Monitoring Data for the River Lee

			_ .	
River Bride	(Blackpool) Certified	Drainage	Scheme

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Biochemical Oxygen	mg/I O ₂	1.1	1.0	1.4	1.0		
Ammonia	mg/I N	0.020	0.030	0.050	0.140		
Nitrogen	mg/I N	4.07	6.30	3.37	4.29		
Ortho-phosphate	mg/I P	0.072	0.058	0.120	0.098		
Suspended solids	mg/I	3.6	4.0	7.3	2.0		
Parameter	Unit	River: Gl	en. Station name ar	nd reference: Glen	Rec. Park		
			RS19G	090400			
		13/01/2015	14/04/2015	01/07/2015	06/10/2015		
Temperature	°C	6.5	10.6	14.4	13.4		
Dissolved Oxygen	mg/l	9.81	9.12	7.23	8.41		
рН	pH units	7.6	7.8	8.2	7.7		
Conductivity @20°C	μS/cm	334	335	342	320		
Biochemical Oxygen	mg/I O ₂	1.3	1.0	1.6	2.1		
Ammonia	mg/I N	0.050	0.150	0.090	0.050		
Nitrogen	mg/I N	4.52	4.86	3.50	1.63		
Ortho-phosphate	mg/l P	0.097	0.098	0.167	0.145		
Suspended solids	mg/l	6.8	4.0	5.6	10.0		
Parameter	Unit	River: C	Glen. Station name	and reference: Spri	ing Lane		
		RS19G090800					
		13/01/2015	14/04/2015	01/07/2015	06/10/2015		
Temperature	°C	6.5	10.9	15.4	13.7		
Dissolved Oxygen	mg/l	10.18	9.72	7.52	8.23		
рН	pH units	7.5	7.7	7.9	7.6		
Conductivity @20°C	μS/cm	443	340	347	325		
Biochemical Oxygen	mg/I O ₂	1.4	1.0	1.4	1.2		
Ammonia	mg/I N	0.050	0.080	0.080	0.030		
Nitrogen	mg/I N	4.69	4.74	2.41	4.44		
Ortho-phosphate	mg/I P	0.093	0.108	0.150	0.115		
Suspended solids	mg/l	4.4	2.0	5.0	1.6		
Parameter	Unit	River:	Kiln. Station name	and reference: Leit	rim St.		
			RS19K	750900			
		13/01/2015	14/04/2015	01/07/2015	06/10/2015		
Temperature	°C	7.3	11.4	16.3	14.7		
Dissolved Oxygen	mg/l	10.20	6.64	3.73	7.20		
рН	pH units	6.9	7.0	7.4	6.9		
Conductivity @20°C	μ S/cm	330	434	10420	372		
Biochemical Oxygen	mg/I O ₂	3.5	23.0	60.0	23.7		
Ammonia	mg/I N	0.060	0.370	2.40	0.140		
Nitrogen	mg/I N	4.71	6.24	6.42	5.04		
Ortho-phosphate	mg/l P	0.123	9.50	0.607	0.038		
Suspended solids	mg/l	4.0	10.0	61.2	4.0		

7.2.3.2 Water Framework Directive

The Study Area is located within the Water Framework Directive (WFD) South Western River Basin District (SWRBD). The main objectives of the SWRBD Management Plan is to prevent deterioration, restore good status, reduce chemical pollution in surface waters and to achieve protected areas objectives. The programme of measures designed to achieve these objectives include the following:

- Control of urban waste water discharges;
- Control of unsewered waste water discharges;
- Control of agricultural sources of pollution;
- Water pricing policy;
- Sub-basin management plans and programmes of measures for the purpose of achieving environmental water quality objectives for Natura 2000 sites designated for the protection of Freshwater Pearl Mussel populations;
- Pollution reduction programmes for the purpose of achieving water quality standards for designated shellfish waters; and
- Control of environmental impacts from forestry.

Information on status, objectives and measures in the SWRBD has been compiled for smaller, more manageable geographical areas than river basin districts, termed Water Management Unit Action Plans. There are twenty-eight Water Management Units (WMUs) in the SWRBD. These units represent smaller river and lake basins where management of the pressures, investigations and measures are focussed and refined during implementation of the plan. In addition, action plans focusing on groundwater and a transitional and coastal water management have been prepared for the SWRBD. WMU Action Plans are a key background document to the plan.

The Study Area is within the Lower Lee Owenboy Water Management Unit (WMU). There are 43 river water bodies in the Lower Lee Owenboy WMU with the following status:

- 9 High;
- 9 Good;
- 11 Moderate; and
- 14 Poor Status.

The status of the various water bodies in this area is calculated using the EPA data described above, physiochemical data and fish status data.

The status of the Lee including its tributaries is described in the Lower Lee Owenboy WMU Action Plan (2010) as follows:

- 2001: Satisfactory apart from Inishcarra Bridge (0600) where again highly eutrophic. The protected pearl mussel has apparently become scarce in the river in the past two decades.
- 2005- Major disruption to fauna at first location, upstream of Gouganebarra Lake (0010), where salmonid parr and other age classes had been killed. Further downstream the water quality status was the same as that of the previous survey with highly eutrophic conditions again recorded at Inishcarra Bridge (0600).
- 2008- Satisfactory apart from at Inishcarra Bridge where again poor ecological quality was recorded. 2009: Poor status dictated by Q score

The identified pressures/risks in this WMU Action Plan include the following:

Nutrient Sources: Main source of TP is from unsewered industry (64%) and agriculture (26%). P

- Point Pressures: There are 24 Waste-water Treatment Plants (WwTP), 2 Water Treatment Plants (WTP), 21 Section 4 licenced facilities, 26 Integrated Pollution Prevention and Control (IPPC) licenced facilities and 1 contaminated site within the WMU.
- Quarries: There are 14 quarries and 5 landfills within the WMU. 3 WB are at risk from quarries
- Agriculture: 39 water bodies have been determined to be at risk from agriculture within the WMU.
- On-site Water Treatment Systems (OSWTS): There are 15275 septic tanks in this WMU. 963 of these are located in areas of very high or extreme risk.
- Forestry: Significant area of SW_19_1910 is under forestry
- Morphology: There are 3 water bodies that have been determined to be at risk from morphology within the WMU. Water Regulation and Impoundments Inniscarra Reservoir is a HMWB. (the local authority also note some drainage & channelisation of WB 19-1584 in the past particularly between Ballinhassig & Halfway when road was realigned, also some drainage upstream of Halfway in 2006)
- Abstractions: One water body has been determined to be at risk from abstractions within the WMU
 : SW_19_1663

Q Rating / Biological Water Quality

A full description of the sampling locations and the results of each sample taken are presented in Appendix 5 to this EIS.

Results of kick samples showed that only small numbers of very clean water (class A) invertebrates were present at sites sampled on the River Bride (North), while only one species from class B was present (also indicative of clean water). The sites were dominated by class C (moderately pollution tolerant) invertebrate species that included good numbers of the mayfly species *Baetis rhodani*, a mayfly species characteristic of slightly polluted waters. In summary the water quality at sites on the River Bride (North) were indicative of Q3-4 moderate status, slightly polluted water.

Both sites sampled on the Glenamought River had a good diversity of clean water stoneflies and mayflies present indicating good quality water. Pollution tolerant invertebrate forms were virtually absent apart from the leech species *Haemoptis sanguisuga* (class D) at one site. In summary the invertebrate composition encountered at sites 8 and 9 were representative of Q4 unpolluted, good status water quality.



Figure 7.2 Q Ratings Blackpool

The Glenamought River was among the cleanest of the river sites surveyed with Q4, good status water quality recorded at both sites sampled. The Glenamought River was located in a non-urbanised environment and rises in a wooded river valley with limited human interference. The river retained a very natural profile with riffle, glide and pool habitat. While some localised realignments have occurred in its lower reaches the water quality appears to be unaffected. The Glenamought River between the Viaduct and the Industrial Estate downstream near its confluence with the River Bride (North) had very high densities of salmonids as observed during electro-fishing surveys in 2014 (See Chapter 5). The river had clean swift flowing water and clean substrata which evidently have helped maintain the rivers unpolluted status. Along the River Bride (North) the water quality deteriorated. This was likely as a result of urban encroachment and associated storm drain point sources of pollution that are entering the river. As such the water quality was recorded as Q3-4 slightly polluted (moderate status).

7.2.3.3 Surface Water Abstraction

The Lee Road Water Treatment Plant is the main source of drinking water for Cork City (70%) with the remaining supplied for the Cork Harbour and City Scheme (30%). Surface water is abstracted from the River Lee for the Lee Road Plant and at Inniscarra Lake for the Cork Harbour and City Supply Scheme. Neither abstraction locations, treatment plants nor their associated reservoirs are within the zone of influence of the proposed River Bride (Blackpool) Certified Drainage Scheme.

7.2.4 Impacts and Mitigation for Surface Water Quality

7.2.4.1 Generation of Silt-Laden Run-off & Increase in Suspended Solids

Short-term Moderate Negative Impact

The preparation phase, site clearance and preparatory groundworks including site compound set-up etc. will lead to exposure of bare ground and the potential for the generation of silt-laden run-off in works areas along the river bank. The potential for the generation of silt-laden surface run-off on the adjacent banks and along access and egress routes is likely to continue through the construction phase of the works and until the ground has consolidated. Stockpiled excavated material also poses an increased threat of increased siltation in the watercourse.

Excessive suspended sediment in the water column can clog and cause abrasions to fish gills, interfere with fish navigation and feeding, affect egg and fry development, while also affecting populations of aquatic invertebrates, on which the fishes' diet is based. Once deposited, excessive amounts of silt may damage fish habitat by clogging interstices between gravels in spawning grounds, resulting in diminished flow of oxygenated water to eggs and rendering these gravels unsuitable for egg incubation. Deposited sediment may also impact on the habitat of bottom dwelling aquatic invertebrates and damage nursery habitat for young fish (See also Chapter 5, Flora and Fauna).

Mitigation Measures

- Measures to minimise the suspension and transfer of sediment downstream will be implemented. These measures are likely to include the use of silt barriers downstream of the works areas and removal of any accumulated silt, construction of silt sumps downstream of the works areas, cofferdamming and dewatering of works areas where concrete and other building works are proposed. Any stockpiling will also be greater than 10 metres from the river bank.
- All works undertaken on the banks will be fully consolidated to prevent scour and run off of silt. Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and also the sowing of grass seed on bare soil.
- Works will only be undertaken during normal working hours (8:00 6:00) thus allowing the river to run clean for 14 hours per day.
- An Environmental Management Plan (EMP) will be prepared prior to the commencement of any works in order to ensure all works are carried out in a manner designed to avoid and minimise any adverse impacts on the receiving environment

Residual Impact - Temporary Slight Negative Impact

It is likely that, with mitigation measures in place this impact will constitute a Temporary Slight Negative Impact.

7.2.4.2 Use of Potential Water Contaminants

Potential Temporary Moderate to Significant Negative Impact

Numerous substances used on construction sites have the potential to pollute both ground and surface water if not properly managed and treated. Such substances include fuels, lubricants, cement, mortar, silt, soil and other substances which arise during construction. The washing of construction vehicles and equipment also poses a pollution risk to watercourses. The spillage or leaking of fuel or oil from fuel tanks or construction vehicles has the potential to contaminate soils, groundwater and surface water. Such substances entering the River could damage the habitat of local populations of fish and aquatic invertebrates and also cause direct harm to aquatic fauna.

Mitigation Measures

- All concrete works will be carried out in dry conditions with no in-stream pouring of concrete.
- There will be no refuelling of machinery within the river channel. Refuelling will take place at designated locations at distances of greater than 30 metres from the watercourse.
- No vehicles will be left unattended when refuelling and a spill kit including an oil containment boom and absorbent pads will be on site at all times.
- Any fuel that is stored on the site will be in a double skinned, bunded container that will be located within a designated works compound at a location that is removed from the river. All other construction materials and plant will be stored in this compound. The compound will also house the site offices and portaloo toilets. This compound will either be located on ground that is not prone to flooding or will be surrounded by a protective earth bund to prevent inundation.
- All vehicles will be regularly maintained and checked for fuel and oil leaks.

Residual Impact – Neutral Impact

It is likely that, with proper implementation of the above mitigation this impact will constitute a slight negative short term impact and a Neutral long-term Impact.

7.3 HYDROGEOLOGY

This section describes the existing hydrogeological environment within the Study Area and assesses the potential impacts of the River Bride (Blackpool) Certified Drainage Scheme.

7.3.1 Methodology

A desktop study was carried out in order to ascertain a comprehensive baseline for the Study Area and give a description of the existing environment. This information was then used in assessing the potential impact the proposed works will have on the hydrogeology within the Study Area.

The following documents were consulted during the preparation of this section:

- The Geology of South Cork (1994)
- The Geological Survey of Ireland (GSI) online database

7.3.2 Hydrogeology in the Existing Environment

The Geological Survey of Ireland (GSI) online database shows the Study Area as being underlain by Devonian Old red sandstone with dinantian mudstone and sandstsone. The site is locally important aquifer with bedrock which is moderately productive only in Local Zones. Groundwater flows through fractures, fissures or joints in the bedrock. The groundwater body is generally covered by till derived from its sandstone parent material. An extract from the GSI Online Database is provided.



Figure 7.3 GSI Groundwater Resources (Aquafers) (<u>www.gsi.ie</u>)

The direction of groundwater flow is likely to be influenced by the topography of the surrounding area. Groundwater within the Study Area is more than likely hydraulically connected to the River Lee and its tributaries including the River Bride (North), River Glen and River Glenamought.

Groundwater Vulnerability

Groundwater vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities.

The Geological Survey of Ireland (GSI) online database was referenced regarding the vulnerability of the local aquifers to contamination from ground waters. The vulnerability mapping indicates that the local aquifers are generally highly or extremely vulnerable within the Study Area. An extract from the GSI Online Database is included below.



Figure 7.4 GSI Aquafer Vulnerability (www.gsi.ie)

Wells and Boreholes

The well card data by the Geological Survey of Ireland (GSI) indicates that a number of wells are in proximity to the scheme, in particular three wells are identified to the east of the scheme at Mallow Road. All other wells are either a sufficient distance for gradient that they are not within the zone of influence of the scheme. An extract from the GSI Online Database is included in Figure 7.5 the locations of the groundwater wells within the Study Area. Where wells protection areas overlap with the study area these have been shown in red.



Figure 7.5 GSI Wells and Springs

A list of abstractions for is provided in Table 7.6.

Table 7.6 – GSI Well Card Data (Boreholes)

Townland	Depth	Depth to	Source Use	Yield	Yield
	(m)	Rock (m)		Class	(m³/day)
Kilcully	38	4.6	Unknown	Poor	38
Kilnap	91	4	Industrial	Moderate	50
Kilnap	60	2	-	-	-
Kilbarry	99.1	6.1	Unknown	Good	272

7.3.3 Potential Impacts on Hydrogeology

Potential Temporary Slight Negative Impact

There are numerous substances that will be used during the construction phase such as fuel, oil, lubricants, cement, silt, soil and other hydrocarbons which have the potential to pollute ground water. Washing of construction vehicles and machinery also poses a risk of polluting ground water. The impacts to hydrogeology as a result of the River Bride (Blackpool) Certified Drainage Scheme are temporary and not significant. Any impacts associated with the scheme will occur during the construction or maintenance phase.

