17 Summary of Impacts and Mitigation Measures

17.1 Introduction

Cork County Council intend to ensure that any potential adverse effects of the proposed scheme 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 scheme. The predicted impacts and recommended mitigation measures are comprehensively detailed in the relevant chapters of the EIS, 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		
General		
	Every effort will be made to ensure that any significant environmental effects will be avoided, prevented or reduced during the construction phase of this scheme. • A construction environmental management plan (CEMP) will be prepared by the Contractor prior to construction commencing. The CEMP will comprise all of the construction mitigation measures, which are set out in this EIS, and any additional measures which are required by the conditions attached to the statutory consent issued by An Bord Pleanála. The main aspects of the CEMP are outlined below. Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum. • The CEMP will have 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 CEMP will be developed in accordance with industry best practice and will be effective for the duration of the construction works. • Cork County Council 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 works are carried out in accordance with industry best practice 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.	**Slight to moderate short-term residual effect**
Generation of Waste		

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
• Construction waste • Excavated material	• 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. • Excavated material will be reused on site where possible and all efforts will be made to keep the volume of material removed from site to a minimum. • A construction and demolition waste management plan will be developed and maintained by the main contractor prior to construction works commencing on site. The Plan will meet the requirements of the DoEHLG Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects. • Hazardous waste generation will be minimised, and such waste will be recovered where feasible, and only disposed of if recovery is not feasible. • The management of hazardous waste will be in line with the National Hazardous Waste Management Plan (2014-2020) and managed in accordance the Waste Management Act 1996 as amended and other relevant legislation.	**Not significant**
Site Tidiness		
• Untidy site	The following are some of the measures that will be taken to ensure that the site and surroundings are maintained to a high standard of cleanliness: • Daily site inspections will be undertaken to monitor site tidiness. • A regular programme of site tidying will be established to ensure a safe and orderly site. • Scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind. • Food waste will be strictly controlled on all parts of the site. • Mud spillages on roads and footpaths outside the site will be cleaned regularly and will not be allowed to accumulate. • Wheel-wash facilities will be provided for vehicles exiting the site.	**Imperceptible residual effect** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• 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.	
Visual Impact		
• Construction establishment will require temporary fencing, signage, temporary site entrances • Erection of signage • Temporary office and welfare facilities • Cranes or other tall site machinery on-site • 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 • Impact on public realm and residential amenity from the localised noise, dust, vibration, access restrictions and visual disturbance associated with the construction works	**General:** • Where concrete is exposed, careful consideration of the design finish will be ensured so as to be sympathetic with the receiving environment. • 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. • Retention of existing trees where possible in the interest of residential amenity, public realm and visual character of the river amenity. Remaining trees will be protected and a tree replanting scheme will be devised. Where retention of existing trees is not an option, these shall be replaced with new trees as close as possible to the original location in the interest of public realm and visual character of the river amenity. • 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. Ballybrack stream). 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. **Specific:** • Location of the proposed flood walls along the line of an existing wall on river bank at St Patrick's Mills in the interest of minimising intrusion on the existing landscape character. • Finish of new wall on dry side at St. Patrick's Mills to be sympathetic to historical character of the built fabric.	**Slight to moderate residual effects** Significant short-term visual effects during the construction phase but these will be reduced to slight to moderate residual effects over time following the implementation of control and mitigation measures.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Finish of new wall on both sides to be sympathetic to character of river amenity and existing boundaries along Ballybrack Stream. • Tree removal at entrance area to Ballybrack Woods and within Douglas Community Park to be compensated with newly planted trees along the banks specifically within these areas.	
Traffic		
• Increase in traffic due to construction activities in the form of HGVs, and workforce and general site traffic • Temporary traffic restrictions	**Mitigation Measures for Construction Related Traffic:** • 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. • 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. • The construction of the replacement local access bridge at Ravensdale 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. The length of the bridge replacement works will also be kept to a minimum to ensure disruption to residents will be minimised. • 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.	**Slight residual effect** Temporary and short term impact on local traffic volumes. Temporary and short term impact on local traffic movement.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• 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 Traffic and Transport Infrastructure 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. • 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 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.	
