17 Summary of Impacts and Mitigation Measures

17.1 Introduction

Cork County Council and the Office of Public Works intends to ensure that any potential adverse effects of the proposed development on the environment are reduced to a practical minimum. Where unavoidable environmental effects have been identified during the environmental impact assessment process, measures have been proposed to mitigate these effects as much as is reasonably possible.

This chapter summarises the likely residual environmental effects associated with the proposed drainage scheme. The predicted impacts and recommended mitigation measures are comprehensively detailed in the relevant chapters of the EIAR, and are summarised in **Table 17.1** below.

Table 17.1 Assessment of Potential Effects and Mitigation Measures

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
CONSTRUCTION PHASE		
Site Clearance and Preparation		
Setting up of site office, contractor facilities including toilets and construction containers Importation of construction equipment Excavation activities Construction waste Excavated material Untidy site	A Construction Environmental Management Plan (CEMP) has been prepared and is included in **Appendix 4.2** which will be updated and finalised by the Contractor prior to construction commencing. The CEMP comprises all of the construction mitigation measures, which are set out in this EIA Report, and will be updated with any additional measures which are required by the conditions to the Minister for Public Expenditure's statutory confirmation of the Scheme under the Arterial Drainage Acts. Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum. The plan has regard to the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK, *Environmental Good Practice on Site Guide, 4th Edition* (CIRIA 2015). The plan also has regard to the TII Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan. The Employer's Representative will have a construction management team on the project site for the duration of the construction phase. The team will supervise the construction of the scheme including monitoring the contractors' performance to ensure that the proposed construction phase mitigation measures are implemented and that construction impacts and nuisance are minimised. The construction management team will liaise with residents and the general community during the construction phase to ensure that any disturbance is kept to a minimum and to ensure that all anticipated nuisances are minimised and that the construction activity will have the lowest possible impacts on the residents and other properties. It is also proposed that a Community Liaison Officer will be appointed who will coordinate communications and liaise with the local community during the construction phase. The appointed CLO may be part of the resident engineering team.	**Imperceptible** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	Soil, Surface Water and Groundwater • Training of site managers, foremen and workforce, including all subcontractors, in pollution risks and preventative measures; • Careful consideration will be given to the location of any fuel storage facilities. These will be designed in accordance with guidelines produced by CIRIA, and will be fully bunded; • All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment to deal with spills will be maintained on site; • Where feasible, soil excavation will be completed during dry periods and undertaken with excavators and dump trucks. Topsoil and subsoil will not be mixed together; • Ensure that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g. by a roll-over bund, raised kerb, ramps or stepped access; • Use collection systems to prevent any contaminated drainage entering surface water drains, watercourses or groundwater, or draining onto the land; • Wheel wash at site entrance to clean vehicles prior to exiting onto public road network; • Minimise the use of cleaning chemicals; • Use trigger-operated spray guns, with automatic water-supply cut-off; • Use settlement lagoons or suitable absorbent material such as flocculent to remove suspended solids such as mud and silt; • Use silt control methods for in-stream working e.g. silt curtains, silt pumps; and	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Ensure that all staff are trained and follow vehicle cleaning procedures. Post details of the procedures in the work area for easy reference. • Appropriate sediment control measures will be employed. • Where cast-in-place concrete is required, all work must be carried out in the dry and effectively isolated from any flowing water (or water that may enter streams and rivers) for a period sufficient to ensure no leachate from the concrete; • Waterproofing and other chemical treatment to structures in close proximity to watercourses shall be applied by hand; and • All pumps used for dewatering excavations shall be located in sump to minimise the sediment generation. **Air Emissions** Refer to Air Quality below. **Site Tidiness** • Daily site inspections will be undertaken to monitor site tidiness; • A regular programme of site tidying will be established to ensure a safe and orderly site; • Scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind; • Food waste will be strictly controlled on all parts of the site. • Mud spillages on roads and footpaths outside the site will be cleaned regularly and will not be allowed to accumulate; • Wheel-wash facilities will be provided for vehicles exiting the site; and • In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed to storage on site, and subsequently disposed of in the normal manner.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	Noise Emissions and Vibrations Refer to Noise and Vibration below. **Invasive Species** Treatment measures and prevention of spread are discussed in **Appendix 4.1**. **Waste Management** • Waste generated during the construction phase will be carefully managed according to the accepted waste hierarchy which gives precedence to prevention, minimisation, reuse and recycling over disposal with energy recovery and finally disposal to landfill. • This hierarchy will be implemented by identifying opportunities to firstly prevent waste from being produced, and secondly minimise the amount of waste produced. Where prevention and minimisation will not be feasible, ways to reuse or recycle waste will be sought, preferably on-site to avoid the impacts arising from transportation. If this is not feasible, opportunities to reuse or recycle the waste off-site will be investigated. If this is not feasible, then waste will be sent to an energy recovery facility, and only where there is no alternative, will waste be disposed of to landfill. To achieve this, existing waste management programmes and networks will be used such as the National Waste Prevention Programme, which is implemented by the Environmental Protection Agency. • All waste removed from the site will be collected only by contractors with valid waste collection permits, under the Waste Management (Collection Permit) Regulations. • All facilities to which waste will be taken will have appropriate waste licences or permits, under the Waste Management Act 1996, as amended, and the regulations thereunder, allowing them to accept the type of waste that is to be sent there. Hazardous waste generation will be minimised, and such waste will be recovered where feasible, and only disposed of if recovery is not feasible. Hazardous waste will be managed in accordance with the relevant legislation.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	The key principles underlying the plan will be to minimise waste generation and to segregate waste at source. The measures to achieve these aims include: • Ordering of appropriate quantities of materials, with a just-in-time philosophy; • Immediate and careful storage of materials delivered to the site; • Storing materials which are vulnerable to damage by rain under cover and raised above the ground; • Careful handling of materials, using appropriate equipment, to avoid undue damage; and • Designation of separate storage areas for different types of waste, in order to maximise the reuse and recycling potential of the waste. The Waste Management Plan will outline how residual waste will be handled as follows: • The identification of disposal sites; • The identification of quantities to be excavated and disposed of and classification of this material; • The identification of measures to prevent nuisance, etc.; • The identification of the amounts intended to be stored temporarily on site and the location of such storage; • The contractor's approach to waste management; and • The names, roles, responsibilities, and authority of the key personnel involved in the waste management. The following will also be considered as part of the Waste Management Plan: • The identification of the amount of materials intended to be stored temporarily on site and the location of such storage;	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Procedures for controlling sub contracts i.e. for checking waste procedures of subcontractors and ensuring sub-contractors fulfil design teams and contractor obligations in respect of waste management; • Designation of separate storage areas for different types of waste materials in order to maximise their re-use and recycling potential; • Procedure for record keeping for waste retained on site; • Procedure for record keeping for hazardous waste, for example, C1 forms and trans-frontier shipment documents; and • Details of authorised waste hauliers with appropriate and up-to-date Waste Collection Permits. Details of permitted or licensed recovery and/or disposal facilities where waste materials will be sent, including copies of permits and licenses. The main contractor will be required to minimise waste and to segregate waste at source. The possible measures used to achieve these aims will include: • Ordering of appropriate quantities of materials, with a just-in-time philosophy. • Immediate and careful storage of materials delivered to the site. • Storing under cover and raised above ground materials, which are vulnerable to damage by rain. • Careful handling of materials, using appropriate equipment, to avoid undue damage. • Designating separate storage areas for different types of waste in order to maximise the re-use and recycling potential of the waste. Anticipated wastes arising can be summarised as follows: • Sanitary waste from toilet and washing facilities. These will be tankered offsite; and	

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	• Construction Waste – e.g. packaging, pallets, and metal waste will be disposed off-site at suitably permitted waste facilities.	