As set out in Section 7.3.2 above, the aquifers in the study area are classified as highly to extremely vulnerable to infiltration but are very poor aquifers. Should any of the above-mentioned substances

contaminate the ground water in the study area presence of a poor aquifer means that there is limited risk to any ground water supply.

Mitigation Measures

A bunded area will be constructed within the site compound in order to avoid any polluting substances infiltrating the ground water during the construction and operation phase of the Scheme. All plant refuelling, maintenance and washing will be carried out within the bunded area. Spill kits will be available at the bunded area in order to ensure the quick and effective cleaning of any substances.

Residual Impact - Potential Negligible Impact

Taking into account the abovementioned mitigation measures, it is considered that the impact will constitute a Negligible Impact.

7.4 FLOODING

This section describes the existing hydrological environment within the Study Area and potential impacts of the proposed works on Flooding. Mitigation measures are also provided for any potentially significant impacts identified.

7.4.1 Methodology

A desktop study was carried out in order to obtain a baseline for the Study Area and provide a description of the existing environment. The information was then used to assess the potential impact the Scheme will have on the hydrology of the Study Area.

The following documents were consulted during the preparation of this section:

- Ryan Hanley McCarthy Keville and O'Sullivan (2014) Lower Lee Flood Relief Scheme Constraints Study;
- The Office of Public Works (2010) Lee Draft Catchment Flood Risk Management Plan;
- JBA Lower Lee Hydrology Report Final Report (February 2017)

7.4.2 Flooding and Hydrology in the Existing Environment

There has been a history of extensive flooding in the Blackpool area of Cork City in recent years. Prior to the early 2000s the primary source of flood risk came from the Glen River. However, in recent years this risk appears to have transferred over to the River Bride (North). Figure 7.6 below summarises the flood history and illustrates the transition of risk between watercourses.





The River Bride (Blackpool) Certified Drainage Scheme proposes a combination of flood defence measures at specific locations and a rigorous and organised channel maintenance programme though the reach of the catchment.

The channel maintenance programme will include the River Bride (North) from its confluence with the Glenamought River, down along the Kiln to its outfall into the River Lee (approximately 3,470m). The maintenance programme also includes the predominantly culverted Brewery Branch reach of the Kiln River (approximately 825m). The channel maintenance programme will pay particular attention to locations where debris is likely to accumulate, such as at structures, sharp bends, culverts inlets etc.

The locations and extents of the proposed flood defence measures are outlined in the scheme drawings contained in Appendix 3 of the EIS and will included the following:

- Site investigation,
- Construction of new culverts,
- Replacement of four existing bridges/ culverts,
- Construction of new flood walls/ earthen embankments,
- Constructing bridge parapets,
- Local channel widening of the River Bride (referred to as a 'Winter Channel'),
- Construction of a sedimentation trap on the left bank of the River Bride,
- Removal of approximately 100m of existing culvert and restoration of open channel (River Bride) at this location,
- Construction of a new trash screen and roughing screens, and removal of existing trash screens on the River Bride (north) and Glen and Glenamought Rivers,
- Modifications to the existing foul and surface water collection networks in the vicinity of the proposed works, including construction of pumping stations, in order to prevent flooding,
- Removal of an existing sluice structure in the channel of the River Bride to the rear of the Dulux factory,
- Localised regrading of ground levels, erection of fencing and access to gates, to facilitate pedestrian /vehicular access to and around flood defences, or to redirect overland surface water flow paths,

- Filling in an existing open watercourse,
- Introduction of a flow control structure on the entrance to the Brewery culvert on the River Bride and the Spring Lane culverted branch of the River Glen, and
- Regular maintenance of the river channel and pumping stations.

7.4.3 Potential Impacts on Flooding

Impact on Flooding and Hydrology

Permanent Significant Positive Impact

The River Bride (Blackpool) Certified Drainage Scheme improves flood protection with the provision of a suite of measures including replacement of culverts, embankment works and defence wall improvements and therefore reduces the risk of water levels overtopping the bank and flooding the surrounding area.

Impact on Water Levels Upstream and Downstream of Proposed Works

Permanent Negligible Impact

The Flood improvements works will not affect the water levels upstream and downstream of the proposed scheme during normal flow conditions. During a storm event the flood defence measures will prevent waters flooding the surrounding area and therefore water levels downstream of the proposed flood defence walls may increase slightly over short stretches.

7.5 ASSESSMENT OF CUMULATIVE IMPACTS

A search in relation to plans and projects that may have the potential to result in cumulative impact on the environment was carried out as part of the EIAR. Data sources included the following:

- Cork County Development Plan 2014
- Cork City Development Plan 2015
- Relevant Local Area Plans
- South Western River Basin Management Plan
- Lower Lee CFRAMS including the Lower Lee Flood Relief Scheme
- An Bord Pleanála Website (Planning Searches)
- Myplan.ie
- Web search for major infrastructure projects in Cork City and County

See also Chapter 5.5 for impact on water quality in relation to biodiversity flora and fauna A synopsis of the search results is provided in Table 7.6. In addition to the plans and projects listed in Table 7.7 a number of small scale development of dwelling house/extensions were identified from the wider area surrounding the proposed flood relief scheme. Given their small size and scale and their location on existing residential and made ground the potential for cumulative impact is not considered significant and therefore not considered further in this assessment.



Table 7.7 Potential Impact in combination with other Plans and Projects (See Table 5.5 for Water Quality Impacts on the River Bride)

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Plans and Projects	Description and Key Issues / Policies/ Objectives Related to the	Potential impact on Biodiversity	In-combination
	zone of influence		Impact
Existing activities: discharges and agricultural practices upstream.	Risk to groundwater quality from agriculture and discharges.	No risk to groundwater as a result of flood scheme. No increased risk of flood as a result of scheme. Scheme has been designed to take into account the existing conditions upstream of the site.	None
Lee CFRAMS Examines and aims to solve risk of flooding, now and in the future, from rivers and tidal waters.	For the Lee Catchment "Seek to minimise the level of exposure to flood damages through the identification and management of existing, and particularly potential future, flood risks in an integrated, proactive and river basin-based manner". The following areas are considered: The River Lee & its main tributaries (including Rivers Bride, Curragheen Dripsey, Glasheen, Laney, Kiln, Shournagh, Sullane,) and estuary; Other main rivers flowing into Cork Harbour – Rivers Tramore, Owenboy, Glashaboy and Owennacurra and their estuaries; and Cork Harbour.	The SEA Scoping study for Lee CFRAMS identified that the potential impact on groundwater is limited and therefore not considered relevant to flood risk management. No groundwater supplies are identified within the catchment.	None
Cork County Development plan 2014	Policy for protection of groundwater as a natural resource and for its ecological and economic value.	Potential Positive Impact	None
Cork City Development Plan 2015 – 2021	Policy for maintaining the quality of groundwater.	Potential Positive Impact	None
South Western River Basin Management Plan	In order to meet the requirements of the EU Water Framework directive, it sets specific standards for the maintenance and improvement of the ecology and chemical water quality of water bodies in the Lee Catchment.	Potential Positive Impact	None

RYANHANLEY River Bride (Blackpool) Certified Drainage Scheme in association with **Proposed Projects** Planning permission granted but currently under appeal consisting Brownfield site. Construction works Mitigation is provided of: Demolition of industrial buildings and construction of residential may pose a direct potential impact for potential impact units (approx. 81 dwelling) at Sunbeam groundwater. Mitigation construction during on required to minimise impact. phase on water Potential impact from runoff during quality for which strict construction phase. adherence is Flood Risk Assessment required for required.

the development.

7.5.1 Conclusion of Cumulative Impact Assessment

It is considered that the design of the proposed River Bride (Blackpool) Certified Drainage Scheme, the scale of the works and the implementation of effective mitigation and best practice will ensure that the proposed development, when considered on its own, will minimise as much as possible significant impacts on Water Quality, Hydrology and Hydrogeology. The proposed project has been considered also, in combination with a number of plans and projects. Following a detailed assessment of the receiving environment, the potential for any further impact when considered in combination with any or all of the above plans and projects. It was found that there was no potential for significant cumulative impacts on Water as a result of the proposed works.

8 AIR QUALITY & CLIMATE / NOISE & VIBRATION

This section, prepared by McCarthy Keville O'Sullivan Ltd. with Damian Brosnan Acoustics, assesses both the air quality & climate and the likely noise & vibration impact of the proposed works, in the context of current relevant standards and guidance, and identifies any requirements or possibilities for mitigation.

The proposed works will not have any air quality or noise and vibration impact during its operational phase. As a result, it is only considered necessary to assess the potential noise and vibration impact on the surroundings during the construction phase.

The construction phase will be short term and transient in nature and will comprise of that identified in chapter 3 of this EIAR.

8.1 AIR QUALITY & CLIMATE – EXISTING ENVIRONMENT

Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on factors such as wind speed, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM10, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than PM2.5) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles (PM2.5 – PM10) will actually increase at higher wind speeds. Thus, measured levels of PM10 will be a non-linear function of wind speed.

County Cork has a temperate oceanic climate, resulting in mild winters and cool summers. The Met Éireann weather station at Cork Airport is the nearest weather and climate monitoring station to the proposed development site located approximately 5.8 kilometres south of the site. Meteorological data recorded at Cork Airport over the 30-year period from 1981-2010 is shown in Table 8.1 overleaf. The wettest months are October and December, and July is usually the driest. July is also the warmest month with an average temperature of 18.7° Celsius.

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Table 8.1 Data from Met Éireann Weather Station at Cork Airport, 1981 to 2010

	Monthly	and Annua	l Mean an	d Extreme	Values								
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE (degrees Celsius)													
Mean daily max	8.2	8.3	9.9	11.8	14.4	17	18.7	18.5	16.5	13.2	10.3	8.5	12.9
Mean daily min	3	3.1	4	4.9	7.4	10	11.8	11.8	10.2	7.7	5.2	3.7	6.9
Mean temperature	5.6	5.7	6.9	8.4	10.9	13.5	15.3	15.2	13.3	10.5	7.8	6.1	9.9
Absolute max.	16.1	14	15.7	21.2	23.6	27.5	28.7	28	24.7	21.4	16.2	13.8	28.7
Absolute Min.	-4.3	-1.6	1.4	5	7.6	10.7	12.8	11.9	10.4	6	0.6	-3.2	-4.3
Mean No. of Days With Air Frost	10.6	10.6	10.9	11.4	15.1	16.2	19	18.4	17.3	15.4	12.8	11.6	19
Mean No. of Days With Ground Frost	-8	-4.7	-4.3	-2.3	-0.9	3.7	6.7	5.3	2.3	-0.9	-3.3	-7.2	-8
RELATIVE HUMIDITY (%)													
Mean at 0900UTC	89.8	89.4	87.8	83.1	80.6	81.3	83.2	85.4	88.4	90.1	90.7	90.5	86.7
Mean at 1500UTC	83.7	78.9	75.5	71.3	70.9	71.5	72.9	72.8	75.4	80.4	83.4	85.4	76.8
SUNSHINE (Hours)													
Mean daily duration	1.8	2.4	3.3	5.3	6.2	5.8	5.4	5.2	4.3	3	2.3	1.7	3.9
Greatest daily duration	8.5	10	11.5	13.6	15.5	16	15.3	14.4	11.9	10.3	8.7	7.6	16
Mean no. of days with no sun	10.1	7.9	6.3	3.1	2.1	2.5	2	2.6	3.6	6.4	8.6	11.9	67.1
RAINFALL (mm)													
Mean monthly total	131.4	97.8	97.6	76.5	82.3	80.9	78.8	96.8	94.6	138.2	120	133.1	1227.9
Greatest daily total	45.7	49.9	55.2	34.2	34.9	59.7	73.2	60.9	58.9	52.1	47.9	41.9	73.2
Mean num. of days with >= 0.2mm	20	17	19	16	15	14	15	15	16	19	19	19	204
Mean num. of days with >= 1.0mm	16	13	14	11	12	10	10	11	11	15	14	15	152
Mean num. of days with >= 5.0mm	9	6	5	5	5	5	5	5	5	8	7	8	73
WIND (knots)													
Mean monthly speed	12.1	12	11.6	10.3	10.1	9.4	9	9	9.4	10.7	10.9	11.6	10.5
Max. gust	78	83	70	62	59	49	57	54	58	75	66	80	65.9

McCarthy Keville O'Sullivar



River Bride (Blackpool) Certified Drainage Scheme

Max. mean 10-minute speed	52	54	43	40	40	33	40	38	39	48	46	56	44.1
Mean num. of days with gales	2.3	1.8	1.3	0.3	0.3	0	0.1	0.2	0.3	1	1.2	1.9	10.8
WEATHER (Mean No. of Days With:)													
Snow or sleet	3.1	3.1	2	0.7	0	0	0	0	0	0	0.3	2.2	11.3
Snow lying at 0900UTC	0.7	0.5	0.2	0.1	0	0	0	0	0	0	0	0.5	2
Hail	1	1.1	1.4	1.9	0.7	0.2	0.1	0	0.1	0.3	0.2	0.4	7.4
Thunder	0.2	0.1	0.1	0.1	0.6	0.5	0.8	0.3	0	0.4	0.1	0.1	3.3
Fog	7.8	6.8	8.5	7.5	7.6	7.6	8.4	8.8	9.1	8.7	7.6	8.4	96.8

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Available Background Data

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality "Air Quality Monitoring Report 2010", details the range and scope of monitoring undertaken throughout Ireland. The Environmental Protection Agency (EPA) has designated four Air Quality Zones for Ireland:

- Zone A: Dublin City and environs
- Zone B: Cork City and environs
- Zone C: 16 urban areas with population greater than 15,000
- Zone D: Remainder of the country.

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Framework Directive and Daughter Directives. The site of the proposed development lies within Zone B, which represents Cork city and its environs.

The EPA publishes Air Monitoring Station Reports for monitoring locations in all four Air Quality Zones. The ambient air quality monitoring carried out closest to the proposed development site is at Blackpool, Co. Cork, located adjacent to the proposed development site. EPA air quality data is available for Blackpool in the report 'Ambient Air Monitoring at Blackpool, Cork City 19th January 2000 to 31st May 2000', as detailed below. This monitoring location also lies within Zone B. Similar measurement values for all air quality parameters would be expected for the proposed development site as it lies directly adjacent to this monitoring location.

Sulphur Dioxide (SO2)

Sulphur dioxide data for the 2000 monitoring period in Blackpool is presented in Table 8.2. A technical problem with the monitor meant that no data was collected between 29th March and 18th May 2000.

Parameter	Measurement
No. of hours	3,188
No. of measured values	1,952
Percentage Coverage	61.2%
Maximum hourly value	161.3 μg/m3
98 percentile for hourly values	96.1 µg/m3
Mean hourly value	25.3 µg/m3
Maximum 24-hour mean	58.3 µg/m3
98 percentile for 24-hour mean	47.3 μg/m3

Table 8.2 Sulphur Dioxide Data Blackpool January to May 2000

During the period of operation there were no exceedences of the $350 \ \mu g/m3$ hourly limit for the protection of human health. There were two exceedences of the $50 \ \mu g.m-3$ lower assessment threshold. The directive stipulates that the lower assessment threshold should not be exceeded more than three times in the calendar year. The mean hourly value of $25.1 \ \mu g/m3$ exceeds the limit value for the protection of ecosystems. However, the report states that this limit may not be relevant to monitoring in an urban environment. It would be expected that SO2 values at the proposed development site (directly adjacent to this monitoring location) would be similar to those recorded at the Blackpool monitoring site.