Noise and Vibration		

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Principal sources of noise: • Earthworks plant and equipment • Construction plant and equipment • Construction traffic	• The construction contractor will be required to manage noise and vibration aspects of the project in accordance with BS 5228 Part 1 (2009) and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001 Code of Practice for Noise and Vibration Control on Construction and Open Sites. This document provides for practical measures that limit the hours in which noisy activities are permitted, provision of acoustic screening for noisy activities, use of silencers on equipment, siting of noisy mobile equipment away from sensitive receptors, and the provision of relevant training with respect to minimising noise disturbance. It is recommended that the contractor liaises with residents of nearby dwellings in advance of works to assist in managing expectations with regard to length and duration of works, to minimise upset and aggravation. • It is expected that works in the distinct zones will be confined to very short periods of time, with a predicted maximum of several months. This will minimise the length of time that receptors are exposed to noise and vibration emissions. Noise emissions will comply with daytime noise limits (65dB LAeq 1h). The following measures will also be employed by the Main Contractor(s): • 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 • A site representative shall be appointed to be responsible for matters relating to noise and vibration. • Unnecessary revving of engines shall be avoided and equipment shall be switched off when not required; • Internal haul routes shall be well maintained and shall avoid steep gradients; • Rubber linings shall be used in chutes and dumpers etc. to reduce noise impact; • Drop heights of materials shall be minimised; • Plant and vehicles shall be started sequentially rather than all together. • Construction plant and activities to be employed on site shall be reviewed to ensure that they are the quietest available for the required purpose; • Where required, improved sound reduction methods, e.g. enclosures shall be used; • Site equipment shall be located away from noise sensitive areas, as much as is feasible;	**Slight residual effect** A preliminary noise assessment of the construction phase impacts has shown that compliance with limit values can be achieved. No significant residual impacts are predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• Regular and effective maintenance by trained personnel shall be carried out to reduce noise and/or vibration from plant and machinery; • 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. • A 2.4m hoarding will be provided around the construction works area where possible. However if this is not suitable for the construction of embankments, the use of pressed-in sheet piling where possible will avoid vibration nuisance. Screens will be positioned as close as possible to either the source or the receptor. The screen will ensure that there is no direct line of sight between the source and the receptor. The site layout will be considered as this can also contribute to noise screening - the position of storage, offices, or other elements of the construction compound can also provide a degree of noise screening if placed between source and receptor; • Site activities shall be limited to 8am - 7pm, Monday to Friday; and 9am - 4pm, Saturday (It may be necessary in exceptional circumstances to undertake certain types of activities outside of normal construction core working hours. Any such working hours outside the normal construction core working hours will be agreed with Cork County Council. The planning of such works will have regard to nearby sensitive receptors; • The Main Contractor(s) shall be required to carry out continuous noise and vibration monitoring in areas where residential properties are directly adjacent to the works. These levels will be compared to the limit values outlined in Table 9.2 and Table 9.3 in Chapter 9 of the EIS. If exceedances are recorded, alternative construction methodologies will be proposed to ensure limits are complied with.	
Air Emissions		

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
• 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	A Dust Minimisation Plan will be formulated for the construction phase of the project. The focus of the control procedures will be to reduce the generation of airborne material. The following measures will be implemented as part of the dust minimisation plan: • 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 • Dust monitoring will be carried out at the site boundary throughout the construction phase. • Control of vehicle speeds and speed restrictions; and • Sweeping of hard surface roads. In addition, the following measures will be implemented for the proposed scheme: • A 2.4m hoarding will be provided around the site works to minimise the dispersion of dust from the working areas; • Generators will be located away from sensitive receptors. • Stockpiles will be located as far as possible from sensitive receptors and covered and/or dampened during dry weather. • Employee awareness is also a most important way that dust may be controlled on any site. Staff training and the management of operations will ensure that all dust suppression methods are implemented and continuously inspected. • Dust monitoring will be undertaken at the site boundary throughout the construction phase. The TA Luft dust deposition limit values of 350 mg/m2/day (averaged over one year) will be applied as a 30-day average.	**Slight residual effect** No significant residual impact predicted.
Climate		

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
• 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 effect** No significant impact on climate predicted.