Landscape and Visual Impact		
Removal of trees and vegetation and the construction of new flood defence walls Visual impacts on the historical character of the built environment and immediate settings of protected structures; Visual impact from construction of new embankments; and Impact on public realm and residential amenity from the localised noise, dust, vibration, access restrictions and visual disturbance associated	**General** • Design of Glashaboy River (Glanmire/Sallybrook) Drainage Scheme shall be sympathetic to the riparian character of the woodland river corridor and historical built environment. • Retain existing trees where possible in the interest of residential amenity, public realm and visual character of the river landscape. Trees to be retained will be protected during the construction period in accordance with BS5837:2012, Trees in relation to design, demolition and construction. Recommendations. • River banks will be left intact and vegetated wherever possible. All disturbed areas will be re-landscaped and seeded, as soon as possible post works. On the 'wetside' of the flood wall, soil areas will be seeded with a native wildflower mix suitable for riparian environments. • Where retention of existing trees is not an option, these shall be replaced with new native species as close as possible to the original location, on the dry side of the wall, in the interest of residential and public amenity and visual character of the river landscape. Species to include Alder (Alnus glutinosa), Birch (Betula pubescens), Hawthorn (Crateagus monogyna), Blackthorn (Prunus spinosa), Pine (Pinus sylvestris), Hazel (Corylus avellana), Spindle (Euonymus europeus) and Holly (Ilex aquifolium). There is also native hedge (Corylus ayellana and Euonymus europeus) carefully provided for around the artificial Otter holts provided for along the river. • Galvanised powder coated finish to be applied to new railings and barriers.	**Imperceptible** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
with the construction works.	• Proposed flood defence walls have typically been aligned to be constructed along existing walls where possible, in the interest of minimising intrusion on the existing landscape character (with the exception of Meadowbrook where wall will be set back in order to retain trees). **Specific** • Installation of 1.8m high fence and hedging along eastern river bank adjacent to Multi Use Games Area in Riverstown in replacement of removed trees (as per Figure 7.1.2.2 in Appendix 7.1) • Sandstone cladding on exposed sections of new walls is of particular importance for the following areas: o The approach road and entrance to Glanmire town (dry and wet side of new wall); o Any new sections approaching Riverstown Bridge. Contemporary capping and railing is deemed appropriate to define boundary with protected structure and avoid a pastiche approach. The finalised detailed design and colour of the railings and finishes at this location will be agreed with Cork County Council's heritage officer, prior to works commencing; o On entrance to (including wall near Multi Use Games Area) and within the Hazelwood Centre (on sections of exposed walls in public areas, mainly dry side). (as per Figure 7.1.1.2); o On exposed side of any reinstated/altered sections of the existing wall opposite Copper Valley Vue (as per Figure 7.1.6.2); o At The Grove: on dry side of new wall along R639 north of Glanmire Bridge (C01_L08 – Works Chainage 0-101); and o Native hedge planting, consisting of hawthorn (*Crateagus monogyna*), blackthorn *(Prunus spinose*), holly (*Ilex aquifolium*), spindle *(Euonymus europeus*) and dog rose (*Rosa canina*) will be planted at 0.45m centres along the dry side of the textured concrete wall running through Meadowbrook (as per **Figure 7.1.4.2** in **Appendix 7.1**). • The quantity and extent of replacement tree planting is curtailed by the need to minimise tree planting within the flood defence measures cause blockage of the channel and/or damage the flood walls; and the amount of available space left for tree planting. However, there has been allowance for some replacement tree planting at;	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	○ 'Circus Field' north of Hazelbrook, where riparian Alder tree planting has been provided along the river bank, ○ John O'Callaghan, where new corpses of Oak, Birch and Alder have been provided within the park. ○ Copper Valley Vue, where new trees have been provided for within the landscape space between the road and the river. **Construction** • Existing trees to be retained where possible in the interest of public realm and visual character of the river amenity. River banks will be left intact and vegetated wherever possible. Coppicing and/or selective removal of trees may be considered where required in preference to total vegetation removal. Trees to be retained will be protected during the construction period in accordance with BS5837:2012, Trees in relation to design, demolition and construction. Recommendations. • Disturbance to private boundaries, gardens, etc. shall be avoided wherever possible and where impacted shall be reinstated prior to completion of the works. • Machinery shall not enter the river unnecessarily. • All landscape, footpath, roads etc., disturbed during the course of the works shall be fully reinstated prior to the completion of the construction works. • Japanese Knotweed is particularly common along stretches of the river (e.g. on main entrance road to Hazelwood centre towards sports pitch). Works on river banks should seek to control/eradicate such invasive weeds. Such weeds shall not spread or relocated in the course of the works.	
Traffic		

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Increase in traffic due to construction activities in the form of HGVs, and workforce and general site traffic. Temporary traffic diversions and road closures Phasing	• All construction works will be subject to industry-standard traffic management measures, including the preparation of a Construction Traffic Management Plan which will be undertaken in consultation with Cork County Council and An Garda Síochána, and which will be prepared and agreed in advance of any works commencing, and will include the sourcing of construction materials, agreement of appropriate haul routes, etc. • These traffic management measures will be designed in accordance with the 'Guidance for the Control and Management of Traffic at Roadworks – Second Edition'. • Consequently, construction-related traffic flows will also be subject to any such traffic management plans, which may include restricted construction working hours, maintaining single-lane or two-way traffic flows and/or suitable diversion routes. • As outlined above, construction working hours will be 08:00-19:00 on weekdays, and 09:00-16:00 on Saturdays. Therefore, construction workforce traffic will arrive and depart at the working areas before the morning peak on the local road network, and after the evening peak. • In addition, it may be necessary to work outside these hours, including at weekends and at night, at certain stages. Working outside normal hours may be necessitated through consideration of safety or weather and sub-contractor availability. Heavy or noisy construction activities will be avoided outside normal hours and the amount of work outside normal hours will be strictly controlled. Approval from Cork County Council will be obtained for works outside normal hours. Specific work activities may also be programmed to coincide with the summer months to avail of the lower local traffic flows during school holiday periods, etc. • The construction of the replacement bridges will be carried out by a suitably qualified and experienced contractor who will be supervised to ensure that the works are carried out correctly. This will ensure that the bridge will be constructed safely and ensure the structural integrity of the structure.	**Imperceptible** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Excavation and reinstatement of the 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 experienced professional to ensure they are carried out correctly. • As with construction-related traffic, 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'. Where necessary, diversion routes will be developed for affected traffic due to road restrictions or closures. **Mitigation Measures for the Local Road Network during Construction** • The construction programme of the scheme will be phased in order to ensure that certain works are not underway simultaneously in proximity to each other where one works element impacts on the mitigation measures associated with an adjacent scheme. • In so far as possible, the Contractor is expected to primarily gain access from the river banks to carry out specific elements of the works. • For example, as outlined in **Chapter 4** the replacement of the internal Hazelwood Shopping Centre bridge will not occur at the same time as the construction of the adjacent culvert outside the shopping centre on Hazelwood Avenue, as this will be a diversion route for traffic displaced by the closure for replacement of the internal bridge (and vice versa). • The adjacent culvert works at Hazelwood Avenue are expected to be constructed in two phases, which will retain vehicular, pedestrian and cyclist access to a limited extent. Due to the generous road width at this location, it may be possible to retain two-way traffic. • Similarly, the culverting works on the R639 and R615 at the Springhill Stream will be phased so as to occur independently of each other in order to enable diversion routes to be incorporated on the local road network.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• The timings of potential road closures or restrictions will, where possible, be arranged so as to carry out the most intensive works elements at off-peak. • Where possible, and subject to local considerations (including impacts on residents and businesses), 24-hour or night-time working will be included in construction phasing. Consultation will occur with local businesses and residents in advance of any works commencing. • Local access will be maintained throughout the works, by provision of new temporary accesses or by retention of existing accesses where possible. • The majority of the proposed works will be undertaken in phases so that partial traffic flow can be maintained at a minimum at all times and at all locations, wherever possible. Many works elements will be undertaken in multiple phases so as to allow for partial road closures so as to minimise the extent of any full road closures. Depending on the commencement date of the works, it may be possible to schedule the more disruptive elements during the summer months to coincide with school holidays. • Although the impact of temporary construction works are likely to be significant in localised areas, there are numerous diversion routes available within the study area due to the extensive local road network. The R615 and R639 can serve as temporary diversion routes for many of the substantial works elements, while East Cliff Road also offers a localised diversion route via Glanmire Bridge. The L3010, Brooklodge Grove and Hazelwood Avenue also offer numerous potential diversion routes. The works in question will not alter the function or operational capabilities of the road network once completed. Access will be immediately restored upon completion of any works that involve a partial or full road closure. • The road network will continue to function as it does at present once the works are completed, and there will be no permanent loss of access or loss of any elements of the existing road network.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Noise and Vibration		