Particulate Matter (PM10)

Particulate matter (PM10) data for the 2000 monitoring period in Blackpool is presented in Table 8.3.

Cable 8.3 Particulate Matte	r (PM10) Data	Blackpool Ja	nuary to May 2000
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Parameter	Measurement
No. of days	133
No. of measured values	117
Percentage Coverage	87.9%
Maximum daily value	239.4 µg/m3
98 percentile for daily values	111.5 μg/m3
Mean daily value	49.1 μg/m3

The 24-hour limit for the protection of human health was breached 46 times during the measurement period; the Directive permits the limit value to be exceeded only 35 times in a calendar year. The mean of the daily values during the measurement period (49.1 μ g/m3) also exceeds the annual limit value for the protection of human health (40.0 μ g/m3). It would be expected that PM₁₀ values at the proposed development site would be similar to those recorded during the 2000 Blackpool monitoring period.

Nitrogen Dioxide (NO2)

Nitrogen dioxide and oxides of nitrogen (NOx) data for the 2000 monitoring period in Blackpool is presented in Table 8.4. No data was collected between 29th February and 18th May because of a technical problem with the monitor.

Parameter	Measurement
No. of hours	3,188
No. of measured values	1,254
Percentage Coverage	39.3%
Maximum hourly value (NO2)	107.1 μg/m3
98 percentile for hourly values (NO2)	72.9 µg/m3
Mean hourly value (NO2)	26.8 µg/m3
Mean hourly value (NOx)	55.4 µg/m3 NO2

Table 8.4 Nitrogen Dioxide and Oxides of Nitrogen Data Blackpool January to May 2000

All hourly mean NO2 values were below the lower assessment threshold (100 μ g/m3) except for one exceedence. The Directive stipulates that the lower assessment threshold should not be exceeded more than 18 times in a calendar year. The mean hourly NO2 value (26.9 μ g/m3) during the period of measurement was below the annual limit for the protection of human health (40 μ g/m3) but just above the annual lower assessment threshold for the protection of human health (26 μ g/m3). The mean hourly value of NOX (55.1 μ g/m3 NO2) during the measurement period exceeds the annual limit value for the protection of vegetation (30 μ g/m3 NOX). However, the report states that the applicability of this limit to urban air pollution monitoring is questionable. It would be expected that NO2 and NOx values at the proposed development site would be similar to those recorded during the 2000 Blackpool monitoring period.

Carbon Monoxide (CO)

Carbon monoxide data for the 2000 monitoring period in Blackpool is presented in Table 8.5. A limited dataset from 19th January until 13th February is available due to a technical problem with the carbon dioxide monitor.

Hourly Values	Result
No. of hours	3,188
No. of measured values	601
Percentage Coverage	18.8%
Maximum hourly value	21.8 mg/m3
98 percentile for hourly values	2.9 mg/m3
Mean hourly value	0.9 mg/m3
Maximum 8-hour mean	10.9 mg/m3
98 percentile for 8-hour mean	3.8 mg/m3

Table 8.5 Carbon Monoxide Data Blackpool January to February 2000

During the monitoring period there was an exceedence of the 10 mg/m3 limit. This was an isolated result and may have been attributable to a local effect at the sampling location. Otherwise, all data is below the lower assessment threshold for the protection of human health. It would be expected that carbon monoxide values at the proposed development site would be similar to those recorded during the 2000 Blackpool monitoring period.

Dust

A study by the UK ODPM gives estimates of likely dust deposition levels in specific types of environments. In open country a level of 39 mg/(m2*day) is typical, rising to 59 mg/(m2*day) on the outskirts of town and peaking at 127 mg/(m2*day) for a purely industrial area. As a worst-case, a level of 127 mg/(m2*day) can be estimated as the existing dust deposition level for the current location.

8.2 NOISE & VIBRATION – BASELINE SCENARIO

8.2.1 Noise receptors

The study site follows the course of the River Bride and its tributaries from the fringes of the city into Blackpool. The noise environment graduates from semi-rural to entirely urban over the approximately 4 km length of the study site. The chief feature of the noise environment is road traffic noise, particularly traffic on national route N20 which becomes the Blackpool bypass. From north to south, the noise environment consists of the following zones:

- The most northerly zone lies in the vicinity of Glennamought Bridge on the Old Whitechurch Road, on the fringes of Cork City. A cluster of one off houses represents the final development of significance before the landscape becomes predominantly rural. An inclined site immediately adjacent to the river, between the Old Whitechurch Road and the Mallow Road, is occupied by a several commercial premises. The noise environment in this area is dominated local road traffic.
- As the river crosses the Mallow Road, the environment quickly transforms from semi-rural to urban, particularly at North Point Business Park. A number of one-off houses are located in this area, one of which lies in a secluded position between the business park and Mallow Road, adjacent to the base of the railway bridge. The noise environment here is dominated by traffic on the local road

network in this area, in addition to N20 traffic which runs to the west and south. Receptors close to the Glenamought River are also affected by water flow noise.

- A detached dwelling at the end of the Killeens off-ramp from the N20 northbound forms a small isolated zone. Although this location lies only several hundred metres from the area described in the previous paragraph, the noise environment is markedly different due to (a) the dwelling's position immediately adjacent to a road junction, and (b) its location close to the N20, albeit at a lower elevation. The noise environment here is consequently dominated by road traffic noise.
- The N20 corridor forms the largest zone in the study site, extending from the Killeens interchange to Blackpool Shopping Centre, a distance of almost 2 km. The zone is dominated by traffic on the N20 which runs parallel to the Bride here. The zone may be divided into a number of sub-zones. The most northerly of these is occupied by the Commons Inn. Downstream of the hotel, nine dwellings form a short length of ribbon development adjacent to the N20. Immediately downstream of these, the area becomes decidedly commercial, and consists of a mixture of old and new commercial and industrial premises, several of which lie in the grounds of the former Sunbeam complex. At the southern end of the zone, Blackpool Retail Park consists of several commercial buildings, a number of which include office floors. To the south of the retail park lies Blackpool Shopping Centre, most of which is occupied by carpark spaces. Apart from the nine dwellings identified, there are no receptors located in proximity to the watercourse. A number of receptors along the southern side of the N20 are situated 70 m or more from the proposed works area. These include apartments at Brideholm, ribbon development opposite the former Sunbeam complex, and dwellings on the Old Commons Road opposite Blackpool Retail Park.
- Downstream of Blackpool Shopping Centre, the River Bride runs to the rear of terraced dwellings along Old Commons Road over a distance of approximately 350 m, and this marks the next zone. A land bank between the river and the N20 is occupied by Orchard Court, a suburban residential development of approximately 50 dwellings with limited retail space at its southern end. The river flows between Orchard Court and the rear of the Old Commons Road terraces. At the northern end of this zone, the noise environment is dominated by N20 traffic which gradually becomes elevated above Orchard Court. The southern end of the zone is less affected by N20 and Blackpool bypass traffic due to increased separation distance and screening provided by buildings. Although N20 traffic remains nonetheless significant at the southern end of the zone, its reduced contribution allows other sources to become audible, including traffic on surrounding streets, and typical residential estate activities such as local car movements, dog barking, pedestrian voices, birdsong and playing children.
- The most southerly zone is entirely urban, following Watercourse Road from Blackpool Church to Madden's Buildings, which marks the southern extent of the flood relief works area. A number of terraced dwellings lie alongside Watercourse Road, or on side roads. The noise environment here is dominated by road traffic, both on Watercourse Road itself and on the N20 which runs to the immediate east.

Descriptions of the various noise environments above relate to daytime hours, as the proposed works will chiefly be carried out during the daytime. The descriptions are based on site inspections, and particularly on a noise survey undertaken across the study site as described below. The evening noise environment in each zone is likely to be similar to the daytime environment, as traffic noise is likely to continue into evening hours. Indeed, previous surveys undertaken by Damian Brosnan Acoustics in relation to other



projects in the local area indicate that road traffic noise on both urban streets and on the N20 continues right through the evening and into the night. The most recent such survey, undertaken September 2015 on Watercourse Road, indicated elevated street traffic noise throughout the evening. Night-time ambient levels are also likely to remain elevated due to N20 traffic noise intrusion

Traffic is the chief noise source present across the study site, arising on the N20 and Blackpool bypass, on streets such as Old Commons Road, Watercourse Road and Thomas Davis Street, and through residential estates and retail parks. The only other noise source of significance noted during site inspections is commercial/industrial noise from scattered premises. These include sources at premises across the Sunbeam site, and industrial emissions at the Dulux facility.

On the margins of the city, in the vicinity of Mallow Road and Old Whitechurch Road, traffic noise is also the chief contributor, although traffic movements are more intermittent. Railway movements occur at intervals. The soundscape in the vicinity of the commercial premises immediately downstream of Glennamought Bridge is influenced by operations at the premises.

The EPA defines a noise sensitive location (NSL) as:

'Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires absence of noise at nuisance levels.'

NSLs across the study site consist almost entirely of residential dwellings. Bedrooms at the Commons Inn hotel may warrant NSL status. While Blackpool Retail Park includes a number of office floors, these are not considered to be NSLs in the context of the proposed project for several reasons:

- The office floors lie at a significantly higher elevation than the works zone, several floors above ground level.
- These floors are likely to be exposed to elevated traffic noise levels on the N20.
- A cursory inspection indicates that the office floors are fitted with acoustic grade windows.
- The proposed floor relief works will be undertaken at ground level, to the rear of several commercial units. None of these opens to this area.

8.2.2 Noise survey methodology

Existing daytime ambient noise levels (see glossary in Appendix 8A) across most of the study site were quantified through a noise survey undertaken Thursday October 22 2015. Following a decision to extend the works zone northwards to Glennamought Bridge, additional monitoring was undertaken on 23 October 2017. Survey methodology, equipment specifications and weather conditions are listed in Appendix 8B. Monitoring was undertaken at eight stations, designated N1-N8, as described in Table 8.6, shown in Figures 8.1-8.7, and shown in Photographs 8.1-8.8. Stations were selected on the basis of the following criteria:

- Flood relief works are proposed locally.
- Dwellings are located in proximity.
- The noise environment is likely to be different to those at other stations, due to geography, terrain, road layout, screening, etc.

A preliminary inspection indicates that there are no sensitive receptors in Sunbeam commercial estate, and monitoring was not carried out here. While a multi-storey office development at Blackpool Retail Park includes office space which overlooks a proposed flood relief works zone, monitoring was not conducted here as the office floors lie several floors above ground level.

Station	ITM NGR	Location
N1	567414 573130	T&A Builders Providers carpark, 6 m from Watercourse Rd. verge, 10 m from rear wall of Madden's Buildings terrace. Selected to represent dwellings at Madden's Buildings and in vicinity of Foley's Row.
N2	567404 573351	Paved area at Blackpool Church, 8 m N of NE corner. Selected to represent terraced receptors in vicinity of Watercourse Rd., Thomas Davis St. and Old Commons Rd.
N3	567382 573436	NW side of square at S end of Orchard Court, 17 m from Old Commons Rd. Selected to represent dwellings around square.
N4	567388 573611	N end of Orchard Court, 10 m from nearest dwelling façade. Selected to represent Orchard Court dwellings. Also selected to represent noise environment in rear gardens of riverside terraced dwellings along Old Commons Rd.
N5	566565 574475	Near S corner of carpark at Commons Inn, 30 m NNE of rear façade at dwelling SE of Commons Inn entrance. Selected to represent noise environment of rear gardens of 9 dwellings on Commons Rd. between Commons Inn and unoccupied commercial premises.
N6	566020 574737	Paved area 27 m NW of dwelling adjacent to roundabout at end of N20 N-bound Killeens off-ramp. Selected to represent adjacent dwelling.
N7	566380 575019	Front lawn of secluded dwelling in valley SW of Kilnap railway bridge, 12 m SW of dwelling SW corner. Selected to represent local noise environment at dwelling.
N8	567191 575352	Front lawn of secluded dwelling in valley, immediately E of Glennamought Bridge, 10 m W of dwelling front façade. Selected to represent adjacent dwelling, in addition to dwelling on incline on opposite bank of river.

Table 8.6: Noise station locations.

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Figure 8.1: Monitoring locations overview.



Figure 8.2: Station N8 location.

NO



Figure 8.3: Station N7 location.





Figure 8.4: Station N6 location.

NO



Figure 8.5: Station N5 location.



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Figure 8.6: Stations N3 & N4 locations

NO



Figure 8.7: Stations N1 & N2 locations.





Photograph 8.1: N1 T&A Builder's Providers carpark, with roof of nearest dwelling at Madden's Buildings visible, looking S.

Photograph 8.2: N2 Blackpool Church, looking NE towards Thomas Davis St.



<image>

Photograph 8.3: N3 Orchard Court (south), looking N.



Photograph 8.4: N4 Orchard Court (north), looking SE.



Photograph 8.5: N5 Commons Inn carpark, with rear of nearby dwelling visible through trees, looking SE.



Photograph 8.6: N6 Dwelling at end of N20 Killeens offramp, looking SW.



Photograph 8.7: N7 Front lawn of secluded dwelling, looking N.



Photograph 8.8: N8 Front lawn of secluded dwelling, looking E.

8.2.3 Results

Noise data recorded are presented in Appendix 8C and summarised in Table 8.7 below. Frequency spectra and time history profiles are shown in Appendix 8D.

Table 8./: Ambient noise data summa

Station	Location	L _{Aeq 15 min}	L _{AF90} 15 min dB	Dominant noise sources
N1	Madden's Buildings,	66	58-59	Watercourse Rd. traffic dominant continuously.
	vv drercourse kd.			
N2	Blackpool Church	62-64	55-5/	Irattic through local junction dominant.
N3	Orchard Court south	51-55	47-49	Road traffic on surrounding streets clearly audible and dominant, although screened by buildings and walls.
N4	Orchard Court north	56-58	52-53	N20 Blackpool bypass traffic continuously clearly audible and dominant.
N5	Commons Inn	55-56	52	N20 traffic continuously dominant.
N6	Killeens off-ramp	65	54-57	Intermittent traffic through adjacent junction dominant. N20 traffic continuously clearly audible.

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N7	Dwelling b Kilnap railway b	oelow or.	51-52	49-50	Water flow in nearby river clearly audible continuously, co-dominant with continuously audible N20 traffic noise.		
N8	Dwelling Glennamought B	at r.	48-56	47	Water flow in adjacent river. Dog barking temporarily raising LAeq 15 min.		

