

1.0 CONTEXT

This Environmental Impact Statement has been prepared by McGill Planning Ltd. in association with O'Connor Sutton Cronin Consulting Engineers on behalf of Bray Town Council for a flood alleviation scheme for the River Dargle through Bray.

The process for the Environmental Assessment the Flood Defence Scheme, as per the OPW Guidelines (Flood Risk Assessment and Management Study) was divided into three stages, as follows:

- Stage I - Constraints Study
- Stage II - Option Appraisal Study
- Stage III - Environmental Impact Assessment

Stage I involved the preparation of a Constraints Report, which identified the key environmental issues associated with a Flood Defence Scheme within the Study Area. Having identified the environmental constraints in Stage I, the Design Team progressed with the development of viable flood risk management measures and options. Stage III involved the undertaking of an Environmental Impact Assessment on the selected Flood Defence Scheme and the production of an Environmental Impact Statement.

In order to achieve the required defence against a 1 in 100 year fluvial flood event or a 1 in 200 year tidal flood event, works are required both in the river channel and along its banks. These works will take place over a stretch of the river, approximately 3.5 km long, extending from the Railway Bridge to the N11 Bridge.

The basic principle behind the proposed flood defence scheme is 1) riverworks, which will be undertaken within the river channel to make it as hydraulically efficient as possible within the existing constraints; and 2) "containment" where defences will then be built along the riverbanks as is necessary to contain all the flow from a 1 in 100 year flood event within the river channel. The proposed scheme is detailed in Section 2.4 of the EIS.

2.0 DESCRIPTION OF THE RECEIVING ENVIRONMENT

The Study Area lies within the Urban Area of Bray. The area from the Diamond Valley Apartments up to the N11, on the northern bank of the River, lies within the administrative area of Wicklow County Council. The remaining area lies within the administrative area of Bray Town Council. The area in the vicinity of the river (within the study area) is for the most part, developed, with the exception of the Bray Golf Club Lands; the People's Park; and the lands which are referred to as 'Rehills' lands under the Bray Development Plan 2005.

For discussion purposes, the Study Area is divided into the following five areas:-

- Area 1 – Harbour Bridge to Bray Bridge
- Area 2 – Bray Bridge
- Area 3 – Bray Bridge to the western end of People's Park
- Area 4 – Western end of People's Park through the Slang/Rehills Land to La Vallee

- Area 5 – La Vallee to N11 Bridge

Area 1 – Harbour Bridge to Bray Bridge

Area 1 comprises the section of the River between the Harbour Bridge and Bray Bridge. This stretch of the River is bounded by Ravenswell Road, to the north, which provides access to the Bray Golf Club Lands; and the residential properties of No.'s 1 - 4 Ravenswell Road. The Residential areas of Seapoint Court; Milton Terrace; and Shankill View are located to the south.

Although the Golf Club Lands are currently undeveloped, it is noted that these lands are zoned “to provide for mixed-use development”.

Area 2 – Bray Bridge

Area 2 relates to Bray Bridge. Bray Bridge links Castle Street to the north and Main Street to the south.

Area 3 – Bray Bridge to the western end of People's Park

Area 3 comprises the section of the River between Bray Bridge and the western end of People's Park. Along this section of the River, the areas to the north include Lower Dargle Road; and People's Park. The Residential area of the Maltings is located to the south of the River Dargle.

Area 4 – Western end of People's Park through the Slang/Rehills Land to La Vallee

Area 4 comprises the section of the River between the western end of People's Park through the Slang/Rehills Land to La Vallee.

The Residential Areas of Glenburgh Terrace; Coburg; the River Vale Apartments; and the Diamond Valley Apartments are located to the north of the River. The Residential Areas of Glenwood; Killarney Glen; and the area known as Rehills Land are located to the south of River.

The Rehills Land is currently undeveloped, however, the lands are zoned “to provide for mixed-use development”.

The County Brook Stream flows into the River Dargle along this section of the river, at the western end of Coburg.