Soils, Geology and Hydrogeology		
• Potential impact on soil and groundwater from leaks or spills from fuel, etc. • Excavation of soil for flood defence structures (wall foundations, embankments, culverts, etc.) • Soil containing Japanese knotweed will be disturbed	As discussed in Section 11.4.15 of the EIS, standard good construction management practices will be employed as part of the construction phase of this scheme which include the implementation of a CEMP which will serve to minimise the risk of pollution of soils (and groundwater) during construction. These will be implemented by the contractor. These measures have been described in detail in Section 4.6.2 in Chapter 4 Construction Activities and specific measures are outlined below: • Designated fuel storage facilities, 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 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;	**Not significant** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• To minimise any impact on the underlying subsurface strata from material spillages all oils, solvents and paints used during construction will be stored within temporary bunded areas. The design (volume and construction) of all bunds will conform to standard bunding specifications. • Spill kits / absorbent pads and boom should be used in the event of a spillage. • Spill kits will be retained on site, in particular at refuelling areas and other high risk areas, to ensure that any spillages or leakages are dealt with immediately. • All dispensing of fuels and hazardous materials will occur over areas of concrete hardstanding or other impermeable surface with drainage directed to an oil / water interceptor or a suitably constructed bund. No refuelling will be permitted in or near soil or rock cuttings. • All associated waste residuals will also be stored within temporary bunded storage areas prior to removal by an appropriate waste disposal contractor for off-site treatment/recycling/disposal.	
Hydrology		
• Potential impact on surface water during heavy precipitation from stormwater runoff which could contain silt, or oils from plant and vehicles • Potential temporary impact on the risk of fluvial flooding from the Tramore River, Ballybrack Stream and Grange Stream and pluvial flooding in Douglas and Togher	The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off, seawater or groundwater. The Construction Industry Research and Information Association (CIRIA) in the UK has issued a guidance note on the control and management of water pollution from construction sites, Control of Water Pollution from Construction Sites, guidance for consultants and contractors (Masters-Williams et al 2001). Additional guidance is provided in the CIRIA technical guidance on Control of Water Pollution from Linear Construction Projects (Murnane et al 2006). Measures, as recommended in the guidance above, that will be implemented to minimise the risk of spills and contamination of soils and waters, include: • Training of site managers, foremen and workforce, including all subcontractors, in pollution risks and preventative measures, • Careful consideration will be given to the location of any fuel storage facilities. These will be designed in accordance with guidelines produced by CIRIA, and will be fully bunded. • Vehicles will not be left unattended during refuelling.	**Negligible** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• 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. • Adequately size spill kits will be provided. • Collection systems will be used to prevent any contaminated drainage entering surface and groundwater. • Silt curtains will be installed within the works area during in-stream works. These silt curtains must be effectively installed and must be monitored and maintained during works to ensure they are operating effectively. • Ensure that all staff are trained and follow vehicle cleaning procedures. Wash down from machinery and in particular concrete trucks must be prevented from entering watercourses. Wash-down should take place well away from the river or in the site compound area provided a sedimentation area is provided. • Construction works, especially works that involve the pouring of concrete must be conducted under dry conditions. • Any stripping of areas of topsoil is to be avoided unless absolutely necessary and if unavoidable, the areas concerned are to be kept to a minimum. • Where temporary stockpiling of topsoil or riverbed material is required, the material should be stockpiled in areas which are not liable to flood and where the risk to water quality is minimised. Geotextile should be used to cover stockpiles to prevent erosion. • Weather forecasts will be checked daily to allow appropriate measures to be taken to mitigate against any negative impact resulting from heavy rainfall. • Works will be carried out in line with the specifications of detailed method statements. • The works will be supervised by a suitably qualified ecologist who will ensure that adequate mitigation is being implemented and who can advise on changes to same where required.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• 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 precautionary 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; • 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 trucks 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. • Biodegradable oils and fuels will be used where possible. • The potential pollution of surface water will be mitigated through the development of containment measures and emergency procedures to deal with accidental spillages in the CEMP. • Drip trays will be placed underneath any standing machinery to prevent pollution by oil/fuel leaks. Where it is necessary to refuel machinery on site this will be done in a carefully managed manner at a minimum distance of 25m away from watercourses.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• An emergency plan to deal with accidental spillages will be drafted and kept on site during the construction period. The pollution control methods will be outlined within the CEMP. • Emergency spill kits will be available on site and staff will be trained in their use. • 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. • Process water used during construction will be disposed of appropriately • 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. • 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.	