Principal sources of noise: Earthworks plant and equipment. Construction plant and equipment. Construction traffic.	• In accordance with best practice, noise aspects during the construction phase will be managed in accordance with BS 5228: Code of practice for noise and vibration control on construction and open sites (Part 1: Noise) (BSI, 2009). • Selection of plant machinery with low inherent potential for generation of noise and/or vibration. All construction plant and equipment to be used at the site will be modern equipment and will comply with the relevant legislation and regulations • Regular maintenance of plant will be carried out in order to minimise noise produced by on-site operations. In particular, attention will be paid to the lubrication of bearings and the integrity of silencers. Silencers and engine covers will be maintained in good and effective working order. • All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the Contract. • Any compressors used on-site will be of the 'sound reduced' models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers. • Machines, which are used intermittently, will be shut down or throttled back to a minimum during those periods when they are not in use. • Any plant, such as generators or pumps, which are required to work outside of normal working hours, will be surrounded by an acoustic enclosure. • Training of drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.	Imperceptible Residual impacts are not envisaged following the implementation of the mitigation measures outlined.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• A maximum speed limit of 30 km/hr will be imposed for HGVs and drivers will be instructed to maintain as far as possible the distances between vehicles. • Prior to the commencement of construction works, baseline noise monitoring will be carried out by the Contractor to determine the existing noise environment. During the works, noise monitoring will take place at the nearest sensitive receptors to the works. A minimum of ten number noise monitoring locations are to be set up to monitor construction noise levels at sensitive locations throughout the scheme. The following areas have been provisionally identified for noise monitoring during the construction phase: Meadowbrook, Riverstown, Hazelwood, Brooklodge Grove, Copper Valley Vue and The Grove. • Monitoring will be carried out at worst-case receptors at these locations, at a minimum. Measured levels will be compared to the limits outlined in Table 9.1 of Chapter 9. • In terms of minimising vibration levels, the Contractor will be required to select and utilise methods of working and items of plant so that the maximum measured ground vibrations do not exceed a peak particle velocity (PPV) of 8.5mm per second at any occupied property, with a lower PPV limit of 5mm per second applying to properties in poor condition or other sensitive receptors, such as the Eurofins facility. Works in proximity to sensitive receptors, such as the Eurofins facility will be carried out at an optimum time to minimise disturbance and potential impacts. Prior to the commencement of construction works in proximity to the Eurofins facility, discussions will be held with management of the facility to confirm the optimum time to carry out the works. • The Contractor will be required to monitor ground vibrations at selected locations to the approval of the Employer's Representative during the progress of the works. Each vibrograph shall be certified as being in proper working order and shall unless otherwise approved, record vibrations in three directions simultaneously with print-out showing the amplitude and frequency of the vibrations. • Vibration measurements shall be taken at the base of buildings, on the side facing the source of vibration. Where feasible, the measurement should be taken on a hard surface on the ground outside the building.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• A pre-condition survey will also be undertaken of all properties potentially affected by the works (likely within a 10m radius of works areas). Crack monitoring will be installed on such affected properties and monitored throughout the works.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Air Quality		
Dust from excavation and site clearance activities Emissions from exhausts of construction plant and vehicles. Dust from movements on site in dry windy weather. Dust from dry surfaces and stockpiles.	The following dust mitigation measures will be implemented by the contractor as part of the CEMP: • Limiting vehicle speeds on the construction site; • During very dry periods, spraying surfaces with water will control dust emissions from heavily trafficked locations; • All vehicles exiting the site will make use of wheel wash facilities prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Public roads outside the site will be regularly inspected for cleanliness, and cleaned as necessary. Wheel-washing facilities will be located away from sensitive receptors; • Topsoil and other dusty material being moved onsite will be transported in covered trucks, where the likelihood of emitting dust is high, and during dry weather conditions the area of removal will be sprayed with water from a mobile tanker on a regular basis to control dust emissions; • Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be minimised through regular servicing; and	**Imperceptible** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Dust monitoring will be carried out at the site boundary adjacent to the works throughout the construction phase. Dust deposition monitoring will be conducted at the nearest sensitive receptors in the vicinity of the proposed development. Monitoring will be carried out using the Bergerhoff method, i.e. analysis of dust collecting jars left on-site (German Standard VDI 2119, 1972). Results will be compared to the TA Luft limit of 350 mg/m2/day. Should an exceedance of the TA Luft limit occur during the construction phase, additional mitigation measures, for example more regular spraying of water, will be implemented. • A dust minimisation plan will be formulated for the construction phase of the project so as to minimise dust emissions. 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 and compliance with the TA Luft limit.	
Climate		
Construction vehicles, generators etc., may give rise to CO_2 and NO_x emissions.	• There will be minor emissions to the atmosphere during the construction phase. No mitigation measures required.	**Imperceptible** No significant residual impact predicted.
Soils, Geology and Hydrogeology		
Potential impact on soil from leaks or spills from fuel, etc. Excavation of soil for wall foundations,	The construction management of the site will take account of the recommendations of the CIRIA guidance Control of Water Pollution from Construction Sites, guidance for consultants and contractors (Masters-Williams et al 2001) to minimise as far as possible the risk of soil, groundwater and surface water contamination. Measures, as recommended in the guidance above, that will be implemented to minimise the risk of spills and contamination of soils and waters, include: • Training of site managers, foremen and workforce, including all subcontractors, in pollution risks and preventative measures;	**Imperceptible** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
embankments, culverts and sediment trap	• Careful consideration will be given to the location of any fuel storage facilities. These will be designed in accordance with guidelines produced by CIRIA, and will be fully bunded; • All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment to deal with spills will be maintained on site; • Where feasible, soil excavation will be completed during dry periods and undertaken with excavators and dump trucks. Topsoil and subsoil will not be mixed together; • Ensure that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g. by a roll-over bund, raised kerb, ramps or stepped access; • Use collection systems to prevent any contaminated drainage entering surface water drains, watercourses or groundwater, or draining onto the land; • Wheel wash at site entrance to clean vehicles prior to exiting onto public road network; • Minimise the use of cleaning chemicals; • Use trigger-operated spray guns, with automatic water-supply cut-off; • Use settlement lagoons or suitable absorbent material such as flocculent to remove suspended solids such as mud and silt; and • Ensure that all staff are trained and follow vehicle cleaning procedures. Post details of the procedures in the work area for easy reference.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Hydrology		
Potential impact on surface water during heavy precipitation from stormwater runoff which could contain silt, or oils from plant and vehicles. Potential impact due to the risk of flooding.	A CEMP has been prepared and implemented for the duration of the construction phase of the project. Prepare an Emergency Response Plan detailing the procedures to be undertaken in the event of flooding, a spill of chemical, fuel or other hazardous wastes, a fire, or non-compliance incident. This plan will contain the following information: • Containment measures; • List of appropriate equipment and clean-up materials; • Maintenance schedule for equipment; • Details of trained staff, location and provision of 24- hour cover; • Details of staff responsibilities; • Notification procedures to inform the relevant environmental authorities: Cork County Council, the EPA and Inland Fisheries Ireland; • Audit and review schedule; • Telephone numbers of Cork County Council and Cork City Council Drainage Services; • List of specialised pollution clean-up companies and their telephone numbers; • Ensure all site staff are trained in the implementation of Emergency Response Plan and the use of any spill control equipment as necessary; • Prepare method statements for the control, treatment and disposal of potentially contaminated surface water;	**Imperceptible** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Prepare a site plan showing the location of all surface water drainage lines and proposed infiltration areas / discharge to combined sewers. This shall include the location of all existing and proposed surface water protection measures, including monitoring points and treatment facilities; • Ensure that all appropriate licenses required for construction are obtained from the relevant authorities; The Contractor will comply with the following guidance documents: • CIRIA – Guideline Document C532 Control of Water Pollution from Construction Sites (CIRIA, 2001); • CIRIA – Guideline Document C649 Control of Water Pollution