Noise levels measured at each location were markedly consistent, showing relatively unchanged levels across all three measurement intervals. This is a typical feature of noise environments dominated by road traffic noise. Also a feature of such environments is the elevated noise levels prevailing throughout the day. The highest levels were measured at locations close to street and road verges (N1, N2 and N6), with LAeq 15 min levels of 62-66 dB recorded. Reductions of several decibels were measured at stations more removed from road noise (N3, N4 and N5), where LAeq 15 min levels fell to 51-58 dB. At N7, located in a sheltered position 330 m from the N20, LAeq 15 min levels decreased to 51-52 dB. Here, N20 traffic and local river flow maintained a steady noise environment. Levels fell further at N8, where the secluded position screened out more distant sources, and only water flow in the adjacent river remainined dominant.

Regardless of location, measured levels at all stations except N8 were relatively elevated, and reflect the intrusion of both local and distant road traffic. The impact of traffic light sequences, which resulted in traffic waves, is readily apparent in most time history profiles shown in Appendix 8D. No tones were noted at any station.

8.2.4 Likely Future Receiving Environment

In line with Guidelines on the information to be contained in environmental impact assessment reports (EPA, August 2017 Draft), a brief comment is warranted here on the likely future progression of the local noise environment in the absence of the proposed development i.e. should the development not proceed. Recorded noise data indicate that the local soundscape is entirely dominated by road traffic. Significant changes in traffic volumes are required before any changes in noise levels become perceptible. Such changes are unlikely in the short to medium term. In the longer term, it is possible that gradual expansion of the city urban area and/or construction of new roads may alter the noise environment. The long term soundscape may also be altered by the introduction of commercial and/or industrial activities. The proposed development, whether it proceeds or not, is unlikely to influence the evolution of the local soundscape.

8.3 ASSESSMENT CRITERIA

8.3.1 Air Quality & Climate

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set. Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values.

In 1996, the Air Quality Framework Directive (96/62/EC) was published. This Directive was transposed into Irish law by the Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999. The Directive was followed by four Daughter Directives, which set out limit values for specific pollutants:

- The first Daughter Directive (1999/30/EC) deals with sulphur dioxide, oxides of nitrogen, particulate matter and lead.
- The second Daughter Directive (2000/69/EC) addresses carbon monoxide and benzene. The first two Daughter Directives were transposed into Irish law by the Air Quality Standards Regulations 2002 (SI No. 271 of 2002).
- A third Daughter Directive, Council Directive (2002/3/EC) relating to ozone was published in 2002 and was transposed into Irish law by the Ozone in Ambient Air Regulations 2004 (SI No. 53 of 2004).
- The fourth Daughter Directive, published in 2007, deals with polyaromatic hydrocarbons (PAHs), arsenic, nickel, cadmium and mercury in ambient air.

The Air Quality Framework Directive and the first three Daughter Directives have been replaced by the Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC on ambient air quality), which encompasses the following elements:

- The merging of most of the existing legislation into a single Directive (except for the Fourth Daughter Directive) with no change to existing air quality objectives.
- New air quality objectives for PM2.5 (fine particles) including the limit value and exposure concentration reduction target.
- The possibility to discount natural sources of pollution when assessing compliance against limit values.
- The possibility for time extensions of three years (for particulate matter PM10) or up to five years (nitrogen dioxide, benzene) for complying with limit values, based on conditions and the assessment by the European Commission.

Table 8.8 below sets out the limit values of the CAFE Directive, as derived from the Air Quality Framework Daughter Directives. Limit values are presented in micrograms per cubic metre (μ g/m3) and parts per billion (ppb). The notation PM10 is used to describe particulate matter or particles of ten micrometres or less in aerodynamic diameter. PM2.5 represents particles measuring less than 2.5 micrometres in aerodynamic diameter.

Pollutant	Limit Value Objective	Averagin g Period	Limit Value (µg/m ³)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Sulphur dioxide (SO2)	Protection of Human Health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO2)	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO2)	Protection of vegetation	Calendar year	20	7.5	Annual mean	19th Jul 2001

Table 8.8 Limit values of Directive 2008/50/EC, 1999/30/EC and 2000/69/EC (Source: EPA)

River Bride (Blackpool) Certified Drainage Scheme

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Pollutant	Limit Value	Averagin	Limit	Limit	Basis of Application	Attainment
	Objective	g Period	Value	Value	of Limit Value	Date
			(µg/m³	(ppb)		
)			
Sulphur dioxide	Protection of	1st Oct to	20	7.5	Winter mean	19th Jul
(SO2)	vegetation	31st Mar				2001
Nitrogen	Protection of	1 hour	200	105	Not to be exceeded	1st Jan 2010
dioxide (NO2)	human health				more than 18 times	
	Ducto ettern of	Calandan	40	21		1 at law 2010
dioxide (NO2)	human health	Calendar	40	21	Annual mean	Tst Jan 2010
Nitrogen	Protection of	Calendar	30	16	Annual mean	19th Jul
monoxide (NO)	ecosystems	year	50	10	Annoar mean	2001
and nitrogen	,	,				
dioxide (NO2)						
Particulate	Protection of	24 hours	50	-	Not to be exceeded	1st Jan 2005
matter 10	human health				more than 35 times	
(PM10)					in a calendar year	
Particulate	Protection of	Calendar	40	-	Annual mean	1st Jan 2005
matter 2.5	human health	year				
(PM2.5)						
Particulate	Protection of	Calendar	25	-	Annual mean	1st Jan 2015
(PAA2 5)	human health	year				
(FM2.3) Stage 1						
Particulate	Protection of	Calendar	20	_	Annual mean	1st Jan 2020
matter 2.5	human health	year				
(PM2.5) Stage 2		,				
Lead (Pb)	Protection of	Calendar	0.5	-	Annual mean	1st Jan 2005
	human health	year				
Carbon	Protection of	8 hours	10,000	8,620	-	1st Jan 2005
Monoxide (CO)	human health					
Benzene	Protection of	Calendar	5	1.5	-	1st Jan 2010
(C6H6)	human health	Year				

The Ozone Daughter Directive 2002/3/EC is different from the other Daughter Directives in that it sets target values and long-term objectives for ozone rather than limit values. Table 8.9 presents the limit and target values for ozone.
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Objective	Parameter	Target Value for 2010	Target Value for 2020
Protection of	Maximum daily 8 hour	120 mg/m3 not to be exceeded	120 mg/m3
human health	mean	more than 25 days per calendar	
		year averaged over 3 years	
Protection of	AOT40 calculated	18,000 mg/m3.h averaged over	6,000 mg/m3.h
vegetation	from 1 hour values	5 years	
	from May to July		
Information	1 hour average	180 mg/m3	-
Threshold			
Alert Threshold	1 hour average	240 mg/m3	-

Table 8.9 Target values for Ozone Defined in Directive 2008/50/EC

There are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the construction phase of a development in Ireland. Furthermore, no specific criteria have been set in respect of this development. However, guidelines from the Department of the Environment, Heritage and Local Government currently exist for dust emissions from quarrying and ancillary activities. These can be implemented with regard to dust emissions from the proposed construction sites.

With regard to dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust) sets a maximum permissible immission level for dust deposition of 350 mg/(m2*day) averaged over a one year period at any receptors outside the site boundary. Recommendations outlined by the Department of the Environment, Health & Local Government, apply the Bergerhoff limit of 350 mg/(m2*day) to the site boundary of quarries.

The concern from a health perspective is focused on particles of dust which are less than 10 microns. EU ambient air quality standards (Council Directive 2008/50/EC transposed into Irish law as S.I. 180 of 2011) centres on PM10 (particles less than 10 microns) as it is these particles which have the potential to be inhaled into the lungs and cause some adverse health impact. The Directive also sets an ambient standard for PM2.5 (particles less than 2.5 microns) which will come into force in 2015 (see Table 8.8).

Climate Agreements

Ireland is a Party to the Kyoto Protocol, which is an international agreement that sets limitations and reduction targets for greenhouse gases for developed countries. It is a protocol to the United Nations Framework for the Convention on Climate Change. The Kyoto Protocol came into effect in 2005, as a result of which, emission reduction targets agreed by developed countries, including Ireland, are binding.

At Kyoto in 2007, the European Union committed to an average annual greenhouse gas (GHG) emission reduction of 8% below the 1990 levels, over the five year period 2008-2012, with the reductions to be shared between EU Member States. Ireland negotiated an increase of 13% above the 1990 level for the period 2008-2012. Other Member States committed to a reduction of more than 8% to facilitate Ireland's increase in emissions.

In Doha, Qatar, on 8th December 2012, the 'Doha Amendment to the Kyoto Protocol' was adopted. The amendment includes:

 New commitments for Annex I Parties (including Ireland) to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020;

- A revised list of greenhouse gases (GHG) to be reported on by Parties in the second commitment period; and
- Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.

During the first commitment period, 37 industrialised countries and the European Community committed to reduce GHG emissions to an average of five percent against 1990 levels. During the second commitment period, Parties committed to reduce GHG emissions by at least 18 percent below 1990 levels in the eight-year period from 2013 to 2020; however, the composition of Parties in the second commitment period is different from the first. Under the protocol, countries must meet their targets primarily through national measures, although market based mechanisms (such as international emissions trading can also be utilised.)

COP21 was the 21st session of the Conference of the Parties (COP) to the United Nations Convention. Every year since 1995, the COP has gathered the 196 Parties (195 countries and the European Union) that have ratified the Convention in a different country, to evaluate its implementation and negotiate new commitments. COP21 was organised by the United Nations in Paris and held from 30th November to 12th December 2015.

COP21 closed on 12th December 2015 with the adoption of the first international climate agreement (concluded by 195 countries and applicable to all). The twelve-page text, made up of a preamble and 29 articles, provides for a limitation of the temperature rise to below 2° C above pre-industrial levels and even to tend towards 1.5° C. It is flexible and takes into account the needs and capacities of each country. It is balanced as regards adaptation and mitigation, and durable, with a periodical ratcheting-up of ambitions.

Research Methodology

The assessment of air quality has been carried out using a phased approach as recommended by the UK DEFRA. The phased approach recommends that the complexity of an air quality assessment be consistent with the risk of failing to achieve the air quality standards. In the current assessment, an initial scoping of possible key pollutants was carried out and the likely location of air pollution "hot-spots" identified. An examination of recent EPA data has indicated that SO2, smoke and CO are unlikely to be exceeded at locations such as the current one and thus these pollutants do not require detailed monitoring or assessment to be carried out. Nevertheless, CO was included in the impact assessment. The initial scoping of pollutants did, however, indicate potential problems in regards to nitrogen dioxide (NO2) and PM10 at busy junctions in urban centres. Benzene, although previously reported at quite high levels in urban centres, has recently been measured at several city centre locations to be well below the EU limit value.

The current assessment thus focused firstly on identifying the existing baseline levels of NO2, PM10 and benzene in the region of the proposed development by an assessment of EPA monitoring data. Thereafter, the impact of the development during the construction phase of the project on air quality at the neighbouring sensitive receptors was determined by an assessment of the dust generating construction activities associated with the proposed development.

8.3.2 Noise criteria

The proposed flood relief works will not give rise to any noise emissions following commissioning. While the current draft proposal includes seven underground pumping stations, noise emissions from installed pumps

at these are expected to be entirely negligible. Operational noise emissions may therefore be discounted. In contrast, construction phase emissions are of greater significance.

There are no mandatory noise limits applicable to the construction phase of projects in Ireland. In granting permission for projects, regulatory authorities may specify maximum noise limits at receptors which construction works are required to meet. In selecting suitable limits, authorities may refer to two guidance documents.

British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 1: Noise (2009) sets out a procedure which may be used to determine the impacts of construction noise at surrounding receptors. The procedure involves setting threshold values based on ambient LAeq T levels. Table 8.10 lists threshold levels determined using the methodology set out in the standard, taking into account ambient noise levels measured across the study site. The standard recommends that, during the construction phase, total noise levels including construction emissions should not exceed these threshold levels.

Table 8.10: Noise threshold lev	els (LAeq T) determined i	n accordance with BS 5228:2009.
---------------------------------	---------------------------	---------------------------------

Period	Receptors adjacent to streets/roads	Receptors set back from streets/roads
Weekdays 0700-1900 h	70 dB	65 dB
Weekdays 1900-2300 h	60 dB	55 dB
Saturdays 0700-1300 h	70 dB	65 dB
Saturdays 1300-2300 h	60 dB	55 dB
Sundays 0700-2300 h	60 dB	55 dB
Night-time 2300-0700 h	50 dB	45 dB

The National Roads Authority (NRA) document Guidelines for the treatment of noise and vibration in national road schemes (2004) also recommends limits applicable to the construction phase of projects. Although the guidance is applicable specifically to road construction projects, the limits are widely applied in Ireland to other construction projects. The limits are presented in Table 8.11.

Table 8.11: Noise limits recommended by the NRA (2004).

Period	LAeq 1 h	LASmax
Weekdays 0700-1900 h	70 dB	80 dB
Weekdays 1900-2200 h	60 dB	65 dB
Saturdays 0700-1630 h	65 dB	75 dB
Sundays & bank holidays 0800-1630 h	60 dB	65 dB

BS 5228:2009 and NRA guidance differs in several ways:

- The NRA document does not include night-time or weekend evening limits.
- The NRA document includes LAmax criteria. It is noted that the LASmax parameter is specified rather than the more common LAFmax.
- Evening cut-off times differ by one hour (2200 h v 2300 h).
- BS 5228:2009 specifies Saturday limits of 70 dB up to 1300 h, falling to 60 dB thereafter. In contrast, the NRA document specifies a limit of 65 dB up to 1630 h.



 BS 5228:2009 guidance relates to free field levels (measured more than 3.5 m from any wall), whereas NRA limits are façade levels (usually measured at 1 m from the façade). Due to reflections, façade levels are typically 3 dB higher than free field levels.

Despite the above differences, both documents specify an identical weekday daytime limit of 70 dB, and an identical weekday evening limit of 60 dB, at least in noisier areas. The 60 dB Sunday limit is also identical. On the basis of the foregoing, Table 8.12 suggests limits considered suitable for the proposed project. Given the importance of the project, and the long term benefit which will accrue to all receptors, including those in more secluded positions, the higher criteria determined in Table 8.10 are applied. In the absence of any NRA LASmax criteria for night-time hours, LASmax limits are adopted from LAFmax limits included in the World Health Organisation document Guidelines for community noise (1999).

Table 8.12: Suggested noise limits at all receptors, based on BS 5228:2009 and NRA guidance.

Period	LAeq 1 h	LASmax
Weekdays 0700-1900 h	70 dB	80
Weekdays 1900-2300 h	60 dB	65
Saturdays 0700-1630 h	65 dB	75
Saturdays 1630-2300 h	60 dB	60
Sundays & bank holidays 0700-2300 h	60 dB	65
Night-time 2300-0700 h	50 dB	60

Given the project's importance to the long term welfare of residents across the study site, it is suggested that limits proposed in Table 8.12 should be free field rather than façade levels. On this basis, levels measured at facades may be up to 3 dB higher than Table 8.12 limits.

It is expected that most construction activity will be undertaken during daytime hours Monday-Saturday. Indeed the NRA document notes that construction activities outside of these times, other than emergency works, will 'normally require the explicit permission of the relevant local authority'.

8.3.3 Vibration criteria

The proposed flood relief works are not expected to give rise to ground borne vibration. Vibration emissions, however, may arise during the construction phase. As with noise, there are no mandatory vibration limits, and reference may instead be made to a number of standards, all of which refer to peak particle velocity (PPV, measured in mm/s) which is usually used to quantify ground borne vibration

British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 2: Vibration (2009) notes that human beings are highly sensitive to vibration, and will detect vibration at levels far lower than those which may cause building damage. Examples of human reactions described by the standard are summarised in Table 8.13.