Biodiversity		
• Temporary physical damage to habitats within the construction footprint or access routes • Changes in the hydrological regime • Changes in water quality and pollution • Disturbances to sensitive species such as birds, otters and bats • Disturbance to fisheries	**Habitats and Flora** • To prevent incidental damage by machinery or by the deposition of spoil during the site clearance stage, any trees earmarked for retention will be securely fenced early in the construction phase. A tree survey has been carried out for the site which specifies which trees should be retained where it is feasible to do so (See Appendix 6.4). All of the trees which can be retained will be clearly marked with hazard tape and the contractor should be made aware of the necessity of protecting the root structure from machinery damage. • Inadvertent damage to river banks on the margins of the works area or damage to vegetation can destabilise river banks and result in long term erosion and siltation. It is important therefore that the works area is adequately fenced and that works are confined to the works area. Access routes will also be clearly defined.	**Not significant** No significant residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
• Invasive plant species in works areas • Channel maintenance activities	**Invasive Plant Species (Japanese Knotweed)** • Where feasible, works will be avoided in areas infested with Japanese knotweed. • The treatment programme will be continued via two treatments in 2017. This will be carried out by a suitably qualified contractor and in line with the provisions of the relevant guidelines. • It is noted that it is not possible to accurately predict the success of the spraying programme in advance. Whilst the spraying programme will result in considerable die off of the plant it may not be entirely eradicated. The root can stay dormant in the soil for long periods and when exposed to light, air and water can start to regrow. Therefore, the entire works area will be resurveyed immediately prior to the commencement of works. The mitigation measures outlined below can then be incorporated into a specific invasive species management plan based on the most up to date information prior to the commencement of treatment. Further details on the management of non-native invasive species are also provided in **Appendix 4.1** of this EIS. • The management plan will make reference to and use of relevant guidelines including Best Practice Management Guidelines - Invasive Species Ireland (Maguire et al. 2008), NRA (2010), Best Practice Management Guidelines Japanese knotweed Fallopia japonica (2008) prepared for NIEA and NPWS as part of Invasive Species Ireland. Appropriate methods are also outlined in Irish Water guidelines (Irish Water Report Information and Guidance Document on Japanese Knotweed Asset Strategy and Sustainability). The management plan will take account of a range of factors including the timeframe in which the work needs to be completed, structural or environmental/ecological features (e.g. watercourses, treelines nesting birds), designated sites, availability of storage areas for contaminated spoil on or off site, access issues and agreement with landowners, seasonal restrictions to work and financial constraints. • To minimise risks in the longer term, a monitoring programme will be put in place for three years following the completion of site works. Where Japanese Knotweed re-emerges within the works area an in-situ herbicide treatment programme will be implemented. Whilst the exact detail to be provided in the management plan can only be specified following repeat surveys prior to construction, the following information/measures will be provided in the management plan: • Any areas of Japanese Knotweed identified by the survey prior to construction will be marked to within 7m of each individual stand or plant using hazard tape. It is imperative that Japanese Knotweed does not damage	

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	flood defences in the future and a root barrier should be put in place for all site works along the Ballybrack Stream. • A supervising ecologist will be present on site, during any works within 7m of a Japanese Knotweed plant to identify pieces of Japanese Knotweed fragments and to determine the volume of spoil to be removed if this is required. Fine nets/silt curtains will be specifically employed downstream of works within areas contaminated with Japanese Knotweed. The purpose of the curtains to catch fragments of Japanese Knotweed dislodged by the site works. The supervising ecologist will regularly inspect the nets, remove fragments where possible or determine when the nets should be replaced. • Methods for treatment of Japanese Knotweed and treatment of contaminated spoil will be specified if required. It is noted that some treatment methods may require an offsite area where Japanese Knotweed can be buried and or bunded. Site selection must take into account environmental/ecological sensitivities and site appropriate mitigation measures will be specified in the management plan. Possible treatment options, if required, include the following: Herbicide treatment; Combined treatment methods; Excavation and Burial; Excavation and Bund Method; Excavation and Root Barrier Cell Method; Removal of contaminated soil to landfill. • It is noted that if Japanese Knotweed has been treated with a persistent herbicide, the excavated material may to be classified as hazardous waste and may need a Waste Permit if it is removed off site. Furthermore, if Japanese knotweed contaminated material is removed off site it will require a licence from the National Parks and Wildlife Service in advance of any removal, in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477). Appropriate site hygiene protocols will be deployed throughout the process. This will include the following: • Only vehicles required for the works within the contaminated works area should be brought on site and the number of visits minimised as much as practicable. Vehicle movements within this area should be kept a minimum • A specialised wash down area will be created for machinery and footwear. All machinery and equipment (including footwear) should be power washed prior to leaving the contaminated works area within this wash down area They should also be visually checked for clods of soil, bits of vegetation etc. and particular care is required with tracked machinery. This wash down area will be located in close proximity to existing stands and the wash down area will be included in the post-works treatment programme for Japanese Knotweed.