from Linear Construction Projects Site Guide (CIRIA, 2006); • CIRIA – Guideline Document C624 Development and Flood Risk – guidance for the construction industry (CIRIA, 2004); and • Guidelines on Protection of Fisheries During Construction Works in and adjacent to Waters (Inland Fisheries Ireland, 2016). The following construction mitigation measures will be utilised to minimise the risk of contamination during in channel works: • Where cast-in-place concrete is required, all work must be carried out in the dry and effectively isolated from any flowing water (or water that may enter streams and rivers) for a period sufficient to ensure no leachate from the concrete; • Waterproofing and other chemical treatment to structures in close proximity to watercourses shall be applied by hand; and • All pumps used for dewatering excavations shall be located in sump to minimise the sediment generation. The following construction mitigation measures will be utilised to control the interaction of wash down water from concrete and cementitious material, vehicle wash down areas and run-off from fuelling areas with surface water: • All batching and mixing activities will be located in areas away from watercourses and drains;	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Surface water drainage around the batching plant will be controlled; • There will be no hosing into surface water drains of spills of concrete, cement, grout or similar materials; and • Washout from mixing plant or concrete lorries will be carried out in a designated, contained impermeable area. • All oils and fuels shall be stored in secure bunded areas and care and attention taken during refuelling and maintenance operations. Particular attention shall be paid to the gradient and ground conditions which could increase the risk of discharge to waters. • Vehicle wash down areas shall be bunded and run-off channelled to a treatment area, such as a settlement pond, prior to discharge. As per the above listed guidelines, protection measures will be put in place to ensure that all materials used during the construction phase are appropriately handled, stored and disposed of in accordance with recognised standards and manufacturer's guidance. Ensure that any discharges to waterbodies will comply with the appropriate legislative requirements as addressed in **Section 12.2.2** of **Chapter 12.** To mitigate the increased risk of fluvial flooding during the construction of the Scheme, the Contractor will be required to ensure all temporary watercourse diversions have adequate hydraulic capacity and do not increase the risk of flooding during high fluvial flows or tidal water levels. Adequate overflow arrangements will be required to ensure high flows can be conveyed downstream without increasing the risk of fluvial flooding. The Contractor will be required to carry out risk assessments prior to undertaking any works (including in-stream works), which will include assessing the risk of flooding. To mitigate the risk of pluvial flooding during the construction stage the Contractor will be required to ensure all surface water drainage networks in the vicinity of the works remain clear and free flowing. The Contractor will also be required to ensure that all surface water drainage outfalls to existing watercourses are maintained or alternative outfalls are constructed.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Biodiversity		
Temporary physical damage to habitats within the construction footprint or access routes Potential changes to the physical regime e.g. estuarine, fluvial and geomorphological processes, salinity levels, tidal regimes, erosion, deposition, sediment transport and accumulation). Changes in the hydrological regime Changes in water quality and pollution Disturbances to sensitive species such as birds, badgers, bats and otters Disturbance to fisheries Invasive plant species in works areas	**Designated Conservation Sites** In order to mitigate identified construction and operational impacts on the Cork Harbour SPA, and also the pNHAs, the following mitigation measures will be implemented: • No works shall take place downstream of Glanmire Bridge. • Localised temporary piling during the construction phase of the proposed scheme shall not take place downstream of Glanmire Bridge, which carries road L2999. • Temporary piling shall not take place during the hours of darkness. • Vibratory piling methods shall be used as a low noise alternative to impact piling. • Piling methods shall use a 'soft-start' approach to piling. • The permanent works (i.e. the flood defence walls) will not encroach into Cork Harbour SPA and Glanmire Wood pNHA. Wherever possible works on the flood defence walls will be conducted from the dry side to limit damage to riverine/estuarine and intertidal habitats along the toe of the walls and works. • Follow pollution prevention measures as detailed in **Section 6.8.9.** **Habitats and Flora** • In-channel working will be minimised, wherever possible;	**Neutral** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Channel maintenance activities	• Sympathetic and suitably extensive erosion control measures will be installed at key changes in flow regime, such as at culvert entrances and exits, so that local erosion does not precipitate a disruption or acceleration of the sediment regime. A transition from hard to soft erosion control measures will be included at all culverts and hard defences. • Upon completion of the works, in-stream (aquatic) vegetation will be allowed to re-colonise naturally, however, this will be monitored and if deemed necessary additional planting of suitable aquatic plant species will be undertaken; • Upon completion of in-channel works, in-channel sediment features will be reinstated. This may be in the form of placing boulders at intervals along sections of channel where the natural river bank is being altered by hard structures; • A silt fence shall be installed at the base of the new embankment at Sallybrook. This silt fence shall be installed prior to the exposure of unvegetated overburden. Sections of embankment will be appropriately covered at the end of each work day to ensure unvegetated overburden is left exposed; • It is anticipated that any alteration of the sediment transport processes will be local to the main in channel works, such as bridges and culverts. It is important that a review of the construction works to capture immediate local channel geomorphological response is undertaken by a qualified geomorphologist. Erosion control measures may be extended further downstream as a result but this assessment has taken that possibility into account. • Follow pollution prevention measures as detailed in Section 6.8.9 of Chapter 6. • 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/or native wildflower seed mix option. • Hedgerow/tree planting will be undertaken to address the loss of hedgerow/treeline to accommodate the new drainage scheme. Hedgerows will be replanted as close to the existing alignment and location as possible and will use native, locally sourced species appropriate to the locality.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	Birds • All vegetation clearance works and site preparatory works will be conducted outside of the bird nesting season (March to August inclusive). If this is not possible, a breeding bird survey will be undertaken by a suitably qualified ecologist 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. • Impacts on Kingfisher have been mitigated through the scheme design, by moving the flood wall to avoid the Kingfisher embankment and placing the flood defence wall behind the existing wall and within Meadowbrook housing estate in order further minimise impacts to Kingfisher. • With respect to Kingfisher at Meadowbrook, no temporary piling or construction of the RC wall shall take place during the breeding bird season (March – August inclusive). Nesting activity shall be monitored by a suitably qualified ecologist. If nesting activity is not observed, ensuring the allowance for a late clutch and/or double clutch, works may proceed during the later months of the breeding bird season. • The Kingfisher nesting area at Meadowbrook will be physically screened off from proposed works in the vicinity of the Kingfisher embankment, • Hedgerow/tree planting will be undertaken to address the loss of hedgerow/treeline to accommodate the new drainage scheme. Hedgerows will be replanted as close to the existing alignment and location as possible and will use native, locally sourced species appropriate to the locality. The planting of unstable banks shall be carried out to assist the re-establishment of habitat cover to the river corridor.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Works to existing walls and bridge structures shall require a breeding bird survey prior to the commencement of works to ensure there will be not impacts on Dipper and Grey wagtail. If nests are found, they will be safeguarded, with an appropriate buffer, until the chicks have successfully fledged. • If nesting areas of Dipper and Grey wagtail, as identified in the breeding bird survey, will be damaged or lost through the proposed scheme, enhancement measures to wall and bridge structures shall involve the installation of nest boxes for Dipper and Grey wagtail in these areas. • This will require consultation with the UCC research department who currently run a Dipper project on the Glashaboy and who have provided information to JBA's ecologists throughout this project. Consultation will be required by the Contractor prior to the installation for the nest boxes. **Otters** • A derogation licence for the Scheme was obtained from NPWS with respect to otter for the proposed Scheme (See **Appendix 6.3**). The derogation licence application that was submitted to NPWS detailed the temporary closure of a number of holts and proposed the locations and design for two artificial holts. A course of monitoring in advance of the commencement of work will be required to establish the relative occupancy of the identified holt structures, including interim reporting and method statements for the temporary closure of the holts in consultation with NPWS. All conditions and mitigation measures required by this licence shall be implemented. Refer to **Figure 1** in **Appendix 6.3** of the **EIAR** for the location of the proposed artificial otter holts. • Prior to commencement of works, a further survey to identify the presence of any new Otter resting places/holts within 200m of the works areas will be undertaken. If found and likely to be damaged/disturbed by the works, a revised derogation licence shall be applied for from NPWS. This licence will include new otter resting places and holts identified during the pre-construction survey. Any further mitigation measures required by the derogation licence shall be implemented.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence

	• A 20m buffer shall be provided for any holt in the vicinity of the proposed construction compound at Circus Field. Physical delineation of the 20m shall be provided with solid screening. This compound area shall be used for the storage of materials and machinery only and will not contain welfare facilities.