PPV	Effect
0.14 mm/s	Just about perceptible in the most sensitive situations for typical construction frequencies.
0.3 mm/s	Just perceptible in residential environments.
1 mm/s	Likely to cause complaint in residential environments, although will be tolerated id prior warning and explanation is given.
10 mm/s	Likely to be intolerable for any more than a very brief exposure.

Table 8.13: Human reactions to vibration, from BS 5228:2009.

In contrast to the markedly low levels presented in Table 8.13, PPV levels which may cause cosmetic or structural damage to buildings are considerably higher. On the basis of extensive studies, limits recommended by the two most respected international authorities are presented in Table 8.14. The limits are those below which cosmetic damage (hairline cracking, etc.) to buildings is unlikely to occur. Limits relating to structural damage are significantly higher.

Table 8.14: Recommended vibration limits.

Source	Structure	Lower frequencies	Higher frequencies
1	Modern dwellings	<40 Hz: 19 mm/s	>40 Hz: 51 mm/s
	Older dwellings	<40 Hz: 12.7 mm/s	>40 Hz: 51 mm/s
2&3	Industrial & heavy commercial	4-15 Hz: 50 mm/s	>15 Hz: 50 mm/s
	Residential & light commercial	4-15 Hz: 15-20 mm/s	>15 Hz: 20-50 mm/s

Sources:

¹US Bureau Of Mines report RI 8507: Structural response and damage produced by ground vibration from surface mines blasting (1980).

²British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.

³British Standard BS 7385:1993 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration.

The strictest limit included in Table 8.14 is 12.7 mm/s reported by the US Bureau Of Mines with respect to older dwellings (typically plaster on wood lath in the US). Limits reported for newer buildings by both US and British authorities are 15 mm/s or higher. With respect to older buildings, such as period dwellings across the study site, British Standard BS 7385:1993 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from groundborne vibration states that 'a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive'.

The NRA's 2004 guidance document includes vibration criteria relevant to the construction phase of road projects, reproduced in Table 8.15. The NRA limits were drawn up taking international guidance into account, and appear to incorporate significant safety margins. It is suggested that the NRA criteria be applied to the proposed development.

Table 8.15: Construction	phase vibration	criteria recommended b	y the NRA (2004).

Frequency	<8 Hz	10-50 Hz	>50 Hz
PPV limit	8 mm/s	12.5 mm/s	20 mm/s

8.4 LIKELY SIGNIFICANT EFFECTS AND ASSOCIATED MITIGATION MEASURES

8.4.1 'Do-Nothing' Scenario

If the proposed development were not to proceed, the existing river channel would remain as it is. There would be no change to the existing air quality, climate, noise or vibration in the area.

If the proposed development were not to proceed, the opportunity to protect Blackpool and surrounding areas in Cork City from future flooding events would be lost.

8.4.2 Construction Phase

8.4.2.1 Air Quality

Material handling activities on site may typically emit dust. Dust is characterised as encompassing particulate matter with a particle size of between 1 and 75 microns (1-75 μ m). Deposition typically occurs in close proximity to each site and potential impacts generally occur within 500 metres of the dust generating activity as dust particles fall out of suspension in the air. Larger particles deposit closer to the generating source and deposition rates will decrease with distance from the source. Sensitivity to dust depends on the duration of the dust deposition, the dust generating activity, and the nature of the deposit. Therefore, a higher tolerance of dust deposition is likely to be shown if only short periods of dust deposition are expected and the dust generating activity is either expected to stop or move on.

The potential for dust to be emitted will depend on the type of activity being carried out in conjunction with environmental factors including levels of rainfall, wind speed and wind direction.

As indicated, dust generation rates depend on the site activity, particle size (in particular the silt content, defined as particles smaller than 75 microns in size), the moisture content of the material and weather conditions. Dust emissions are dramatically reduced where rainfall has occurred due to the cohesion created between dust particles and water and the removal of suspended dust from the air. It is typical to assume no dust is generated under "wet day" conditions where rainfall greater than 0.2 mm has fallen. Information collected from Cork Airport Meteorological Station (1962-1991) identified that typically 204 days per annum are "wet". Thus for greater than 55% of the time no significant dust generation will be likely due to meteorological conditions.

Large particle sizes (greater than 75 microns) fall rapidly out of atmospheric suspension and are subsequently deposited in close proximity to the source. Particle sizes of less than 75 microns are of interest as they can remain airborne for greater distances and give rise to the potential dust nuisance at the sensitive receptors. This size range would broadly be described as silt. Emission rates are normally predicted on a site-specific particle size distribution for each dust emission source.

Whilst construction activities are likely to produce some level of dust during earth moving and excavating phases of the project, these activities will mainly be confined to particles of dust greater than 10 microns. Particles of dust greater than 10 microns are considered a nuisance but do not have the potential to cause significant health impacts. For instance, bulldozing and compacting operations release 84% of particles which are greater than PM10 with only 16% of particles being less than 10 microns.

Mitigation Measures

A dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential source and any impacts from dust deposition will typically be within several hundred metres of the construction area.

In order to ensure that no dust nuisance occurs, a series of measures will be implemented. Site roads shall be regularly cleaned and maintained as appropriate. Hard surface roads shall be swept to remove mud and aggregate materials from their surface. Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.



Speeds shall be restricted on hard surfaced roads as site management dictates. Vehicles delivering material with dust potential shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust.

Worst-case truck movements during the peak construction period would be about 4 inward and 4 outward / hour. Construction traffic of this level will lead to dust emissions of the order of 3 g/m2 each hour along the haul roads based on no mitigation being implemented. However, provided vehicle speeds are restricted to less than 40 km/hr, this level of construction traffic will lead to dust emissions of the order of 2 g/m2 each hour along the haul roads. Thus, it is unlikely that the emissions of this magnitude will lead to dust deposition levels at the site boundary which exceed the TA Luft limit value for dust nuisance of 350 mg/(m2*day).

It is envisaged that the construction of the development will occur in distinct phases. As such, the potential for dust nuisance and significant levels of PM10 & PM2.5 concentrations will vary both temporally and spatially as the construction develops.

Public roads in the vicinity of the site shall be regularly inspected for cleanliness, and cleaned as necessary.

At all times, the dust mitigation measures put in place will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movement of materials will be immediately terminated and satisfactory procedures implemented to rectify the problem before the resumption of the operations.

The dust minimisation plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures.

Residual Impact

With effective implementation of a dust minimisation plan, the proposed development is expected to have a negligible impact on air quality during the construction phase. Due to the size, nature and location of the development, which will lead to no increase in road traffic emissions, the proposed development is expected to have an imperceptible impact on air quality once it is operational.

Significance of Effect

Based on the assessment above there will be no significant effects.

Monitoring

The dust mitigation measures put in place will be strictly monitored and assessed throughout the construction phase to ensure their effectiveness. If a dust minimisation plan is effectively implemented there will be no need for dust monitoring during the construction phase.

8.4.2.2 Climate

The construction of the proposed development will require the operation of construction vehicles and plant on site. Greenhouse gas emissions, e.g. carbon dioxide (CO2), associated with vehicles and plant will arise as a result of the construction and demolition activities. This potential impact will be slight only, given the insignificant quantity of greenhouse gases that will be emitted, and will be restricted to the duration of the construction phase. Therefore, this is a short-term slight negative impact.

Mitigation Measures

All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise.

Residual Impact

Short-term Imperceptible Negative Impact on Climate as a result of greenhouse gas emissions.

Significance of Effect

Based on the assessment above there will be no significant effects.

8.4.2.3 Noise and Vibration

Noise sources

The proposed development will not give rise to audible noise emissions following commissioning. While seven underground pumping stations will include pumps which will operate during high flow events, noise emissions from these are expected to be entirely negligible at the nearest receptors. Occasional maintenance works following commissioning, including sediment trap cleaning, will not be audible beyond their immediate vicinity due to masking by road traffic noise. Accordingly, operational noise emissions may be discounted.

Construction phase emissions, albeit occurring over a confined period, have greater potential to cause local noise intrusion. The construction phase will involve installation of a number of flood defence measures, the final design and positioning of which will be determined at detailed design stage. The measures will include the following, proposed at various positions:

- Channel cleaning, including debris removal and dredging where required.
- Bridge and culvert replacement or reconstruction.
- Construction of new walls and repairs to existing parapet walls.
- Construction of flood embankments.
- Sluice removal.
- Installation of sediment trap and trash screens.
- Construction of winter channel above existing watercourse.

Implementation of the above works is likely to require the following activities:

- Where debris/sediment removal is required, this typically involves use of bankside excavators which transfer material to HGVs or dump trucks.
- Embankment construction works, involving use of 1-2 midsized tracked excavators, and possibly a small number of dumpers or dump trucks. Such works are proposed at the Commons Inn, at Blackpool Retail Park, adjacent to the secluded dwelling near the railway bridge, and adjacent to a dwelling at Glennamought Bridge.
- Concrete breaking may be required at several locations, involving either hydraulic breakers on tracked excavators, or handheld pneumatic breakers powered by compressors. Concrete saws may also be required.

- Wall and parapet wall repair and construction works are proposed between North Point Business Park and Blackpool Shopping Centre, adjacent to the dwelling at the end of the Killeens off-ramp, at the commercial premises downstream of Glennamought Bridge, and adjacent to the dwelling upstream of the bridge. Such works are likely to involve a number of activities, including blockwork and concrete pours. Plant such as telescopic handlers and mini-excavators may be required. Various activities are likely to require mobile generators to power equipment, lights and pumps. Larger works areas are likely to be surrounded by temporary hoarding to a height of 2.4 m.
- The construction method for the proposed sediment trap at Sunbeam will involve sheet piling, as will the proposed wall near Commons Inn. While unlikely, sheet piling may also be required at other works zones. The specific requirements for piling, and selection of piling method, will not be determined until site specific investigations are undertaken in due course. Sheet piling may involve use of driven or pressed-in piles, or use of vibro-displacement techniques.
- Removal of dredged material, rubble and spoil, and deliveries of concrete and other materials will
 require a large number of HGV movements throughout the project. These will be concentrated at
 specific areas where easements are available.

The overall duration of the construction phase is expected to be approximately 18 months. However, activities at each of the proposed works zones are expected to last no more than several months, depending on the works involved.

Noise impacts

The proposed construction works will be finalised following detailed site inspections, environmental assessment and public review. Although the works required at each location are unlikely to change significantly, the methodologies, plant and timeframes may only be determined by the appointed contractor(s). It is therefore not possible to accurately predict noise impacts at surrounding receptors at this stage. Moreover, prediction of noise impacts associated with the construction phase of any project is complicated by several additional factors:

- The timing, duration and amplitude of emissions associated with activity in each works zone will vary considerably.
- Construction details and plant requirements will alter on a daily basis as construction progresses.
- Plant requirements and activities may vary considerably due to unforeseen changes in the construction program.
- There will be extended periods when little or no construction noise emissions arise eg. during concrete drying periods.
- Each individual source may be relocated frequently eg. excavators.
- The overall construction period will be relatively short. The duration of individual stages will be limited, lasting days or weeks at most eg. excavation.

Due to the foregoing, it is not possible to accurately calculate the noise output which will arise onsite throughout the construction phase at each receptor across the study site. An alternative approach here is to calculate likely noise levels expected to arise in the vicinity of work zones. The calculation is presented in Table 8.16, based on typical plant sound pressure levels at 10 m provided by British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 1: Noise

(2009). The worst case scenario assumed in each zone is unlikely to occur routinely, if at all. With respect to sheet piling, it is assumed that pressed-in piles will be used where possible.

Activity	Worst case scenario	SPL at 10 m	Total SPL at 10 m
Dredging	Long-reach tracked excavator x1	78 dB (178 kW)	81 dB
	Dump truck x1	78 dB (187 kW)	
Embankment	Tracked excavators x2	75 dB (134 kW)	83 dB
construction	Dump trucks x2	78 dB (187 kW)	
Concrete breaking	Hydraulic breaker x1	72 dB (143 k₩)	72-91 dB
	Consaw x1	91 dB (3 kW)	
Wall construction	Telescopic handler x1	71 dB (60 kW)	77 dB
	Discharging mixer truck x1	75 dB	
	Generator x1	65 dB	
Sheet piling	Pressed-in piling rig x1	60-70 dB	60-70 dB

Table 8.16: Expected	sound pressure	level (SPL) in	work zones.
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Noise impacts at receptors associated with emissions presented in Table 8.16 are assessed in Table 8.17 in light of the 70 dB daytime LAeq 1 h criterion discussed above. The table does not take into account screening provided by possible hoarding panels around each work zone.

Table 8.17: Noise impacts at receptors.	
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Activity	Total SPL at 10 m	Impacts
Dredging	81 dB	LAeq 1 h will reduce to 75 dB at 20 m, and 69 dB at 40 m where operations progress continuously over 1 h. A number of dwellings immediately upstream of North Point Business Park, and several dwellings on Old Commons Road and at Orchard Court, may receive LAeq 1 h levels above 70 dB.
Embankment construction	83 dB	Proposed at the Commons Inn, at Blackpool Retail Park, adjacent to the secluded dwelling near the railway bridge, and adjacent to the dwelling at Glennamought Bridge. All except Blackpool Retail Park lie within 10 m of proposed embankments, and will thus be subject to LAeq 1 h levels which exceed 70 dB.
Concrete breaking	72-91 dB	Where required, concrete breaking is unlikely to exceed the 70 dB criterion. Cutting of concrete using a consaw will reach 91 dB LAeq 1 h at 10 when undertaken continuously over 1 h. Any NSLs within approximately 100 m of consaw operations will receive emissions over 70 dB.
Wall construction	77 dB	Proposed between North Point Retail Park and Blackpool Shopping Centre. The only NSLs here are located immediately downstream of the Commons Inn. Most of these are sufficiently removed from the proposed flood defence wall, and noise levels will not exceed 70 dB. However, LAeq 1 h levels at the most northerly dwellings may exceed 70 dB during certain operations. At the hotel itself, there are no bedrooms in the vicinity of the proposed wall. Works proposed

		immediately adjacent to the dwelling at the end of the Killeens off- ramp may also give rise to noise levels above 70 dB at the dwelling. Wall construction proposed adjacent to the dwelling at Glennamought Bridge may exceed the 70 dB criterion at certain times. While wall construction is proposed at the commercial premises downstream of the bridge, this premises is not considered to be a NSL.
Sheet piling	60-70 dB	Sheet piling will not give rise to levels which exceed the 70 dB criterion at any receptor where pressed-in piles are used.