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	Ideally works including site investigation works should be undertaken in dry weather to minimise the potential for dispersal of fragments of invasive species. • The areas where contaminated soil is to be stockpiled will be clearly marked out on site. Unauthorised access to these areas will be prevented. Any trucks used to transport contaminated spoil offsite must be sealed so that no fragments of material can escape on route. Vehicles leaving the site will be inspected for any plant material and washed down into a contained wash down area. • To prevent Japanese Knotweed from outside the site being inadvertently being brought in to the site, the contractor will inspect vehicles before usage on site. Particular attention is required for vehicles with caterpillar tracks. The supplier of fill will be required to provide a guarantee that imported material does not contain Japanese Knotweed. In addition, the fill will be inspected for signs of knotweed, prior to importation to site. The UK Environmental Agency's publication Managing Japanese knotweed on development sites - The Knotweed Code of Practice (EA 2013), states that inspection of topsoil brought into the site, should be carried out using the guidance in Appendix I-IV of the code BS 3882:2007 'The British Standard Specification for topsoil and requirements for use'. This Standard was replaced subsequently by BS3882:2015 Specification for Topsoil. The inspection of fill will be carried out according to this Standard **Birds** • Vegetation will be removed outside of the breeding season, when possible. NRA guidelines on the protection of trees and hedges prior to and during construction will be followed. • If works are required within the bird nesting season a survey for nesting birds including dipper, grey wagtail and in particular kingfisher will be carried out. Specific mitigation measures as specified by the supervising ecologist will be implemented where nests are discovered. • An existing dipper box will be removed by the proposed works. A replacement next box will be provided in the finished development. **Otter**	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• No otter signs or holts were noted within 150m of the proposed works. However, otters do occur along the watercourses impacted by the works. A detailed pre-construction survey will confirm the absence of otter holts within 150m of the proposed works area. • Any holts found to be present will be subject to monitoring and mitigation as set out in the NRA *Guidelines for the Treatment of Otter prior to the Construction of National Road Schemes (2006b).* If found to be inactive, exclusion of holts may be carried out during any season. No wheeled or tracked vehicles (of any kind) will be used within 20m of active, but non-breeding, otter holts. Light work, such as digging by hand or scrub clearance will also not take place within 15m of such holts, except under licence. The prohibited working area associated with otter holts will be fenced and appropriate signage erected. Where breeding females and cubs are present no evacuation procedures of any kind will be undertaken until after the otters have left the holt, as determined by a specialist ecologist. Breeding may take place at any season, so activity at a holt must be adjudged on a case by case basis. The exclusion process, if required, involves the installation of one-way gates on the entrances to the holt and a monitoring period of 21 days to ensure the otters have left the holt prior to removal. • As there is evidence that otters move between the Ballybrack Stream and the estuary the works must allow free passage of otters through the works area on the Ballybrack Stream in Douglas. This should be implemented under ecological supervision. • Following completion there must be no impediments to the movement of otters through the affected area on the Ballybrack Stream. **Bats** • Removal of mature trees will be kept to a minimum. Prior to felling mature trees will be checked for bats by the supervising bat expert to ensure impacts on same are minimised. • Trees will be removed where possible during the September/October period. Any ivy covered trees will be left to lie on the ground for 24 hours after cutting to allow any bats to escape. • Excess lighting can impact on bat feeding behaviour. Ideally lights shouldn't be used from dusk to dawn; if lighting is required it should be kept to the minimum necessary and will focus away from adjoining habitats such as treelines which may be used by feeding bats. Following completion of works any new lighting in proximity to watercourses should be cowled and faced away from the water.