	• The provision of lighting for the compound shall be designed in such a way that it is directional and thus preventing unnecessary light spillage and light pollution. Lighting shall be controlled by a timeclock/ sensors.
	• Night-time working shall be avoided within 20m of the known otter holts and resting places, or those that may be identified as part of the pre-works Otter survey. If night-time work is required within 20m of an otter holt, this shall be detailed in the revised derogation licence, the appropriate mitigation measure strategy devised and any additional requirements of the derogation licence implemented.
	• The design of new structures shall include the provision of ledges for the movement and passage of otters in accordance with 'Guidelines for the treatment of otters prior to the construction period of national road schemes' (NRA, 2008) and 'Guidelines for the crossing of watercourses during the construction of national road schemes' (NRA, 2008). Ledges shall tie into the adjoining riverbanks, or river bed where practicable, and should be screened with landscape planting. A 500mm wide ledge will be constructed from concrete with its top at 150mm above the 1 in 5-year event. It will be on one side of the bridge/culvert structure only. These ledges will be provided at the following culverts:
	  ○ Shopping centre bridge at Hazelwood
	  ○ All three new structures on the Glenmore Stream
	• 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 be 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.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• All materials stored on site will be stacked securely so as to prevent accidental collapse if investigated by an Otter, or any other large mammals. **Badger** • To minimise the potential for Badgers 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 be 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. • All materials stored on site will be stacked securely so as to prevent accidental collapse if investigated by Badger, or any other large mammals. • Prior to commencement, all works areas, site compounds and access routes will be re-surveyed to ensure that new Badger setts have not been established. If found, appropriate mitigation strategies will need to be devised and implemented. **Bats** In order to mitigate identified construction and operational impacts on bats the mitigation measures listed below will be implemented. A derogation licence for the scheme has been obtained from NPWS with respect to bats for the proposed scheme (See **Appendix 6.4** of the **EIAR**). All conditions of the derogation licence shall be implemented. In survey areas where habitats present and currently provide good commuting and some foraging potential for bats, it is best practice to avoid damaging activities. It is proposed that the following measures be put in place to avoid or lessen the degree of construction and operational impacts on bats.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	Mitigation by avoidance • Do not remove trees and shrubs along waterway banks adjacent to the bridge structures, where feasible. Protect this habitat from any potential damage as a result of the proposed development works. • Treelines and shrubs should remain in-situ, where possible, and remain protected from potential management work. • Minimise damage to the woodland habitat adjacent to the bridges/walls/ culverts and along the rivers. • Ensure that all equipment, construction materials are stored on the roadway and not in adjacent habitats to the bridges. • Open areas required to facilitate works should be limited, where feasible, to areas where tree and hedgerows are not present. Lighting of such work spaces can also disrupt traditional foraging grounds for bats and therefore should be limited and should not occur during foraging period (30 minutes prior to sunset to 30 minutes after sunrise). *Priority Mitigation Measures for Bats – Riverstown Bridge* Riverstown bridge is the only bridge within the Scheme that has bat potential to which works will be carried out. A derogation licence has been obtained from NPWS for the works on Riverstown bridge (See **Appendix 6.4 of** the **EIAR**). The mitigation measures outlined below are those contained in the derogation licence application. • A bat specialist examines the arch prior to proposed works. If crevices are not used by bats, they are filled temporarily with bubble wrap. This will prevent the bats using the crevice during works. Once works are finished, the bubble wrap is removed allowing the bats to use the crevices post works. However, at the section where the pedestrian foot bridge meets the stone bridge, there are gaps suitable for roosting bats. There is also evidence of nesting birds. This, where possible, should remain open. • It is preferable that works are undertaken outside the main maternity season (May-July/August) and the main hibernation season (Dec/Jan – this is weather dependent). Works should be avoided during freezing conditions, where possible.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Crevices that remain open will have to be daily checked prior to filling in unless the canvas sheeting procedure as recommended below in undertaken. • Due to the number of open crevices found in Riverstown Bridge, a bat inspection of any bridge is required the night before works are due to be undertaken. In preparation for this survey, two sheets of canvas that will close the arches (post bat survey), are required to be in place (i.e. canvas sheeting to be erected from the top of the bridge and held in place. When the sheeting is unfurled, the length of it should reach the water level. The width of the sheeting should also ensure that entire opening to the 1/2 arches of the bridges (upstream and downstream) are covered to prevent bats accessing the bridge for the duration of the works. Once the bat inspection and survey determines that there are no bats within the bridge, the canvas sheets are to be released. While the canvas sheeting can be opened during the daytime to allow works to be undertaken, it is of paramount importance that each evening, the canvas sheets are released to close the arches during the night for the duration of the works under the arches. Once the works are finalised and a bat inspection is completed, the crevices blocked to be retained are unblocked and the canvas sheets removed. *Removal of Trees* • Minimise the removal of mature trees with bat roost potential, i.e. PBR trees, where possible. • If the trees are to be removed, felling should be undertaken during the months of September and October (potentially November – weather dependent), and February and March during mild weather conditions. Note: the breeding bird season is March to August inclusive. Thus, tree removal during March may only conducted if a breeding bird survey is undertaken by a suitably qualified ecologist in advance of the works. • Tree felling of PBR trees may be permitted in December and January in mild conditions (i.e. >8ºC day time temperature). This will be undertaken in consultation with the bat specialist. Planting will be required to mitigate for tree removal. Consideration should be given towards hawthorn, blackthorn mix with individual ash, alder and birch to form a native tree hedge and deciduous trees (native tree species include ash, oak, alder, birch) should be planted in public areas.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	An assessment of trees according to their PBR value determines the methodology of felling. Trees with B-value PBR have a medium suitability for roosting bats and require more intensive procedures prior to felling, for example: • Any trees showing crevices, hollows, etc., should be removed while a bat specialist is present to deal with any bats found (i.e. PBR Value A or B). Such animals should be retained in a box until dusk and released on-site. Large mature trees will be felled carefully, essentially by gradual dismantling by tree surgeons, under supervision of a bat specialist. Care will be taken when removing branches as removal of loads may cause cracks or crevices to close, crushing any animals within. These cracks should be wedged open prior to load removal. The dead branches should be lowered to the ground using ropes to avoid impacts which may injure or kill bats within. This measure refers to B-value trees. These trees should be marked with spray paint prior to felling in order for them to be felled correctly in relation to method described above. • A bat expert will survey all trees due for removal prior to construction works commencing once there is a consensus on what trees are to be removed and there is a clear access to all of the trees on-site. • Any ivy covered trees which require felling will be left to lie for 24 hours after cutting to allow any bats beneath the cover to escape (i.e. PBR Value C). *Alternative roosting sites - Bat Boxes* If trees are proposed to be felled then, a bat box scheme is required to mitigate for this. The number of bat boxes is calculated according to the number of trees to be felled and their PBR value. Bat box locations (exact trees for erection of bat boxes) should be undertaken by bat specialist prior to construction works are undertaken. • For every A-value tree to be felled – one bat box is required. • For every three B-value trees to be felled – one bat box is required. • For every five C-value trees to be felled – one bat box is required.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	As there are 1 A-value; 5 B-value and 28 C-value trees proposed to be felled, a minimum of 9 bat boxes are required to be erected to mitigate for tree felling. To mitigate for habitat loss a further 15 bat boxes are required to be erected. Therefore, a total of 24 bat boxes are required. These should be erected in John O'Callaghan Park and adjacent public land with wooded (siting should be on mature trees adjacent to the river). This type of bat box is suitable for brown long-eared bats, pipistrelles and Leisler's bat. The bat box design recommended for use is: • 'Schwegler' woodcrete bat box designs are recommended – 1FF design (flat box, self-cleaning). However, 24 bat boxes is a large number of bat boxes in public areas. Therefore, alternatively, 12 bat tubes can be inserted/attached on to flood defence walls/culverts/ structures along the river within the survey area constructed to replace 16 of the bat boxes. There are two types of bat tubes recommended and the type used will be dependent on how the tube can be inserted/attached to structures. This is a preferred option as bat tubes have proven to be good alternative roosting sites for Myotis species of bats, those typically found in wooded area and along the rivers. Therefore, a combination of bat boxes and bat tubes will cater for the entire suite of bat species recorded utilising the river system surveyed. The bat tube designs recommended for use are: • 'Schwegler' 1FR bat tubes and 'Schwegler' 1WI Summer and Winter Bat Box, which is designed for year-round occupation. The 1FR bat tube, for best results, should be used where it is inserted into the fabric of structures. The 1WI is an insulated version which is more suitable for attaching to external surfaces of structures such as flood defence walls. Therefore, this type of bat tube is recommended where it is not possible to build the standard bat tube into the fabric of a structure. There will then only be a need for 8 bats boxes which can be erected within the John O'Callaghan Park on mature trees, while the bat tubes can be inserted into walls, or attached to bridges and other suitable structures. Any wall approximately 2m or higher are suitable for the tubes.