Area 5 – La Vallee to N11 Bridge

This area comprises the section of the River from La Vallee Apartments to the N11. La Vallee Apartments are located on the northern bank of the River.

There is an extensive woodland area to the south of the Rehills Land, along this section of the River, which is zoned “to protect and provide for recreational, open space and amenity provision”.

3.0 ALTERNATIVES CONSIDERED IN THE DEVELOPMENT OF THE SCHEME

Under Stage II of the Environmental Assessment, six possible Options were identified, as follows:

Option 1 – Do Nothing

The 'Do Nothing' scenario is used as a basis against which the advantages/disadvantages of flood relief options can be assessed. The analysis of the 'Do Nothing' scenario involved the running of the computer model for a variety of combinations of tidal and riverflow events and examination of the predicted extent of flooding.

Option 2 – Containment Only

The simplest method of increasing the cross-sectional capacity is to build up the sides of the river and contain all the flow within the river. This Option involved raising the existing riverwalls and embankments together with the construction of new walls or embankments, where required.

Option 3 – Containment and River Works

The second method of increasing the channel cross section involved the use of riverworks to lower the required height of defences. This involved the widening and deepening of the river channel, where possible, to increase the area available for the flow. The construction of walls and embankments were still required to safely convey the flow, however, the defences were lower than Option 2.

Option 4 – Upstream Storage

The basis of this Option involved restricting the flow permitted into the lower reaches of the river to that which can be safely conveyed within the existing channel. Therefore, in a storm event, floodwater is stored upstream of Bray. The storage location consists of parts of Charleville Demense, Newtown and Tinnehinch townlands, located approximately 4km to the south west of Bray.

Option 5 – Partial Storage and Containment

The Partial Storage and Containment Option is a combination of Options 2 and 4 above. During times of high flow, a portion of stormwater is stored upstream while the remainder is then permitted to flow downstream. The flood defences through the town are then upgraded to safely convey the required flow. These works are as per Option 2 but would be constructed to a lower level as the flow through the river has been reduced.

Option 6 – Partial Storage with Containment and River Works

This Option is a combination of Options 3 and 4 above. During times of flow, a portion of stormwater is stored upstream while the remainder is then permitted to flow downstream. The channel is then widened and regraded with an upgrading of the river defences to safely convey the flow.

4.0 DESCRIPTION OF THE SCHEME

An integral part of the development of the flood defence options was a series of public consultations, where members of the public were given the opportunity to make inputs into the design process.

In this regard, a Public Information Day was held at the Town Hall in Bray on the 10th April, 2006. The main purpose of the Public Consultation Day was to allow the public and other interested parties/bodies to discuss flood protection proposals for the River Dargle. During the Public Consultation Day, the public met the Design Team and representatives of environmental consultants and expressed their views on a number of flood related matters.

A second series of public consultation evenings and a Public Information Day took place in October/November 2006. Three informal public consultation evenings were held on 31st October; 1st November; and 2nd November 2006. These evenings were attended by invited residents of:-

- Coburg, Killarney Glen, Upper Dargle Road, River Vale and La Vallee on Tuesday 31st October;
- Seapoint Court, The Maltings and Bray Golf Club Lands on Wednesday on 1st November; and
- Little Bray and Dwyer Park on Thursday 2nd November.

At each of the Public Information evenings, the six Options were put on display. The display included engineering and landscaping drawings for each Option. Members of the public were given the opportunity to study each Option and discuss the Options with the relevant Design Team Consultants in attendance.

A formal Public Consultation Day was held on the 6th November 2006 in the Royal Hotel, Bray. The Public Consultation Day was divided into two separate sessions from 2 p.m. to 5 p.m. and from 7 p.m. to 10 p.m. At each of the two sessions, members of the public were given the opportunity to view and discuss each of the Options with the relevant Consultants in attendance. Attendees at the Public Consultation Day (PCD) were given the opportunity to make formal submissions on the six options that were presented and to express a preference for a particular option. The majority of those who responded expressed a preference for Options 3 and 6 with a provision for variations. A significant number of attendees at the Public Consultation Day were opposed to the landscaping proposals through People's Park, which were part of both Option 3 and Option 6.