On the basis of the foregoing, the 70 dB criterion may be exceeded in the following cases:

- A number of dwellings immediately upstream of North Point Business Park, and several dwellings on Old Commons Road and at Orchard Court, may be exposed to LAeq 1 h levels above 70 dB if channel dredging is undertaken within approximately 40 m.
- The secluded dwelling near the railway bridge, the dwelling at Glennamought Bridge (and a nearby dwelling on the opposite bank of the river), and bedrooms at the Commons Inn are likely to be subject to LAeq 1 h levels which exceed 70 dB during local embankment construction.
- Any dwelling within approximately 100 m of consaw operations, and with a direct line of sight, may be exposed to levels above 70 dB.
- During construction of flood defence walls, a small number of dwellings immediately downstream of the Commons Inn, one dwelling adjacent to the Killeens off-ramp, and the dwelling at Glennamought Bridge (and a dwelling on the opposite bank of the river), may receive LAeq 1 h levels above 70 dB during certain operations.

With respect to 70 dB exceedances identified above, consaw operations may be readily controlled by erecting a hoarding around the cutting area. In addition, the flood defence wall construction operation downstream of the Commons Inn, at the Killeens off-ramp dwelling, and at the Glennamought Bridge dwelling, may be similarly treated by erecting a hoarding along the boundary of the works zone. In each case, the hoarding should extend to a height of 2.4 m, and should consist of plywood boarding on both sides of timber framework, with waterproofed cavity to be filled with mineral wool or similar. Gaps at partition interfaces should be boarded. If such measures are installed, consaw and wall construction operations are expected to meet the 70 dB LAeq 1 h criterion.

Given the size of plant associated with dredging, and the proximity of receptors at certain locations, use of hoarding to screen noise emissions is unlikely to be practical. In this case, it is considered more suitable to notify residents in advance of operations. The affected NSLs consist of three dwellings upstream of North Point Business Park, and a number of dwellings along Old Commons Road and at Orchard Court.

Like dredging, embankment construction is similarly unsuitable for treatment using hoarding. A more practical solution is to liaise with the affected receptors (the secluded dwelling near the railway bridge, the Glennamought Bridge dwelling, the dwelling on the opposite side of the river at Glennamought, and the Commons Inn) in advance.

In addition to the sources discussed above, noise emissions will also arise from HGV movements across the study area associated with import of materials and export of soils, etc. HGV access to work zones will be facilitated using the local road network, and through privately owned access points by agreement. The number of HGV movements required has not been accurately quantified at this point. On the basis of

experience with other large scale construction projects, the number of movements at most work zones is unlikely to exceed two per hour. Where civil engineering works are required, such as embankment construction, this may increase to five per hour.

Noise levels attributable to HGV movements may be determined using:

 $L_{Aeq 1h} = L_{AE} + 10 log N - 10 log T$

 L_{AE} Sound exposure level from vehicle pass. Truck L_{AE} will vary. Typical L_{AE} value of 83 dB at 5m is assumed, based on experience at other sites.

N: Number of passes.

T: 1 hour.

On this basis, $L_{Aeq 1 h}$ levels associated with up to five movements per hour will be 54 dB at 5 m. It follows that $L_{Aeq 1 h}$ levels will be significantly lower than the 70 dB criterion at all receptors. Given the dominance of existing traffic noise in the local environment, HGV movements are highly unlikely to alter existing traffic noise levels.

During the construction phase, noise impacts at all receptors will be temporary and localised. At most of these, impacts will be imperceptible. At a small number of dwellings, particularly those immediately adjacent to dredging or embankment construction works, impacts will range from slight negative to noticeable negative. Given the benefit which will accrue to these dwellings in particular, the overall long term impact is expected to be positive.

Vibration impacts

Three potential sources of ground borne vibration may arise during the construction phase: vibratory compaction, concrete breaking, and sheet piling.

Vibratory compaction of infill may be required over small areas prior to the laying of finished surfaces. This source is unlikely to be significant offsite due to the small areas involved and the limited time present. Moreover, the fluidic nature of infill when vibrated tends to attenuate ground vibration; most of the vibration energy is lost through particle settlement before reaching underlying strata. Low peak particle velocity (PPV) levels in the order of 1.5 mm/s have been reported at a distance of 25 m at some sites. At the nearest receptors, PPV levels are therefore likely to be significantly lower than criteria presented in Tables 8.11 and 8.12.

Concrete breaking, where required, will involve hydraulic breaker units fitted to tracked excavators, or pneumatic handheld units. Although this activity may give rise to high levels of ground vibration in proximity to the breaking area, the vibration tends to contain relatively little energy in the lower frequencies at which buildings and occupants are most vulnerable. In addition, higher frequencies attenuate more rapidly than low frequencies, thus minimising the impact zone. For this reason, most vibration guidance documents such as British Standard BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration ignore concrete breaking vibration. Table 8.18 lists various PPV levels reported in literature at sites where hydraulic rock breaking has been undertaken. The range in levels noted reflects variations in equipment power and rock type.

Table 8.18: Reported rock breaking vibration levels.

Distance	5 m	10 m	20 m	50 m
PPV	0.2-4.5 mm/s	0.06-3.0 mm/s	0.02-1.5 mm/s	0.1-0.3 mm/s

The highest PPV level presented in Table 8.18 is 4.5 mm/s, measured at 5 m from the breaking operation. This level is considerably lower than criteria presented in Tables 8.11 and 8.12. It should be noted that levels presented in Table 8.18 relate to rock breaking. PPV levels associated with concrete breaking are likely to be lower.

Sheet piling will be required when constructing the proposed sediment trap and downstream of Commons Inn. Although unlikely, piling may also be required when constructing or repairing other bank defences. Traditional piling methods such as driven piling may generate high levels of ground borne vibration. Vibodisplacement piles may also give rise to elevated PPV levels. If either of these is deemed necessary, it is recommended that real time monitoring of PPV levels is undertaken at surrounding receptors. It is also recommended that prior test piling be undertaken, with concurrent PPV measurement, to determine piling parameters required to meet criteria presented in Tables 8.11 and 8.12.

It is noted that the piling method most likely to be used at the study site will be pressed-in piling where ground conditions allow. British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 2: Vibration (2009) notes that vibration levels associated with pressed-in piling are minimal. The document refers to PPV levels measured in the vicinity of two separate pressed-in piling projects where the following levels were measured: 2.5-4.3 mm/s at 4.5 m, 0.3-0.7 mm/s at 7.1 m, and <0.5 mm/s at 24 m.

In summary, vibration impacts are expected to be imperceptible where pressed-in piles are used. Any other piling methods are likely to result in temporary community-wide impacts, ranging from noticeable negative to substantial negative depending on separation distance.

Mitigation Measures

Following completion of the proposed flood relief works, noise emissions are expected to be satisfactory, and no specific mitigation measures are required.

Noise emissions associated with the construction phase will in general be satisfactory at most receptors. At each work zone, operations will be confined to a relatively short period, extending to several months at most. Apart from a small number of exceptions, noise emissions at each zone will comply with the daytime 70 dB LAeq 1 h criterion. The exceptions are as follows:

- Three dwellings immediately upstream of North Point Business Park, and several dwellings on Old Commons Road and at Orchard Court, may be exposed to LAeq 1 h levels above 70 dB if channel dredging is undertaken within approximately 40 m. It is recommended that the contractor liaises with the occupants of these dwellings prior to undertaking works.
- The Glennamought Bridge dwelling (and a dwelling on the opposite bank of the river), the secluded dwelling near the railway bridge, and bedrooms at the Commons Inn may be subject to LAeq 1 h levels which exceed 70 dB during local embankment construction. It is again recommended that the contractor liaise with the occupants of these dwellings prior to undertaking works.
- Any dwelling within approximately 100 m of consaw operations, and with a direct line of sight, may be exposed to levels above 70 dB. This may be readily mitigated by erecting hoarding between the operations area and nearby receptors.
- During construction of flood defence walls, a small number of dwellings immediately downstream of the Commons Inn, one dwelling adjacent to the Killeens off-ramp, and the Glennamought Bridge

dwelling (and a dwelling on the opposite bank of the river) may receive LAeq 1 h levels above 70 dB during certain operations. As above, this may also be readily mitigated if required by erecting hoarding.

Where hoarding is required, it is recommended that hoarding panels should extend to a height of 2.4 m, and should consist of plywood boarding on both sides of timber framework, with waterproofed cavity to be filled with mineral wool or similar. Gaps at panel interfaces should be boarded. If such measures are installed, consaw and wall construction operations are expected to meet the 70 dB LAeq 1 h criterion at receptors.

Installation of hoarding will be less suitable for control of dredging and embankment construction works. At the affected properties, it is recommended that the contractor liaises with the occupants of these dwellings prior to commencing works. It is noted that the dwellings lie in close proximity to the channel, and are therefore vulnerable to flooding. The proposed works will eliminate the possibility of flooding at these receptors. In this light, short term construction works are likely to be considered acceptable.

It is recommended that appointed contractor(s) be required to adopt practices set out in British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 1: Noise and Part 2: Vibration (2009). Measures recommended in the standard include:

- Appointing a project representative responsible for noise and vibration issues, and for liaising with local representatives. A clear communication channel should be established between all parties prior to project commencement.
- Requiring that contractors ensure that site personnel are familiar with potential noise and vibration issues, and that personnel apply a common-sense approach to eliminating unnecessary noise emissions.
- Use of quieter plant and methods where possible.
- Installation of temporary barriers or enclosures around local sources such as compressors and generators.
- Limiting times of activities which may generate elevated noise or vibration emissions.

With respect to sheet piling, no mitigation measures are considered necessary where pressed-in piles are used. If ground conditions require an alternative piling method, it is recommended that real-time monitoring of PPV levels is undertaken at surrounding receptors. It is also recommended that prior test piling be undertaken, with concurrent PPV measurement, to determine piling parameters required to meet criteria presented in Tables 8.11 and 8.12.

The assessment above relates to daytime operations. Where evening or night-time operations are required, it is recommended that noise impacts associated with proposed works be assessed in advance.

Residual Impact

Noise and vibration impacts during the construction phase, inclusive of mitigation, are expected to be temporary, localised and imperceptible at most locations. At dwellings close to proposed works zones, particularly adjacent to dredging and embankment construction areas, impacts are likely to be slight negative to noticeable negative. Impacts may increase to noticeable negative or substantial negative where piling methods other than pressed-in piles are used. However, it should be noted that these impacts will be entirely short term in nature, lasting several days or weeks locally in most cases. Implementation of

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mitigation measures described above will further reduce impacts. Moreover, the long term impact is expected to be positive, given the elimination of flood risk in these areas. Impacts are summarised in Table 8-19.

Factor	Determination
Probability of effects	Noise emissions are likely to arise. Likely effects are as described above. Vibration effects are likely to arise in proximity to piling works. No unplanned effects are likely.
Quality of effects	Negative/adverse at some positions while works are underway. Neutral at most locations during works. Neutral at all locations once works are complete, although the removal of flood risk is expected to generate an overall positive effect.
Significance of effects	While underway, impacts are likely to be imperceptible at most locations. At certain positions, noise impacts may be locally significant adverse during certain operations. Once complete, such impacts will cease.
Extent of effects	Local only.
Context of effects	Where audible, effects will be greatly mitigated by (a) local urban context, where road works and sewerage/drainage works occur at intervals, and (b) the perceived benefit which will accrue i.e. flood risk removal.
Duration of effects	Effects will be short term during works, expected to last several weeks at most at any particular location. Resulting positive effects will be permanent.
Reversibility of effects	Short term effects will be reversible i.e. emissions will cease once works are complete. Positive long term effects will be irreversible.
Frequency of effects	Where audible, impacts will arise at intervals during construction working hours. In some cases, emissions may arise almost continuously throughout the working day. These impacts will last several weeks at most.
Indirect effects	During the works, indirect effects may arise at receptors adjacent to roadways due to HGV traffic. Such impacts are likely to be negligible in the context of existing road traffic. Long term reductions in noise emissions may arise at some receptors following the construction of embankments due to screening of sources such as traffic and watercourse flow.
Cumulative effects	None expected. The possibility that some receptors may be affected by simultaneous construction emissions from the proposed development and other non-related projects cannot be discounted, particularly in urban areas.
Do nothing effects	Noise emissions associated with periodic flood clean up projects may continue to arise if the project does not proceed.
Worst case effects	Most serious potential impact: Iniital works indicate that extensive piling

Table 8.19: Summary of noise & vibration effects.

River Bride (Blackpool) Certified Drainage Scheme

	is required close to receptors. Liaison with local residents will be required here.
Indeterminable effects	None identified.
Irreversible effects	Positive long term effects following completion of the project will be irreversible.
Residual effects	Noise and vibration impacts likely to be neutral once construction is complete. However, removal of flood risk is expected to render to overall impact significantly positive.
Synergistic effects	None identified.

Significance of Effect

Based on the assessment above there will be no significant effects.

8.4.3 Cumulative Impact Assessment

For the assessment of cumulative impacts, any other existing, permitted or proposed developments have been considered where they had the potential to generate a significant in-combination or cumulative impact with the proposed River Bride (Blackpool) Certified Drainage Scheme.

Projects that were included in the Cumulative Impact Assessment for Air Quality and Climate, Noise and Vibration included:

- Proposed Monard residential/commercial development (including the associated proposed infrastructure for water supply, wastewater treatment, transport, etc.)
- Proposed Cork City northern ring road
- Permitted development of the old Sunbeam factory in Blackpool
- Proposed greater Lower Lee (Cork City) Drainage Scheme
- Dulux paints Ireland Ltd. IPC Licensed facility at Shandon Works, Commons Road
- Existing commercial, industrial and agricultural facilities and practices
- Numerous small scale proposed, permitted and existing developments (e.g. single house, commercial units, agriculture, etc.)

Air Quality

The construction phase of the proposed development, in combination with the construction phases of projects listed above will have the potential to negatively impact on air quality of the area. The mitigation measures employed during the construction phase of the proposed development will minimise as much as possible the contribution that it will make towards impacting on air quality. There is the potential for a short-term imperceptible negative cumulative impact in terms of air quality and dust for reasons discussed in Section 8.4.2.1 above.

Climate

The proposed development, in combination with the projects listed above will have the potential to have a short-term imperceptible negative cumulative impact on climate as a result of vehicle emissions on any site.

Noise & Vibration

In the unlikely event of all of the projects listed above being constructed simultaneously, there is a potential for a moderate short-term negative cumulative noise impact. The construction phase of the proposed development will implement the mitigation measures listed in 8.4.2.3 above, thereby minimising the potential cumulative impact that this project could have. Any impacts from the proposed development will most likely be temporary and transient in nature as the works progress along the river channel. Impacts will also differ between receptors, depending on distance to the works areas, and the type of works being carried out in the area. Given the mitigation measures being implemented for this project, and depending on the receptor in question, there is potential for no impact or a short-term imperceptible to slight negative cumulative impact.

9 LANDSCAPE

9.1 INTRODUCTION

This Environmental Impact Assessment Report (EIAR) has been prepared by Ryan Hanley in association with McCarthy Keville O'Sullivan Ltd. on behalf of the Office of Public Works (OPW) who intend to implement the River Bride (Blackpool) Certified Drainage Scheme. The Office of Public Works (OPW) is the lead agency for flood risk management in Ireland. The coordination and implementation of the Government's policy on the management of flood risk in Ireland, in conjunction with its responsibilities under the Arterial Drainage Acts, 1945-1995, form one of the four core services of the OPW.