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	They are approximately the size of a concrete block with an opening to allow bats to enter into the internal space of the tube. They are built into walls with the opening at the bottom and facing out onto the waterway to allow bats to enter and exit freely over water. The exit point needs to be 1.5m above the water level to ensure that they are not flooded. Bat boxes should be erected prior to works (e.g. tree felling) while bat tubes should be inserted in walls during construction. Discussions with the bat specialist are recommended in relation to siting of bat boxes and bat tubes. The main function of bat boxes and bat tubes are to provide alternative safe roosting sites for groups of bats where natural sites become unavailable. The internal diameter of a bat box is required to be sufficient to allow bats to cluster together in numbers to retain body heat. It is important to understand the life cycle of bats and their tendency to use an array of roosting sites through the year. In summary, bats require different roost conditions for hibernation, during the sensitive time of rearing their young (maternity roost), night roosts for resting stops during night feeding and satellite roosts in between the main hibernation and maternity season. Roosting conditions also vary with each species. In general, hibernation boxes require greater insulation (wall thickness of 100 mm timber) to provide a constant temperature for bats throughout the winter to prevent bats from freezing. All other boxes, typically called summer boxes, are designed to provide secure and dry sheltered conditions. These boxes have relatively thin walls (about 20-30 mm timber) and are used by bats outside the hibernation period. These requirements mean that any Bat Box Schemes should provide suitable bat boxes to cover the general requirements of different bat species all year around. 'Woodcrete' boxes are made of a mixture of concrete, sawdust and clay moulded into to shape. They have the advantage of allowing natural respiration, stable temperature and durability. 'Woodcrete' boxes last, on average, for 25 years. To ensure that bats use the bat boxes, it is very important to site them carefully and this should be undertaken by a bat specialist. Some general points to follow include: • Straight limb trees (or telegraph pole) with no crowding branches or other obstructions for at least 3 metres above and below position of bat box. • Diameter of tree should be wide and strong enough to hold the required number of boxes.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Locate bat boxes in areas where bats are known to forage or adjacent to suitable foraging areas. Locations should be sheltered from prevailing winds. • Bat boxes should be erected at a height of 4-5 metres to reduce the potential of vandalism and predation of resident bats. • It is recommended to erect a number of bat boxes on one tree at an array of aspects. South facing boxes will receive the warmth of the sun, which is necessary for maternity colonies. In large bat box schemes, it is generally recommended to have three bat boxes arranged at the same height facing North, South-East and South-West. This ensues a range of temperatures are available all day. If the South facing boxes become warm, bats can safely remove to the cooler North facing box. Acceptance of boxes by bats is less predictable than those for birds. Therefore, it is essential to monitor their use over a period of time. Those boxes that remain unused within two years of date of erection should be re-located. Bat boxes should also be checked in wintertime for general wear and tear and to remove droppings from the previous summer use. Bat boxes should be inspected, by bat licence holder (bat specialist), at least once within 12 months of erection at appropriate season in order to monitor bat use and the species using boxes. This should be followed up with another inspection within 24 months of setting up. At this point, any bat boxes not used should be re-located to a new site. Any bats found should be counted and identified to species level. All data collected should be submitted to Bat Conservation Ireland. Bat box scheme should be registered with Bat Conservation Ireland and monitoring should be undertaken annually for 2 years. *Enhancement Work – Tree Planting* • A large array of trees is proposed to be felled as part of the flood relief works. It is therefore recommended to plant tree species in adjacent public lands to mitigate for such habitat loss. Bats utilise trees as they develop tree holes, splits etc. in reaction to the aging process or weather damage. Different tree species develop different features at different ages. Tree species such as alder and birch grow quickly and also develop suitable roosting sites for bats quickly, while slow growing tree species develop suitable roosting sites for bats at a slower rate.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	Therefore, it is recommended to plant a mix of Irish native trees species such as alder, birch, oak with undershrub layer of hawthorn, blackthorn and holly. **Fisheries** In order to mitigate identified construction and operational impacts on fisheries the following mitigation measures will be implemented: • IFI Guidance on the Protection of Fisheries During Construction Works in and adjacent to Water (IFI, 2016) should be followed and consultation with IFI will be carried out prior to works. • In-channel working will be minimised, wherever possible. Where in-channel working is unavoidable, works should be preferentially done in the dry wherever possible, through the use of temporary coffer dams and dewatering, following a fish rescue from any wetted channel area within the coffer dam. Fish rescues should be undertaken by an appropriately experienced fisheries contractor in possession of the relevant permits and consents from the regulator. • In-channel works will only occur during the in-stream working window, i.e. July – September inclusive. Extension of the July – September working window shall be in consultation with IFI. • During the construction phase it will be ensured that fish can migrate past areas of in-channel working. • Where piling is required, a presumption against the use of percussive piling should be made. Where possible, a press-in piling technique should be used, with a presumption to use vibration piling, using a variable moment vibrator, where press-in techniques are not appropriate due to ground conditions. • Any pumps used for over-pumping/de-watering must be fitted with appropriate screens. • Method statement to be drafted and approved with IFI for in-channel works relating to fitting of all non-return drainage outlets to new flood defence walls.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Hard engineering of the river bed will be avoided. • Any riverbed materials removed or disrupted as part of the works will be replaced and any areas where new bed materials will be installed (i.e. wall footings, bed armour to prevent scour), will be designed to replicate natural bed conditions. Existing bed material will be used to cover new bed materials, wherever possible. Bed material removed from the river will be stored on the bankside. The storage facility will be such that there will be no loss of sediments from the material stored and no external contamination (e.g. a bunded plastic sheet or sealed plastic container). Once excavations are complete, and any new material has been introduced, the stored material will be replaced over the bed. Once normal flows are restored after demobilisation, the replaced material will be redistributed by the currents. These measures will ensure no net loss of material and no significant changes to bed sediment morphology or composition. • Follow pollution prevention measures as detailed in section 6.8.9 of Chapter 6. • Ensure that all culverts and trash screens are designed and installed in line with published best practice on fish passage (e.g. CIRIA 2010; Armstrong et al 2010; Turnpenny& O'Keefe 2005). • Inclusion of cost effective fish passage measures at the wooden weir on the bottom end of the Springmount Stream to enable upstream migration and exploitation of habitat (albeit limited). **Non-native Invasive Species** In order to mitigate the possible spread of non-native invasive species, the mitigation measures will be implemented: • Where feasible, avoid working in areas where Japanese Knotweed is present; all areas within 7m of visible above-ground growth will be avoided and clearly demarcated. • If work is required in areas infested with Japanese Knotweed (including any area within 7m of visible above-ground growth) an appropriate Japanese Knotweed Mitigation Strategy will need to be devised and implanted to prevent spread. Refer to Appendix 4.1 of the EIAR for further details.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Prior to commencement, all works areas, site compounds and access routes will be re-surveyed to ensure that stands of non-native invasive species have not become established. If found, appropriate mitigation strategies will need to be devised and implemented. • An overall site specific Invasive Species Management Plan will be developed to address any areas that may affect the proposed scheme prior to the commencement of works. • All contractors and staff shall adhere to Biosecurity Protocols for invasive species. **Construction and Environment Management Plan** **Chapter 4** of this EIAR details the main constraints required to be contained in the Construction and Environmental Management Plan (CEMP) during the construction phase and will be included in the tender documents for the construction of the proposed scheme. • A detailed and site-specific CEMP will be prepared (**Appendix 4.2**) and it will be provided to the competent authority by the contractor prior to works commencing. This has been completed in consultation with a suitably qualified ecologist. • All works will be monitored by a suitably qualified ecologist who will report to the Heritage Officer of Cork County Council. Reporting format and programme to be agreed with Cork County Council. **Pollution Prevention Measures** Appropriate mitigation measures will be implemented prior to the construction phase to ensure that water quality of the Glashaboy River is not adversely affected through pollution incidents and silt mobilisation. This mitigation will include: • Appropriate sediment control measures will be employed.