Variations to Option 3 and Option 6 were discussed at length during Steering Committee meetings, as detailed in Section 3.3.2 of the EIS. In an attempt to minimise the land take requirement for Option 3 Variation C and D and improve the cost-benefit ratio of a scheme that includes a provision for widening the channel into the Golf Club Lands, a more localised north bank widening immediately upstream of Bray Harbour Railway Bridge was assessed under Variation E.

It was noted that a greater number of respondents preferred Option 3 above all other options and that Option 3 had a greater cost benefit than Option 6. Public concerns about the reliance on upstream storage contributing to the provision of a 1 in 100 year defence standard from a Health and Safety viewpoint were also considered.

For these reasons, the Steering Group agreed that a 2 Phase approach could provide the optimum solution to protecting the low lying areas of Bray while addressing the primary concerns of local residents. Phase I could involve the implementation of Option 3, Variation E to provide flood defence against the 1 in 100 year flood event. Phase II could involve further study and implementation of upstream storage by the OPW to provide a higher level of defence. The scheme in its final state could provide a c. 1 in 300 year defence level.

The basic principle behind the proposed flood defence scheme is 1) riverworks, which will be undertaken within the river channel to make it as hydraulically efficient as possible within the existing constraints; and 2) "containment" where defences will then be built along the riverbanks as is necessary to contain all the flow from a 1 in 100 year flood event within the river channel. The proposed scheme is detailed in Section 3.4 using the following areas:-

Area 1 – Harbour Bridge to Bray Bridge

The river in this stretch will be deepened and widened where possible with defences being constructed along each side of the river.

Area 2 – Bray Bridge

The riverbed at Bray Bridge will be lowered to increase its cross sectional area. A culverted by-pass channel will be constructed under Castle Street on the northern side of the river to provide greater flow capacity at the bridge.

Area 3 – Bray Bridge to the western end of People's Park

The river channel in this section will be widened and deepened where possible to increase the flow capacity. The existing riverwalls will be replaced with new defences to the required flood defence level.

Area 4 – Western end of People's Park through The Slang/Rehills Land to La Vallee

An extensive amount of river clearing and excavation will be undertaken in this area. The existing defences will be enhanced and additional defences will be provided where necessary. A debris trap will be located in this river reach to prevent trees and other large objects from travelling down the river.

Area 5 - La Vallee to N11 bridge

The river channel will be deepened and widened where possible along this reach to increase the flow capacity.

5.0 METHODOLOGY

5.1 HUMAN BEINGS

Within each of the five Study Areas (as referred to above), a number of engineering measures are required to provide flood defences along the river. The impact of each engineering measure has been assessed in terms of the impact on the immediate area affected. The criteria used to describe the impacts on Human Beings are based on the EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements).

The impacts in relation to visual amenity; residential amenity; and access to the River Dargle and People's Park were assessed in terms of the impact on a) the residents of Bray; b) people working in Bray; and c) visitors to the town.

5.2 TERRESTRIAL ECOLOGY

5.2.1 FLORA

The information on the habitats and flora was collated following a desk study and a walk-over site survey on 20th July 2006. The survey was by Dr Tom Curtis. The main sources consulted were Brunner (1950), Curtis (1973), Carvill and Curtis (1974), Curtis (1989) and Bradley (1989), as well as the archive on flora of the area collected by Tom Curtis over the last 30 years. In addition, information on designated areas

was provided by the National Parks and Wildlife Service of the Department of the Environment, Heritage and Local Government.

Habitat types are described according to the classification scheme used by Fossitt (2000). Nomenclature for vascular plants follows Scannell and Synnott (1987) and for cultivated species Griffiths (1994).

There were no special seasonal constraints in regard to the habitat and flora survey as it was carried out within the optimum period for botanical survey.