This section of the Environmental Impact Assessment Report addresses the landscape and visual aspects of the proposed River Bride (Blackpool) Certified Drainage Scheme. The main elements of the proposed development is briefly described, The relevant sections of the River Bride have been described with reference to Landscape Character and the relevant landscape policy recommendations that have been set out for this area by Cork City Council in Cork City Development Plan 2015-2021 in terms of landscape and visual characteristics are also addressed. A number of photomontages are included to assist the assessment of landscape and visual impacts. This chapter should be read in conjunction with the drawings for the proposed drainage scheme in Appendix 3A.

9.1.1 Proposed works

The proposed works for the River Bride (Blackpool) Certified Drainage Scheme comprise works at a variety of locations, as set out in Chapter 3. The works which are relevant from a landscape and visual point of view are as follows:

- Site investigation works
- Construction of new culverts,
- Replacement of a number of existing bridges/ culverts, and removal of existing pedestrian bridges, and also changes to pedestrian access and constructing bridge parapets
- Construction of new flood walls/ earthen embankments.
- Local channel widening of the River Bride (referred to as a 'Winter Channel' on the scheme drawings in Appendix 3A),
- Construction of a sedimentation trap on the left bank of the River Bride,
- Removal of approximately 70m of existing culvert and restoration of open channel (River Bride) at this location,
- Construction of a new trash screens and roughing, and removal of an existing trash screen on the River Bride, and the Glen and Glenamought Rivers,
- Modifications to the existing foul and surface water collection networks in the vicinity of the proposed works, including construction of pumping stations, in order to prevent flooding,
- Removal of an existing sluice structure in the channel of the River Bride to the rear of the Dulux factory,
- Localised regrading of ground levels, erection of fencing and access gates, to facilitate pedestrian/vehicular access to and around flood defences, or to redirect overland surface water flow paths,
- Introduction of a flow control structure on the entrance to the Brewery culvert on the River Bride and the Spring Lane culverted branch of the River Glen, and
- Filling an existing open watercourse

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9.1.2 Study Area

The study area for the Landscape and Visual Assessment was defined following the desk study and again following site visit, and the examination of the proposed works.

The proposed works are located along the northern section of the River Bride in Blackpool, and a section of the River Glenamought, as well as the Fairhill Stream just inside the Cork City Boundary in Blackpool in the north of Cork City. The study area also includes a short section of the River Glen, to the east of Blackpool Shopping Centre and south of Spring lane.

To the north, the proposed works begin at Kilbarry, along the River Glenamought, east of the Railway Viaduct, where the City and County Boundary runs along the river. The works continue in various locations along the River Bride in Blackpool. The proposed works finish close to where Watercourse Road meets the N20 Blackpool Bypass.

For the Landscape and Visual Impact Assessment, the Study Area takes in the river itself as well as lands immediately on both sides of the river, including areas where the proposed works will be visible or will have a potential landscape or visual impact. Due to the nature of the proposed drainage works as well as the nature of the Rivers Bride, Glenamought and Glen, and the landscape context, a Study Area which extends on both sides of the rivers and takes in the immediate features, views and prospects and areas from where the proposed works will be most visible is considered appropriate. The built form and topography restrict views of the rivers considerably and the majority of views of the river are available only from the immediate vicinity of the proposed works.

This follows the LI/IEMA (2013) Guidance referenced below which proposes that the level of detail in the landscape baseline studies should be "appropriate and proportionate to the scale and development. The Guidelines also state that for the landscape baseline the aim is to provide an understanding of the landscape in the area that may be visually affected. The Study Area is illustrated in Figure 9.1

9.2 METHODOLOGY

This section broadly outlines the methodology used to undertake the landscape and visual assessment of the proposed development, and the guidance used to in the preparation of each section. There are four main sections to the assessment:

- Outline of guidance followed
- Baseline landscape and visual assessment
- Nature and visibility of the proposed development
- Assessment of potential impacts

9.2.1 Guidance Documents

The only available, quasi-official document providing guidance on landscape quality for some time at a national level was 'Outstanding Landscapes', published by An Foras Forbartha in 1976. However in 2000, the Department of the Environment and Local Government built on this document by producing 'Landscape and Landscape Assessment: Consultation Draft of Guidelines for Planning Authorities', which recommended that all Local Authorities adopt a standardised approach to landscape assessment for incorporation into Development Plans and consideration as part of the planning process.

In 2002, Ireland signed and ratified the European Landscape Convention (ELC), which introduces a pan-European concept which centres on the quality of landscape protection, management and planning. The Department of Arts, Heritage and the Gaeltacht has published a National Landscape Strategy for Ireland



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in 2015. The Strategy aims to ensure compliance with the ELC and contains six main objectives, which include developing a national Landscape Character Assessment and developing Landscape Policies.

Although the DoEHLG 2000 guidance remains in draft form, this section of the EIS has been informed by the landscape assessment guidelines presented in the DoELHG document, as well as a range of other guidelines which include:

- Guidelines for Landscape and Visual Impact Assessment (The Landscape Institute/Institute of Environmental Management and Assessment, UK, 2013)
- EPA Guidelines on the information to be contained on Environmental Impact Statements (EPA 2002)
- EPA Advice Notes on Current Practice in the preparation of Environmental Impact Statements (EPA, 2003).
- Guidelines on the Information to be contained in Environmental Impact Assessment Reports Draft August 2017 '(EPA 2017).

9.2.2 Baseline Landscape Assessment

One of the first stages of carrying out a Landscape and Visual Impact Assessment is to establish the baseline landscape and visual conditions. In order to carry out this assessment, an initial desk study was undertaken which identified relevant policies and guidelines, both at national and local level. This includes any relevant Cork City Council policies on landscape and landscape character, designated landscapes, and scenic routes.

The Study area consists of the areas to which works are to be carried out is described in Section 9.1.2 and are described in general terms of Landscape Character Areas and types as identified 'Landscape and Landscape Assessment: Consultation Draft of Guidelines for Planning Authorities' (Department of the Environment and Local Government, 2000), and as defined in the Cork City Development Plan 2014-2020. In addition, a field visit was undertaken in Autumn 2015 to assess the landscape character and elements both in the Study area and in the wider landscape.

The desk study reviews previous landscape character assessments and reviews that have been carried out within the Study Area. The desk study also includes information on landscape within the immediate vicinity of the proposed works. It incorporates a description of the policies and objectives of Cork City Council and Cork City Council with regards to the Landscape Appraisal, including any Landscape Character Units, Scenic Routes and Protected Views, Landscapes, with specific reference to the Study Area location. The primary sources of information consulted during the course of the desk study include:

- Cork City Development Plan 2014-2020
- Cork City Landscape Study 2008

A site visit was conducted to gain familiarity with the Study Area and to ascertain the limits of the visual unit and a walkover survey of the Study Area to assess the landscape character and verify the extents of the Study Area. Photographs illustrating the landscape attributes of the Study Area were taken and notes were taken on landscape features and views in the Study Area.

9.2.3 Visibility of the Proposed Development

The locations of viewpoints for photographs (described further in Section 9.5) were informed by the nature of the proposed development, and the landscape context, maps and aerial images, with actual visibility being verified on the ground by a site visit.

In addition, a number of photomontages representing the likely visual effects of the development were prepared. These were based on an artist's impression and give an indication rather than the specific description of the likely appearance of the proposed flood relief works.

These were taken at varying locations along the river. The selection of photo locations is designed to give a representative range of views of the proposed development site and the choice of viewpoints (photo locations) is influenced by both the view available and the type of viewer. Due to the site location and the nature of the proposed development, visibility by the general public will be possible only in certain areas.

9.2.4 Assessment of Potential Impacts

Landscape and Visual Impact Assessment

Landscape and Visual Impact Assessment, though related, can be described separately. Descriptions based on the LI/IEMA Guidelines on Landscape and Visual Impact Assessment (2013) define each as follows:

Landscape Impact Assessment: This can be described as deriving from changes to the physical landscape, and which may result in changes to the landscape character and how it is experienced, as well as changes to the landscape as a resource.

Visual Impact Assessment: The assessment which relates to the changes in the composition of views available to people a result in changes to the landscape, including human response to the change and the overall changes to visual amenity.

The potential impacts of the proposed development in terms of visual and landscape impact are informed by both the desktop study, the site visit which outlines current visibility from chosen viewpoints, and study of the proposed works. The impact assessment is also assisted by the production of photomontages or artist's impressions which show the likely appearance of the proposed works. The assessment of impacts is assessed using the terminology recommended by the EPA (2002/3) as set out in Chapter 1 Introduction.

9.3 RECEIVING ENVIRONMENT

The receiving environment is located on the northern side of Cork City, and a very small portion is located just outside the City Boundary. Therefore the Cork County Development Plan is also referred to as well as the City Development Plan, particularly in terms of Landscape Character.

9.3.1 Cork County Development Plan 2014-2020

The Cork County Development Plan 2014 came into effect on January 15th 2015. The Plan includes policies and objectives regarding development and landscape and amenity designations which are referred to in the following sections.

Landscape Character

Section 13.6 of the Cork County Development Plan 2014 sets out the policies and objectives of the Council with regard to landscape.

The Cork County Draft Landscape Strategy (2007) hereafter referred to as the Strategy, continues to inform Landscape Policy within the County. This document identifies 76 Landscape Character Areas (LCAs) within the county. The LCAs were then amalgamated into a set of 16 generic Landscape Character Types (LCTs) based on similar physical and visual characteristics. Landscape Character Areas (LCAs) are smaller physical units with a more detailed description. This section focuses on LCTs, with more detailed discussion of the landscape character of the study area in Section 9.4 of this Chapter.

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The Cork County Development Plan notes that it is proposed to wait until the publication of the National Landscape Strategy before commencing a review of the current 2007 Draft Cork County Landscape Strategy. The Plan states that the Draft Strategy will be used as a supporting background document to inform the Plan in the interim, while improving its practical application in managing change in the landscape of the County.

Each LCT is assigned a value, sensitivity and importance, and these are listed in Appendix E of the Development Plan.

In terms of Landscape Values, LCTs are assigned defined values ranging from Very High to Low. Landscape Sensitivity is defined as the ability of a landscape to accommodate change without suffering unacceptable effects to its character and values. Landscape sensitivities range from Low. Medium, High and Very high in the Draft Strategy. Landscape Importance is rated as either of Local, County or National importance.

High Value Landscape

The County Development Plan 2014 considers that the LCTs which have a high or very high landscape value, and high or very high landscape sensitivity, and which are of county or national importance, should be designated as High Value Landscapes (HVL). (Note that landscape sensitivity, value and importance are explained further below. These are areas where considerable care is needed to successfully locate large scale developments, and such developments should generally be supported by as assessment including a visual impact assessment.

These areas are highlighted in green in the list in Appendix E, and illustrated in Figure 13.2 of the Cork County Development Plan.

While only a small portion of the Study Area falls within the County Boundary, the County Development Plan assigns landscape character to the whole county on a broad scale. The study area, and the wider city of Cork and environs is located within LCT 1 'City Harbour and Estuary'. This is classified as an LCT of Very High Value, Very High Sensitivity, and National Importance. The area to the north of the City Boundary, which includes a very small section of the study area at Kilbarry townland, is classified as an area of High Value Landscape (HVL) in the development plan. This is shown in Figure 9.1. However, the proposed works in these areas are minor in nature and of very limited extent.

In the Strategy, The LCT is not further sub-divided into Landscape Character Areas, however it is clear that there are areas of very different character. Below is a brief overview of the key characteristics within this LCT. The study area is further described in terms of landscape character in Section 9.4.

Landscape Character Type

This LCT is described as a mixture of rural and intensely urban areas, combined with a large expansive harbour. The description refers to areas to the south of the city, where the western side of the harbour supports major industrial development, while on higher ground telecommunication masts of water storage towers punctuate the skyline. There are no specific descriptions of the rural areas north of the city boundary, but the Strategy refers to the rural areas around much of the greater harbour area as being characterised by the prevalence of infrastructure such as roads, bridges and electricity power lines and some urban sprawl.

The Draft Strategy also contains a number of recommendations. Those which are relevant to this part of the LCT and to the proposed works are included below:

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• 'Protection of the north and south ridges and hillsides around the city, to ensure the visual backdrop to the city. These ridges would be adversely affected by unsympathetic development thus interfering with views of special amenity value to the city and surrounding area.

The Plan lists the following objectives with regard to landscape:

County Development Plan Objective GI 6-1: Landscape

(a)Protect the visual and scenic amenities of County Cork's built and natural environment.

(b)Landscape issues will be an important factor in all landuse proposals, ensuring that a proactive view of development is undertaken while maintaining respect for the environment and heritage generally in line with the principle of sustainability.

(c)Ensure that new development meets high standards of siting and design.

(d)Protect skylines and ridgelines from development.

(e)Discourage proposals necessitating the removal of extensive amounts of trees, hedgerows and historic walls or other distinctive boundary treatments.

County Development Plan Objective GI 6-2: Draft Landscape Strategy

Ensure that the management of development throughout the County will have regard for the value of the landscape, its character, distinctiveness and sensitivity as recognised in the Cork County Draft Landscape Strategy and its recommendations, in order to minimize the visual and environmental impact of development, particularly in areas designated as High Value Landscapes where higher development standards (layout, design, landscaping, materials used) will be required.

There are no scenic routes or views in this section of the Study Area.

9.3.2 Cork City Landscape Study 2008

The Cork City Landscape Study was prepared in 2008 and has been incorporated into Chapter 10 of the Cork City Development Plan 2015-2021 (see below). The Study establishes principles for protecting and enhancing the City's natural environment. The Study includes a Landscape Character Assessment, Analysis of Key Landscape Elements, identification of Key Landscape Elements and Formulation of Policy Recommendations and the elements which are contained in the Development Plan are outlined in Section 1.2.2 below.

9.3.3 Cork City Development Plan 2014-2020

The Cork City Development Plan 2014-2020 refers to policies and objectives for landscape in Chapter 10.

The Council seek to enhance the landscape through the development of a framework including developing and enhancing primary green links along the river Lee Corridor, extending public access along Secondary Green links along the other river tributaries, developing and improving Key Landscape areas in the City and creating new Urban woodlands.

9.3.4 Landscape Character Areas

Eight Landscape Character areas were identified in the Study. These are shown in Figure 9.2 and include:

- Estuarine/Riverine
- Natural harbour
- Historic urban core

- Fine-grained inner city residential
- Suburban residential
- Urban sylvan character
- Urban industrial/commercial
- Rural agricultural

The proposed works are to be carried out largely in areas characterised as Suburban residential, Urban sylvan character and Urban industrial/ commercial.



Figure 9. 2 Cork City Landscape Character Areas

9.3.5 Key Landscape Assets

The Landscape Study identifies a number of landscape assets which combine to create Cork's unique cityscape. The Key landscape assets are included in Table 10.1 in the Development Plan and are summarised below:

- Topography (ridges, slopes and escarpments).
- Water/River Corridors (river, estuary, harbour)
- Tree Canopy
- Ecology
- Visually Important Land (includes views and prospects)
- Historic Core
- Landmarks
- Public or Private Open Space
- Institutional Open Space
- Historic Landscapes
- Rural Character Green Belt

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- Built Form
- Public Realm
- Gateways to the City
- Bridges
- Pedestrian/Cycle Routes in the City
- Vehicular Access
- The Railway in the City

Key Landscape Assets which are potentially relevant to the areas of the proposed drainage works include river corridors, visually important land, open space, gateways to the city, and bridges.