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Any chemical, fuel and oil stores will be located on an impervious base within a secured bund with a storage capacity 110% of the stored volume. • Biodegradable oils and fuels will be used where possible. • Drip trays will be placed underneath any standing machinery to prevent pollution by oil/fuel leaks. Where practicable, refuelling of vehicles and machinery will be carried out on an impermeable surface in one designated area well away from any watercourse or drainage (at least 10m). • Emergency spill kits will be available on site and staff trained in their use. • Operators will check their vehicles on a daily basis before starting work to confirm the absence of leakages. Any leakages will be reported immediately. • Daily checks will be carried out and records kept on a weekly basis and any items that have been repaired/replaced/rejected noted and recorded. • Any items of plant machinery found to be defective will be removed from site immediately or positioned in a place of safety until such time that it can be removed. All items of plant will be checked prior to use before each shift for signs of wear/damage. • All washing out of grout pumps will be carried out in designated areas away from the river, such as in the lined compound area. At no point will grout pumps be washed out at the worksite. **Tree Removal** Hedgerow/tree planting will be undertaken to address the loss of hedgerow/treeline to accommodate the new drainage scheme. Hedgerows and trees will be replanted as close to the existing alignment and location where feasible and will use native, locally sourced species appropriate to the locality.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	A number of trees require removal at Sallybrook to facilitate the construction of the new embankment. The root systems of trees within a minimum of a 2m buffer from the channel edge shall be left in-situ and shall not be removed. This area is also covered in Japanese knotweed and therefore, measures and controls must be in place to ensure that the works do not cause the spread of Japanese knotweed. See also bat mitigation above regarding tree removal.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Archaeological Architectural and Cultural Heritage		
Ground disturbance at numerous locations Potential disturbance to potentially surviving subsurface archaeological deposits. Removal of features of cultural significance	Following a comprehensive archaeological assessment carried out as part of the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme, twenty-three cultural heritage Sites (CHS) were identified. Fourteen of these sites (CHS Nos. 01, 03, 05, 06, 07, 08, 09, 10, 11, 12, 15, 21, 22 and 23) will be directly impacted by the proposed works, specific mitigation measures for these CHS are: • **CHS 01(CO 01):** Ex-situ mass of bonded brick. **Mitigation**: Record (descriptive and photographic) of this feature. Further consultation with NMS. • **CHS 03 (CO 01):** Section of revetment wall along the eastern bank of the river and part of the curtilage of Sallybrook House (NIAH 20903332) and Sallybrook Mill (CO063-069 and RPS 00390). **Mitigation:** Archaeological record (descriptive and photographic) of the sections of wall to be impacted. Licenced archaeological monitoring by an experienced underwater archaeologist. • **CHS 05** (**CO 01**): Tailrace associated with Sallybrook Mill (CO063-069 and RPS 00390).	**Imperceptible to slight effects** Slight effects where features are to be removed.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	Mitigation: Archaeological record (descriptive and photographic) of any features identified. Licenced archaeological monitoring by an experienced underwater archaeologist • **CHS 06 (CO 01):** Weir and sluice associated with Glansillagh Mill (CO063-094 and RPS 00389). **Mitigation:** Avoidance of impact to the training wall into the sluice, if possible. If avoidance is not possible, archaeological record (descriptive and photographic) of the sections of wall in advance of any impact. The proposed flood defence works will be sympathetically faced with materials similar to those existing to minimise potential negative aesthetic visual impacts. Licenced archaeological monitoring of any works in this area. • **CHS 07 (CO 08):** Headrace associated with Glansillagh Mill (CO063-094) and RPS 00389). **Mitigation:** Archaeological testing in the area of the pumping station followed by licenced archaeological monitoring by an experienced underwater archaeologist of any works in this area. • **CHS 08 (CO 01**): Revetment wall on the eastern bank of the river. **Mitigation:** Archaeological record (descriptive and photographic) of the revetment wall in advance of impact and licensed archaeological monitoring by an experienced underwater archaeologist • **CHS 09 (CO 01):** Revetment wall along the western bank of the river. **Mitigation:** Archaeological record (descriptive and photographic) of the revetment wall in advance of impact and licensed archaeological monitoring by an experienced underwater archaeologist • **CHS 10 (CO 06):** Tailrace from the flour/corn mill at Spring Hill. **Mitigation:** Archaeological record (descriptive and photographic) of any elements of the tailrace and licensed archaeological monitoring by an experienced underwater archaeologist.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• **CHS 11 (CO 01):** Intra-riverine feature immediately south of the headrace of Riverstown Mill. **Mitigation:** Avoidance if possible, if avoidance is not possible, archaeological record (descriptive and photographic) of the revetment wall in advance of any impact. The proposed flood defence works will be sympathetically faced with materials similar to those existing to minimise potential negative aesthetic visual impacts. Licensed archaeological monitoring by an experienced underwater archaeologist • **CHS 12 (CO 01):** Riverstown Bridge (CO064-111, RPS 00394, NIAH 20906415) a four-arch hump back road bridge. **Mitigation:** Licensed archaeological testing in green areas in advance of construction for all works within the ZON of Riverstown Bridge. A full archaeological survey of the bridge to be undertaken prior to any construction works. Licensed archaeological monitoring by an experienced underwater archaeologist during construction including construction of flood defence walls along the eastern and western river banks upstream of the bridge. Archaeological assessment of the proposed works on the bridge and its vicinity outlining likely impacts and proposing appropriate mitigation. This assessment will be carried out by a professional underwater archaeologist and submitted to the NMS at the DCHG for consideration. • **CHS 15 (CO 01):** Revetment wall. **Mitigation:** Archaeological record (descriptive and photographic) of the revetment wall in advance of impact and licensed archaeological monitoring by an experienced underwater archaeologist. • **CHS 21 (CO 01):** A rectangular well structure in Cois na Gleann stream **Mitigation:** Full archaeological record (descriptive and photographic) in advance of any impact and further consultation with the NMS at the DCHG prior to any works taking place.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• **CHS 22 (CO 05):** A weir and random rubble culvert in the Glenmore stream. **Mitigation**: Archaeological record (drawn, descriptive, photographic and GIS survey) of the weir and culvert prior to any works. Licenced archaeological monitoring of any works in this area thereafter. • **CHS 23 (CO 01):** A roofless, ruinous structure a short distance upstream of the Glanmire Bridge in the townland of Poulacurry South. **Mitigation:** Archaeological record (descriptive and photographic survey) of the structure prior to any works. Licenced archaeological monitoring of any works in this area thereafter. Construction work on the drainage scheme will require extensive ground disturbance in multiple locations. Some of these areas have been previously disturbed, however, *in situ* localised subsurface deposits may survive in places. • In areas where in situ subsurface deposits may be present licensed archaeological monitoring of ground works will be carried out. • In areas where intra-riverine archaeological deposits may survive licensed archaeological monitoring will be carried out by an experienced underwater archaeologist. All construction works, i.e. construction of flood defence walls along the river banks, construction and replacement of culverts; removal and replacement of bridges; construction of embankments and pumping stations; conveyance improvements (river channel widening and deepening), and localised regrading of ground levels will be subject to archaeological monitoring. A monitoring methodology will be agreed for all works carried out during construction to include licenced archaeological monitoring and metal detection of an agreed portion of materials recovered.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	The monitoring program will be reviewed and modified depending on the quantity of archaeological material recovered and will be scaled back if quantities are small. The monitoring works will be carried out under the supervision of a professional underwater archaeologist. This includes preparatory or temporary works in advance of full works, and includes the clearance of topsoil and subsoil stripping of riverbanks, green field areas, areas for works compounds, etc. Similarly, the excavation for all culverts that will impact subsurface levels beneath the existing culvert will be subject to archaeological monitoring. Any archaeological features identified during archaeological monitoring will be fully resolved to professional standards of archaeological practice. Such material will be preserved *in situ* or preserved by record, as appropriate, as outlined in Policy and Guidelines on Archaeological Excavation – Department of Arts, Heritage, Gaeltacht and the Islands.	