5.3 AQUATIC ECOLOGY

The freshwater ecological assessments comprised of the following investigations:

- A survey of macroinvertebrate populations, involving kick sampling at four sites on the River Dargle within the development area.
- An aquatic macrophyte survey recording aquatic vegetation and habitats at each site.
- Recording of standard physico-chemical parameters in the field as pH, oxygen levels (% saturation and mg/l of O₂) and conductivity (µS/cm).
- A survey of salmonid habitats on the River Dargle at macroinvertebrate sampling sites and along the channel adjacent to the proposed development, including investigations of the substrata, macrophytes, water depth and general suitability for spawning, rearing etc.
- A survey of the estuarine habitat present within the stretch of river adjacent to the proposed development.
- An otter survey of the study area.

5.4 SOILS, GEOLOGY AND HYDROGEOLOGY

An assessment of the Soils (including Subsoils/Quaternary Geology), Bedrock Geology, and Hydrogeology underlying the study area was undertaken in consultation with, inter alia, the following:

- The Geological Survey of Ireland;
- Geology of Kildare - Wicklow, 1:100,000 Bedrock Geology Map (Geological Survey of Ireland Publications, 1994);
- Ordnance Survey Sheet 56 (Discovery Series, Second Edition);
- Review of historical OS maps;
- Wicklow County Council Groundwater Protection Scheme as produced by the Geological Survey of Ireland, March 2003;
- EU Council Decision of 19th December 2002 “establishing criteria and procedures for the acceptance of waste material at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC”;
- CIRIA Document 532 “Control of Water Pollution from Construction Sites” dated 2001, and
- Drawings and sections of the proposed development as compiled by O’Connor Sutton Cronin & Associates.

5.5 WATER

The requirements of a flood defence scheme to protect the whole of Bray have been assessed by detailed computer assisted HEC-RAS hydraulic modelling for specified design criteria of the river reach from upstream of the Enniskerry Road Bridge to Bray Harbour.

A detailed topographical survey (undertaken by Murphy Surveys Ltd. from December 2003 to March 2007) of the main channel and flood plains of the River Dargle and the County Brook and Swan Streams within the upstream and downstream limits of the study formed the basis of the HEC-RAS model.

5.6 AIR AND NOISE

5.6.1 AIR QUALITY AND CLIMATE

The air quality assessment consisted of the following elements:

- Evaluation of the existing air quality through a review of published EPA data.
- Assessment of construction phase impact on air quality adjacent to the site, based on observations at similar construction sites.
- Calculation of nitrogen oxide emissions from traffic associated with the completed development, based on the methodology of the UK "Design Manual for Road and Bridges".

5.6.2 NOISE AND VIBRATION

The methodology used for this assessment is outlined as follows:

- The existing ambient noise levels were measured at representative reference positions, in accordance with ISO 1996 "Description and measurement of environmental noise".
- Construction noise was calculated with reference to typical construction noise data in BS 5228 "Noise Control on Construction and Open Sites", and assessed according to Irish National Roads Authority construction noise criteria
- The potential impact of ground vibration levels was evaluated based on experience at similar sites, with reference to BS 7385 "Evaluation and measurement of vibration in buildings" and BS 6472 "Guide to evaluation of human exposure to vibration in buildings".

5.7 LANDSCAPE AND VISUAL

The system of evaluation normally used in the preparation of the visual and landscape impact assessment of an Environmental Impact Statement is utilised. The assessment methodology is therefore based on the following:

- Guidelines on the information to be contained in Environmental Impact Statements prepared by the Environmental Protection Agency (EPA) 2002.
- Advice Notes on Current Practice in the preparation of Environmental Impact Statements (Environmental Protection Agency (EPA), September 2003).

5.8 MATERIAL ASSETS

5.8.1 TRAFFIC AND TRANSPORTATION DURING CONSTRUCTION

Using the description of the project in Chapter 2 of the EIS, potential impacts on traffic and transportation were identified and rated. The potential impacts were evaluated using the EPA Guidance Document “Guidelines on the information to be contained in Environmental Impact Statements” published in March 2002 based on: Magnitude and intensity; Integrity; Duration; and Probability.