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• It is noted that any works interfering with bats and especially their roosts, including for instance, the installation of lighting in the vicinity of the latter, may only be carried out under a licence to derogate from Regulation 23 of the Habitats Regulations 1997, (which transposed the EU Habitats Directive into Irish law) issued by NPWS. • There will be replacement planting of trees along sections of the scheme where there is the capacity. Along the Ballybrack Stream, replanting will take place in Douglas Community Park and between the ICA Hall and the Church Road culvert. Replacement planting of trees along will help to maintain thus watercourse as a linear feature which can be used by commuting and feeing bats. • As a mitigation/enhancement measure, four bat boxes will be installed under the guidance of the supervising ecologist. **Fish** The works will incorporate the relevant elements of the guidelines outlined below: • Murphy, D. (2004) *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.* • IFI (2016) *Guidelines on protection of fisheries during construction Works in and adjacent to waters (IFI, 2016)* • Inland fisheries Ireland Biosecurity Protocol for Field Survey Work. (2011) Mitigation will include the following: • Detailed method statements will be prepared by the contractor in consultation with the supervising ecologist. • Stone slabs (circa 600mm square x 100mm deep) will be tightly packed to form the base of concrete u-channels in the Ballybrack Stream. This will provide a mixed substrate and will diversify flow patterns in areas where gravel would be scoured out by flood events. • A low flow channel will be established in the area to be widened and deepened within the Ballybrack Stream. This prevents the river from becoming too shallow during periods of low flow.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• A natural substrate will be provided within any sections of watercourses impacted by in-stream works where it is feasible to do so. Re-use of the original gravels from the affected watercourse, which can be stored for reuse, is preferred. In any event the gravel used should be similar in size and chemical composition. Large rocks will be incorporated into the river bed to create greater heterogeneity within the channel. • To maintain the gradient and prevent excessive scouring of the river bed the invert of the proposed culvert at Church Road will be buried between 300mm and 500mm in depth. Large rocks will be incorporated into scour protection at the upstream face of the Church Road culvert and concrete u-channels. • Rock armour will be placed in front of gabions in the lower section of the Douglas Community Park. Varying the line of rock armour will provide staggered deflectors within the channel. Rock armour will also be utilised upstream of the Donnybrook Commercial Centre. • In-stream works will be carried out in the period from May to September (inclusive). This restriction does not apply to tidal waters on the Tramore River. • The new trash screen in woodland upstream of Douglas will allow fish movement. • An electrofishing salvage operation to remove fish from areas affected by direct works will be carried out under section 14 licence as issued by the Department of Communications, Energy and Natural Resources. Fish will be removed to suitable habitat within the same watercourse/catchment. After the works are complete natural re-colonisation of recreated habitat is predicted to occur. • In-stream works and fish salvage operation will follow the Inland fisheries Ireland Biosecurity Protocol for Field Survey Work (2011) to ensure no negative impacts are caused to other watercourses. • Appropriately sized screens will be used where pumps are utilised.	
Archaeological Architectural and Cultural Heritage		
• Ground disturbance at numerous locations	Construction work on the proposed development site will require extensive ground disturbance in a number of locations. Some of these areas have been previously disturbed. However, in situ localised sub-surface deposits may survive in places. Archaeological monitoring of ground works will be carried out at a number of locations including:	**Imperceptible effect** No significant impact on features predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
• Potential disturbance to potentially surviving subsurface archaeological deposits • Removal of features of cultural significance	• Ballybrack Stream, Douglas townland, in Douglas Community Park • Ballybrack Stream in Ardarrig and Ballybrack townlands, Ravensdale, Douglas • Tramore River at Doughcloyne and Lehenagh More townlands, Leheneghmore Industrial Estate • Tramore River at Doughcloyne and Lehenagh More townlands upstream of Togher Road Roundabout, Togher Intermittent archaeological monitoring/inspections of subsurface disturbance will be carried out in the following areas: • Grange Stream in Grange and Castletreasure townlands in Donnybrook Commercial Park, Douglas • Tramore River at St Patrick's Woollen Mills/ Douglas Mills in Grange townland • 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. • Two structures included in the RPS in Cork County Development Plan (2014) are in proximity to the proposed works; St Patrick's Woollen Mills which is included twice in the RPS, listed as St Patrick's Woollen Mills (RPS 01243) and Douglas Woollen Mills (RPS 00482) and millhouses associated with the milling complex at Donnybrook Commercial Park (RPS 00566). • All construction works will be securely fenced off and separated by a buffer zone from the Protected Structures. Intermittent archaeological monitoring and inspection of the buildings will be undertaken. • A number of buildings included in the NIAH are in proximity to the proposed works. In Douglas a number of these are adjacent to the works areas; a terrace of eight houses (NIAH 20871033) near Tramore River at Douglas Mills/St Patrick's Woollen Mills and the former water mill (20908622), associated store or warehouse (20908628) and office (20908629) associated with the milling complex at Donnybrook Commercial Park. • In Togher one of these is adjacent to the works areas; a single-storey house (NIAH 20870009) near Tramore River upstream of Togher Road Roundabout, Togher. Archaeological monitoring and inspection of the buildings will be undertaken.	