- Objective 10.1: Landscape Strategic Objectives: To preserve and enhance Cork's landscape character and key landscape assets, and to preserve and enhance Cork's views and prospects of special amenity value.
- Objective 10.2: Cork City Landscape: To preserve Cork's unique and distinctive landscape character through appropriate management and enhancement of Key Landscape Assets as set out in Table 10.1)
- **Objective 10.3**: To preserve and enhance Cork's landscape and where appropriate, to increase access to and utilise the landscape for recreational purposes through the implementation of the Landscape Structure Plan.

9.3.6 Landscape Protection Designations

The Development Plan includes several categories of landscape designations which aim to preserve and enhance the significant landscape elements of the city. These include Areas of High Landscape Value and Landscape Preservation Zones.

Areas of High Landscape Value

These are areas which comprise one of more landscape assets listed above as identified in the Cork Landscape Study 2008. These areas display an intrinsic landscape character and a special amenity value. The Plan notes that development will be appropriate only where it results in a neutral or positive impact on the landscape and that new developments in AHLVs must respect the dominance of the landscape. The Council's objective is as follows:

Objective 10.4 Areas of High Landscape Value

To conserve and enhance the character and visual amenity of Areas of High Landscape Value (AHLV) through the appropriate management of development, in order to retain the existing characteristics of the landscape, and its primary landscape assets. Development will be considered only where it safeguards to the value and sensitivity of the particular landscape. There will be a presumption against development where it causes significant harm or injury to the intrinsic character of the Area of High Landscape Value and its primary landscape assets, the visual amenity of the landscape; protected views; breaks the existing ridge silhouette; the character and setting of buildings, structures and landmarks; and the ecological and habitat value of the landscape.

There are three Areas of High Landscape Value within the Study Area, two of which are along the Glenamought River where it borders the City Boundary. One area of AHLV occurs to the west of the Old Whitchurch Road, and takes in the land at O' Shea's Buildings along the river, as well an area further west of the Railway Line at Kilnap Railway Viaduct. This area consists of a period residence in in a riverside landscape setting, with the Railway Viaduct also located within this area. This is illustrated in Plate 9.1

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Plate 9.1: Area of High Landscape Value at Kilnap, looking through Kilnap Viaduct along the Glenamought River.

A second area occurs along the west side of the N20 at Brideholm, which is also an area occupied by residential development. These Areas of High Landscape Value are illustrated on Figure 9.3

Landscape Preservation Zones (LPZ).

Landscape Preservation Zones (LPZ) are areas which are considered highly sensitive to development, and typically combine distinctive landscape assets such as topography, tree cover, settings to historic structures or open spaces and other landscape assets. These areas have limited development potential. The Plan contains the following Objective:

Objective 10.5 Landscape Preservation Zones

To preserve and enhance the character and visual amenity of Landscape Preservation Zones through the control of development. Development will be considered only where it safeguards to the value and sensitivity of the particular landscape and achieves the respective site specific objectives, as set out in Table 10.2.

There are six LPZs which fall within or partially within the Study Area. The Cork City Development Plan also the Landscape Assets to be protected and also site-specific objectives for each LPZ. These are as shown in table 9.1.



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LPZ	Landscape Assets to be protected	Site Specific Objectives
NE1 Bride Valley	Topography, River, Tree Canopy, Ecology, Visually Important Land (from train)	Re-establish river as a key element of the valley floor by providing a linear park with publicly accessible riverside treed walk
NE2 Bride Valley	Topography, River, Tree Canopy, Ecology, Visually Important Land (from train)	Re-establish river as a key element of the valley floor by providing a linear park with publicly accessible riverside treed walk
NE3 Bride Valley	Topography, River, Tree Canopy, Ecology, Visually Important Land (from train)	Re-establish river as a key element of the valley floor by providing a linear park with publicly accessible riverside treed walk with new tree coverage and linked spaces.
NW11Farranferris Ridge Upper	Topography, River, Tree Canopy, Ecology, Visually Important Land	Provide a passive amenity space which benefits from an enhanced landscape structure and significant tree planting. To protect and enhance the watercourse and its setting.
NW12 Farranferris Ridge	Landmarks, Open Space	To seek the development of a passive public open space to provide for the surrounding residential areas.
NW13 Commons Road/Lover's Walk Ridge	Tree Canopy, Landmarks, Historic Core	To connect between Commons Road and Seminary Walk/Lover's Walk
NW14 Blackpool Valley (west) Ridge Commons Road	Rural Character/Green Belt, Topography, Tree Canopy, Visually Important Land, Gateway to the City	To develop a woodland park on the southern valley slope to provide an attractive landscape feature at the gateway and to connect the rural landscape with the city; To provide pedestrian linkages between residential areas at the top of the slope and Fitz's Boreen and Sunbeam development area.

 Table 9.1 Landscape Preservation Zones



Plate 9.2: View towards the Landscape Preservation Zone on Commons Ridge

9.3.7 Protected Views

Chapter 10 of the Development Plan lists a number of Views and Prospects. There are several types of views, and these include Linear Views of Landmark Buildings, Panoramic Views, River Prospects, Townscape and Landscape Features and Approach Road Views.

The views which relate to the Study Area are shown on Figure 9.3. The views relevant to the study area are categorised as Landscape and Townscape as follows:

Table 9.1 Landscape and Townscape Views

View		
LT24A	Woodland on Commons Ridge	N20/Commons Road Inbound
LT24B	Woodland on Commons Ridge	N20/Commons Road Outbound

Both views are towards the Commons Ridge, a wooded ridge which lies to the west of the N20 Cork-Mallow road as it enters Cork City. The river lies to the east of the N20 and is not visible in either of the protected views, being at a lower level that the N20 and screened by vegetation and earthworks from the N20. View LT24A is shown in Plate 9.3 below.



Plate 9.3: Protected View LT24A with the Commons ridge on the right of the image

The Objective associated with protection of the views and prospects is as follows:

Objective 10.6 Views and Prospects

To protect and enhance views and prospects of special amenity value or special interest and contribute to the character of the City's landscape from inappropriate development, in particular those listed in the development plan. There will be a presumption against development that would harm, obstruct or compromise the quality or setting of linear views of landmark buildings, panoramic views, rivers prospects, townscape and landscape views and approach road views. To identify and protect views of local significance through the preparation of local area plans, site development briefs and the assessment of development proposals on a case-by-case basis.

9.3.8 North Blackpool Local Area Plan (LAP) 2011

The North Blackpool LAP lies within the southern portion of the Study Area, and contains some specific objectives relation to Landscape and Open Space. These include the following relevant Key Objectives:

- To promote the creation of a high quality public realm and establish a high standard of design in architecture and landscape architecture.
- To protect and improve existing residential neighbourhoods
- To create a network of linked public open spaces (along the River Bride) to enhance the quality of the environment
- To protect and improve the rural character and landscape value of the Commons Ridge

Objectives relating to Public Open Space are as follows:

- To protect and enhance existing public open spaces, sports ground and leisure facilities which provide for the passive and active recreational needs of existing and future residents
- To provide new parks and public open spaces, including a linear park along the River Bride and the Commons Ridge
- To improve the accessibility and passive supervision of public open spaces through the development of a safe and attractive pedestrian / cycle network connection these spaces

Section 3.7 also refers to several proposals relating to open space as follows:

- The River Bride, bounded by a 'riparian' strip, (a planted, landscaped area) of Not less than 10 metres each side of the watercourse, should extend to a substantial public open space abutting Fitz's Boreen, including the existing landscaped amenity space and escarpment within the Dulux complex.
- It is proposed that the visually prominent rail embankment on Redforge Rd is retained and developed as a landscaped pedestrian access route to the (proposed) rail station.

9.3.9 Other Projects - Cumulative Effects

There are a number of other projects which have the potential to have Cumulative Effects in conjunction with the proposed development. The focus here in this chapter is on those projects which have the potential to cause significant cumulative landscape and visual effects.

The OPW have prepared the Lower Lee (Cork City) Drainage scheme which, as set out in Chapter 2, contains a number of flood relief measure to be implemented long the River Lee in Cork City, as well as in the rural lands west of the city, from Inishcarra in the west to Kennedy Quay in the City. The majority of the flood defence works proposed as part of the Lower Lee (Cork City) Drainage scheme will not be visible in conjunction with the proposed measures outlines in this EIAR. While the study area for the Lower Lee scheme extends for a short section north along the N20, however the main works will be along the riverside of the North and South channels. In terms of visual effects, these are unlikely to be visible form the same location, rather in a sequential way - for example, a viewer travelling or walking from Blackpool to the City Centre along the N20 would be likely to see the various flood defences from both projects on this journey, but not at the same time. Cumulative effects as a result of this project are considered Imperceptible.

The proposed new settlement at Monard is not developed in detail, however this may result in Cumulative effects which are also sequential in nature as the viewer moves from the new settlement to the study area of the proposed works. This project is a large scale, strategic settlement project, and it is anticipated that the proposed Blackpool Drainage scheme in conjunction with this, will not add any notable visual effects and result in have an imperceptible visual effect. The proposed Northern Ring Road, though mentioned, however is currently suspended, so while Cumulative visual effects are possible, this would be dependent on the detailed design and route of the proposed Ring Road. The proposed residential development at the Sunbeam factory would be visible form the River Bride, to the rear of the Millfield Industrial Estate. However, as the current view in this direction is to a vacant yard and across to the industrial estate, it is considered that the proposed residential development, but that this would be a positive visual effect.

9.4 LANDSCAPE CHARACTER

The topography, vegetation and anthropological features on the land surface in an area combine to set limits on the amount of the landscape that can be seen at any one time. These physical restrictions form individual areas or units, known as physical units, whose character can be defined by aspect, slope, scale and size. A physical unit is generally delineated by topographical boundaries and is defined by landform and land cover.

9.4.1 Physical Unit

The physical landscape unit in which the Study Area is located is defined largely by the Rivers Bride and Glenamought and a small section of the Glen River, and their associated river valleys. While in certain areas such as along the River Glenamought, to the northeast of the study area, the river valley and associated woodlands are evident, changes to the landcover of the physical landscape are evident further downstream in the built up areas where the river edges have been modified. Although the Bride valley is somewhat evident, built form has strongly influenced the landscape further downstream in Blackpool.

Landform

Present-day landscapes owe their form to the geological materials from which they were carved. Landform is the term used to describe the spatial and formal arrangement of landscape components as a natural product of geological and geomorphologic processes in the past, and refers primarily to topography and drainage.

9.4.2 Topography

The topography of the Glenamought River in the Study Area is characterised by a vegetated river valley which slopes sharply in certain areas. The level of the riverbanks and surrounding land ranges from approximately 20 to 40 metres OD. The change in level in the landscape is particularly evident in this part of the Study Area as the Glenamought river lies in a narrow valley, and a viaduct is located where Cork-Dublin railway line travels over the valley in the northeast of the study area, as shown in Plate 9.4 below. In the wider landscape, there are several hills – Rathpeacon Hill and the Commons Ridge to the northwest and west, the latter which is a feature of the City's landscape. To the east of the rivers lie the hills of Kilbarry/Ballyvolane.





Plate 9.4: Sloping topography where the Glenamought river flows west of Kilbarry near O' Shea's Buildings



Plate 9.5: Steep topography and Urban sylvan character adjacent to Railway Viaduct at Kilnap

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To the northwest of the Study Area, close to the Lower Killeens Road, the river valley of the River Bride is also evident along the urban fringe and here it is characterised by a tree lined corridor. However, as one moves further towards the City, the road drops in level and enters the built up area of the city, where the river valley is evident, as shown in 9.6 below. Plate 9.3 also shows the view down the valley, which is defined by the Commons Ridge which lies adjacent to the N20 and to the west of the river. The higher ground at Kilbarry and Ballyvolane lies to the east of the river. The river itself is hidden somewhat as the river is surrounded by the urban fabric. Further downstream in Blackpool village, along the valley floor, the natural river valley topography is more difficult to perceive due to the urban fabric.



Plate 9.6: Views to the River Bride Valley from sloping ground along the N20. The river lies to the rear of the vegetation on the far side of the N20 while the Commons Ridge lies to the right of the image.

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Plate 9.7: Topography and character of riverbank in Orchard Court, Blackpool

9.4.3 Drainage

The River Bride rises near Kerry Pike, some 4.9 kilometres to the west of the Study Area boundary. The River Glenamought rises near the townland of Coole East, approximately 4.4 kilometres north of the study area boundary.

9.4.4 Geological Processes

Chapter 6 refers to the geomorphology of the South Cork region, where uplands and valleys are characteristic of the region. The Study Area is underlain by Devonian 'Old Red Sandstone'. (The geology of Cork City is reflected in the use of sandstone and limestone in the buildings and walls in the city).

Landcover and Landuse

Landcover

Landcover is the term used to describe the combinations of vegetation and land-use that cover the land surface. It comprises the more detailed constituent parts of the landscape and encompasses both natural and man-made features. Landcover includes vegetation, structures and built form.

The CORINE land cover data (2012) for the Study Area was obtained from the Environmental Protection Agency (EPA). CORINE land cover is a map of the environmental landscape based on the interpretation of satellite images. It provides comparable digital maps of land cover for each country for much of Europe.

The CORINE data for the Study Area shows that on a broad level, to the north of the study area, there are small areas characterised as Agricultural Areas – Land Principally Occupied by agriculture with significant areas of natural vegetation (243) as well as a small area of Discontinuous Urban Fabric (112). However, the majority of the Study Area, which lies further south, is characterised as Artificial Surfaces – Industrial and Commercial units (121) with a portion to the south of the Study Area in Blackpool characterised as Continuous Urban Fabric (111).

Glenamought River

On the ground, it is evident that the landcover in the Study Area changes considerably as one moves from north to south. In the north, along the city periphery, land cover in the Study Area along the riverbank consists mainly of vegetation – grass, shrubs and trees, with considerable areas of tree cover. The study area includes the area around O' Shea's Buildings and bridges and the Kilnap viaduct. Some of these areas are also designated as Areas of High Landscape Value and Landscape Preservation Zones as illustrated in Figure 9.3. Plate 9.8 below shows the type of landcover found along the Glenamought River to the northeast of the study area, which is also a Landscape Preservation Zone while the area around O' Shea's Buildings is an Area of High Landscape Value (AHLV). There are several historic structures (Viaduct, stone bridges and buildings) in this section of the Study Area.



Plate 9.8: Vegetated land cover along Glenamought River to north of study area
River Bride

Landcover along the River Bride, in the north of the study areas along the City and County Boundary, is predominantly rural in character, consisting of fields and hedgerows, with some scattered built form as shown in Plate 9.9 below.

As one moves further south along the river corridor, towards the Commons Inn, the landcover is characterised by some areas of vegetation close to the river, along with areas covered by roads, (the N20), and hard surfaces and buildings, such as areas close to the North Point Business Park and to the rear of buildings such as the Commons Inn and the MacDonald's Drive Thru. Further downstream, the landcover close to the river becomes characteristic of industrial areas, as it flows through the Dulux Paints yard and the Sunbeam Industrial Estate, as shown in Plate 9.10 below.



Plate 9.9: Rural character and vegetated land cover along Bride River to north of study area