Population and Human Health		
Traffic disturbances Noise and vibration effects Dust generation Potential loss of cultural heritage	• See **Roads and Traffic** • See **Noise and Vibration** • See **Air Quality and Climate** • See **Archaeological Architectural and Cultural Heritage**	**Imperceptible** No significant negative residual impact predicted. Positive residual impact due to lower risk of flooding to residential, commercial properties, amenities etc.
Material Assets		
Construction phase will require potable water,	• Standard industry practice or construction works will ensure the safety of the workers and maintain the integrity and operational functions of any service, above or underground.	**Imperceptible**

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
power, fuel, materials such as steel and concrete. Generation of waste and excavated material. Potential temporary impact on services.	• Prior to construction, drainage networks, electrical cabling, gas pipelines and telecommunications infrastructure will be reported in detail and incorporated into the construction design as to be avoided where possible. • Planned diversions will be implemented after discussion with the relevant bodies and all affected persons including businesses and residents will be notified in advance of any disruptions. Contractors will be provided with all the locations of any services, including liaison with service providers and for the execution of the work so as to avoid the risk of injury to the construction personnel as well as the risk of damage to services. • Mitigation measures for impacts on roads and transport networks are discussed in **Chapter 14 Roads and Traffic** and further details of mitigation measures of construction waste can be found in **Chapter 4 Construction Activities and Chapter 11 Soils, Geology and Hydrogeology.**	No significant residual impact but there will be a residual positive impact on properties.
OPERATIONAL PHASE		
Landscape and Visual		
	The following mitigation measures are included for the post construction stage of the scheme: • Where retention of existing trees is not an option, these shall be replaced with new native species as close as possible to the original location, on the dry side of the wall. • Where shrubs and vegetation are removed, new plants of appropriate species shall be planted in replacement. • Where space permits, native hedge planting shall be planted at 0.45m centres along the dry-side of the wall where feasible. Areas where this is deemed necessary are as follows: Hazelwood, Meadowbrook and Copper Vue.	**Slight Negative** Overall the impacts on residential and public amenity are considered to be slight negative once new planting matures and screening begins to establish. Considering the scale of the project, on adhering to mitigation measures outlined, the proposed Glashaboy River Drainage Scheme will not have an appreciable impact on the

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• All trees retained in proximity of the construction works, i.e. within root protection area (RPA), shall be subject of to a post-construction tree survey in accordance with BS 5837.This survey is to be carried by the works contractor and competent Arboricultural professional. The post construction survey shall be made available to the OPW for approval and any tree works recommended shall be undertaken by the Contractor.	integrity or landscape planning aspects of the Glashaboy River corridor, with impacts reducing as existing and new planting matures. Positive impacts arise due to the reduced risk of flooding in the area
Traffic		
Potential impact during channel maintenance works	• Impacts due to channel maintenance works cannot be foreseen. A traffic management plan will be put in place where works are foreseen to cause disruption.	**Not significant**
Noise and Vibration		
Use of surface water pumps and foul pump.	• Pumps will be used during flood events.	**Imperceptible effect and temporary effect.**
Air Quality		
	No mitigation measures are deemed necessary.	**Not significant**
Climate		

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	No mitigation measures are deemed necessary.	**Not significant**
Soils, Geology, Surface Water and Groundwater		
	• The OPW may have to carry out channel maintenance activities on the river. These maintenance activities may disturb the river bank however they will only be carried out where they are deemed necessary for the integrity of the flood defences. No mitigation measures are deemed necessary other than good standard construction methods. • All OPW maintenance work is undertaken in accordance with Environmental Management Protocols and Standard Operating Procedures (OPW, 2011) along with additional measures where the SOPs show deficiencies, to ensure adverse impacts on the environment are considered and minimised. OPW drainage maintenance activities will also be subject to a separate Ecological and Appropriate Assessment process to ensure no adverse impacts arise. • Consultation will be required with the relevant stakeholders as necessary during the planning of these maintenance works including landowners, IFI, the National Monuments Service (NMS), Cork County Council (CCC) and National Parks and Wildlife Service (NPWS) to ensure that the works are carried out with minimal environmental impact	**Positive effect**
Biodiversity		
Bat Monitoring Channel Maintenance	*Monitoring* Monitoring is recommended post-construction works. This monitoring should involve the following aspects: • Inspection of bat boxes/bat tubes within one year of erection of bat box scheme and inspection of current bat box scheme. Register bat box scheme with Bat Conservation Ireland. This should be undertaken for a minimum of 2 years.	**Not significant**

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Monitoring of any bridge works. All mitigation measures should be checked by a suitably qualified ecologist to determine that they were successful. *Channel Maintenance* The following mitigation measures shall be implemented in order to inform the required and suitable assessment in order to conduct maintenance activities. The following (but not limited to) measures shall be implemented, as determined by the EcIA; • Ecological surveys, including an invasive species survey, shall be conducted in the appropriate seasons by a suitably qualified ecologist to inform the EcIA as required. • The mitigation measures resulting from the EcIA shall be implemented when carrying out channel maintenance activities. • Channel maintenance activities shall be avoided where possible downstream of Glanmire bridge. • If a derogation licence is required, e.g. otter and bats, this shall be acquired prior to the decision to progress with the channel maintenance activities. Any further mitigation measures required by the derogation licence shall also be implemented during the channel maintenance activities. • Channel maintenance shall be carried out as much as possible from the river bank without in-stream tracking. • In-stream works shall be avoided where possible. If in-stream works are unavoidable, these shall be conducted during July-September inclusive. Extension of this in-stream working window shall be in consultation with IFI. • Tree removal shall be limited to the removal of fallen trees or overhanging branches, unless identified as dead of diseased trees that are a risk of blockage. Tree roots shall not be removed from the river bank. • Channel maintenance activities shall be carried out in accordance with, but not limited to, the following guidance where appropriate and applicable;	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	○ Environmental Management Protocols and Standard Operating Procedures (OPW, 2011) ○ CIRIA Guidance C741: Environmental good practice on site guide (Charles & Edwards, 2015), ○ NetRegs Guidance for Pollution Prevention for works and maintenance in or near water (NetRegs, 2017), ○ Inland Fisheries Ireland Guidance on Protection of Fisheries During Construction Works In and Adjacent to Waters (IFI, 2016), ○ Inland Fisheries Ireland biosecurity protocols (IFI, 2010). ○ If maintenance activities are required, which fall outside the scope and nature of maintenance activities described in Chapter 4, those maintenance activities will be subject to a separate Appropriate Assessment process to ensure no adverse impacts arise to Natura 2000 sites.	
Archaeological, Architectural and Cultural Heritage		
Disturbance due to channel maintenance activities	Under Section 37 of the Arterial Drainage Act 1945, the Office of Public Works (OPW) is statutorily obliged to maintain all rivers, embankments and urban flood defences on which it has executed works since the 1945 Act in "*proper repair and effective condition*". Channel and embankment maintenance operations can encompass a variety of activities, including silt and vegetation management, aquatic vegetation cutting, bank protection, bush cutting/branch trimming, tree cutting, mulching, mowing and structure maintenance (Ryan Hanley, 2014). All riverine maintenance work and riverbank works will be carried out in consultation with the NMS. Where required, a monitoring methodology will be agreed for channel maintenance works to include, as appropriate licenced archaeological monitoring and or metal detection of an agreed portion of materials recovered.	**Not significant and temporary**

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Population and Human Health		
Improved resilience of the local area to flood events	• Reduced flooding of residential areas, businesses.	**Positive effect**
Material Assets		
	• No mitigation measures are necessary.	**Imperceptible effect**