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
Population and Human Beings		
• Traffic disturbances • Nosie and vibration effects • Dust generation • Visual impacts • Potential loss of cultural heritage • Temporary amenity loss	• See **Roads and Traffic** • See **Nosie and Vibration** • See **Air Emissions** • See **Visual Impact** • See **Archaeological, Architectural and Cultural Heritage** • Works will be designed to minimise impacts on local amenity during the construction period. A construction environmental management plan (CEMP) will be implemented to reduce the impact of construction works. Refer to Chapter 4 Construction Activities for further information. • In order to ensure the greatest possible access to the Douglas Community Park during works, the entrances at Church Road and Church Street will remain open. The footprint of the works will be kept to the minimum. • This will minimise impacts on the amenities in the Community Park, ensuring that the cycle track/walkway that runs through the Park, as well as the multi-use games area, Community Centre and playground will remain accessible to the public for the duration of the works. Part of the adult exercise equipment will need to be dismantled during the construction works period. The pedestrian/cyclist routes will be temporarily diverted but access will be maintained at all times. • The duration of works at the Lower Ravensdale Bridge will be limited to a number of weeks to minimise the impact on residents of the area who will have no vehicular access to their properties during the works. Alternative secure parking for cars will be arranged in agreement with the residents affected, while pedestrian access will be maintained throughout the construction period via a temporary pedestrian bridge or similar • The boundary walls/fences, vegetation and trees in the areas of the proposed works (particularly in Area 1 and generally parallel with watercourses) that will be temporarily removed to facilitate construction access will be reinstated on completion of the works in agreement with the Council and landowners. Landscaping and replanting will also be carried out on completion in agreement with the Council and landowners.	**Imperceptible effect** No significant negative residual impact predicted.

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• A traffic management plan will be implemented to minimise disruptions to traffic. Refer to Chapter 14 Roads and Traffic for further details. Traffic restrictions will be limited in time and to ensure that impacts are only felt for the shortest possible period of time. The period of works will also account for "high season" and busy periods, e.g. Christmas. • Access to tourist amenities such as shops, restaurants and public houses will be maintained throughout the construction stage to ensure minimal impact on tourism. • Noise disturbance and emissions to air will also be minimised. Best practice measures for noise control will be adhered to during construction. Refer to Chapter 9 Noise and Vibration of the EIS for further detail of noise mitigation measures. A dust minimisation plan will be prepared and implemented by the contractor during construction. Refer to Chapter 10 Air Quality and Climate of the EIS for further detail of the mitigation measures to be implemented as part of the dust minimisation plan. • With regard to liaison, the Main Contractor will be required to prepare a Community Liaison Plan, which will include details of how the local community, road users and affected residents will be notified in advance of the scheduling of major works, any temporary traffic diversions and the progress of the construction works.	
Material Assets		
• Impacts on local settlement, road and transport networks, commercial and industrial development. • Construction phase will require potable water, power, fuel and materials such as steel and concrete	• The impact of the scheme during the construction stage has been carefully considered in the design of the defences. Vehicular and pedestrian access to all properties will be maintained throughout the construction of the scheme. • In Douglas Community Park, the proposed works are limited to the area in the vicinity of the Ballybrack Stream. This will require the closure of the walkway closes to the stream but the existing footpath / cycle track running through the centre of the park will be open throughout the construction period. The outdoor exercise equipment impacted by the scheme will be reinstated / relocated on completion of the works. • In Ravensdale, it is proposed to use precast concrete U channels in areas where space is restricted. This will minimise the land required in the gardens of the existing properties to construct the works. • Refer to Traffic section for details on mitigation measures for traffic.	**Not significant and short-term impact**

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• In Lehenaghmore Industrial Estate, the horizontal and vertical alignment of the culvert has been designed to minimise the construction impacts. Also, it is proposed to construct the new trash screen adjacent to the existing river channel to minimise the impact on the river itself and the industrial estate circulatory road. • At St Patricks Mills the construction methodology chosen for the flood defence wall will minimise the time taken to complete the works and therefore, minimise the impact on the car park adjacent to the Tramore River. • In Donnybrook Commercial Centre, a temporary access to Donnybrook Hill will be constructed to maintain access to the properties in the eastern part of the development during the construction of the new culvert. • Standard industry practice for construction works will ensure the safety of the workers and maintain the integrity and operational functions of any service, above or underground. Prior to construction, drainage networks, electrical cabling, gas pipelines, and telecommunications infrastructure will be reported in detail and incorporated into the detailed design of the scheme to avoid any clashes where possible. All diversions will be designed and constructed in accordance with the requirements and under the supervision of the relevant utility provider. Businesses and residents will be notified in advance of any disruptions. Contractors will be provided with all the locations of any services. • Standard mitigation measures for dealing with waste arising will be employed, including the implementation of a CEMP	
OPERATIONAL PHASE		
Visual Impact		
• Visual impact • Impact on landscape character of the local area	• Climbing plants, (e.g. Ivy and Honeysuckle) shall be planted along new walls where possible to reduce the visual impact on the character of the river corridor. • Where trees are removed, new trees of appropriate species (e.g. Alder, Birch) shall be planted in replacement as close as possible to original location (it is noted that replanting potential is restricted at Ravensdale). Where shrubs and vegetation are removed, new plants of appropriate species shall be planted in replacement.	**Slight to moderate negative residual effects** Following the implementation of mitigation measures, impacts on the overall landscape character and visual appearance of the study area will be reduced to slight to moderate negative for the most part,

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• All trees retained in proximity (i.e. within root protection area (RPA) as per BS 5837) shall be subject to a detailed post-construction tree survey carried out by a qualified arborista. Any works recommended shall be undertaken and the survey shall be made available to the Client. • The following planting and species are advised where trees and shrubs are removed in order to avoid any significant negative impacts as a result of their removal: River edge: • Alder (Alnus glutinosa), 18-20cm girth, root balled at 4m centres. • Hawthorn hedge (Crataegus monogyna), 0.9-1.2m high, bare-root, planted at 0.45m centres, double row staggered. Landscape areas in park/verges: • Birch (Betula pendula), 18-20cm girth, root balled at 4m centres. • Maple (Acer platanoides 'Columnare' and Cultivars, 18-20cm girth, root balled at 5m centres.	particularly as existing and new planting matures. **Moderate to Significant positive effects** Moderate to Significant positive impacts will also arise due to the enhancement of the visual environment and public realm, the enhancement of public and residential amenity, the enhancement of recreational aspects and the protection of historical townscapes and structures from flooding.
Traffic		
• Potential impact during channel maintenance works	• No mitigation measures are deemed necessary as channel maintenance will be an infrequent maintenance item, and will comprise negligible traffic flows.	**Not significant**
Noise and Vibration, Air Emissions, Climate, Soils, Geology, Surface Water and Groundwater		
	• No mitigation measures are deemed necessary.	**Not significant**
Archaeological, Architectural and Cultural Heritage		

Source / Scale of Effect	Control and Mitigation	Residual Impacts, Significance Level, Environmental Consequence
	• No mitigation measures are deemed necessary.	**Not significant and temporary** Positive impact on archaeological, architectural and cultural heritage features due to the significantly reduced risk of flooding impacting these features.
Population and Human Beings and Material Assets		
• Improved resilience of the local area to flood events	• Maintenance works may be undertaken at various intervals post-construction in order to ensure that blockages (e.g. fallen trees) within the watercourses are not impacting on conveyance or to repair structural elements of the drainage scheme such as flood walls, culverts etc. • Mitigation measures during the operational phase will relate primarily to the proposed maintenance works, and will broadly reflect those employed for the construction phase but on a much smaller scale.	**Positive effect** Positive residual impact due to lower risk of flooding to residential, commercial properties, amenities etc.