5.8.2 PROPERTY

Each engineering measure was assessed in terms of the impact on property directly affected. The significance criteria used is based on the EPA *Advice Notes on Current Practice (in the preparation for Environmental Impact Statements)*.

5.8.3 ACCESS

Each engineering measure was assessed in terms of the impact on access and rights of way directly affected. The significance criteria used is based on the *Advice Notes on Current Practice (in the preparation for Environmental Impact Statements)*.

5.8.4 TOURISM AND RECREATION

Each engineering measure was assessed in terms of the impact on the area directly affected and the overall impact on tourism within Bray directly affected. The significance criteria used is based on the *Advice Notes on Current Practice (in the preparation for Environmental Impact Statements)*.

5.9 CULTURAL HERITAGE

The Archaeological, Architectural Heritage and Local History components of the study comprise the results of a survey and evaluation of selected sites of interest and potential within the subject study area. The work consisted of the results of a paper survey, consultation with the National Monuments Section, Heritage and Planning Division, Department of the Environment, Heritage and Local Government and a field inspection.

6.0 LIKELY SIGNIFICANT IMPACTS

The potential impacts in relation to each environmental aspect are set out hereunder:

Environmental Aspect	Significant Impacts
Human Beings	<ul style="list-style-type: none"> - Temporary negative impacts during construction including increased noise and dust emissions; impact on visual amenity; and impact on traffic. - Significant positive impact due to reduced risk to life and property during a flooding event.

Terrestrial Ecology	<ul style="list-style-type: none"> - Loss of the population of yellow cress at Seapoint Court - In the long-term, and providing mitigation measures are successfully implemented, the impact on the otter; and the kingfisher population and on other birds is likely to be minor.
Aquatic Ecology	<ul style="list-style-type: none"> - Release of sediments into surrounding watercourses, could result in direct and indirect fishery impacts. - Widening of the river channel could result in a reduction in water depth, which could restrict passage for salmonids during times of low flow. - The construction of the Debris Trap will result in the permanent loss of a small area of riverbed habitat, and the alteration of the flow around the structures may result in the habitat immediately surrounding the structures to be altered. - Potential for the spread of Japanese knotweed along greater stretches of the river. - The removal of the weir between Bray Bridge and the Harbour will increase the length of the estuarine habitat in the lower River Dargle, returning the area to a more natural state. - Disturbance of the river bed will affect the macroinvertebrate populations directly.
Soils, Geology and Hydrogeology	<ul style="list-style-type: none"> - Potential contaminants such as fuel and lubricants, which will be used in connection with the on-site machinery, have the potential to spill, which could result in the contamination of the local soil. - The sheetpile walls will have a moderate significant impact on local groundwater flow.
Water	<ul style="list-style-type: none"> - Pollutants and chemicals used during the construction could have toxic impacts on the flora and fauna in the adjacent waters. - The flood defences will have a significant positive impact on the human environment by reducing or eliminating economic damage to residential and commercial properties vulnerable to flooding; stress and anxiety experienced by residents and property owners from the threat of future flooding; and economic loss to traders whose premises are located in flood-prone areas.
Air Quality and Climate	<ul style="list-style-type: none"> - Air quality impacts will be of limited duration and will only occur during the construction phase of the scheme.
Noise and Vibration	<ul style="list-style-type: none"> - During the construction phase, significant noise levels will be generated during excavation, rockbreaking and sheet piling. When works are in progress adjacent to houses, noise will exceed the 70 dB(A) NRA daytime construction noise criterion for short periods. - Night-time construction works at Bray Bridge will result in a severe noise impact at all residents within a 500m from the proposed culvert.
Landscape and Visual	<ul style="list-style-type: none"> - There is potential for a significant and negative landscape impact if the removal of existing vegetation, where necessary, is not monitored and managed properly which may result in more vegetation being removed than is necessary. - Once the engineering measures have been completed, there is the potential for significant and negative visual impacts in the event that site compounds are not properly decommissioned or if planting is not maintained.
Material Assets	<ul style="list-style-type: none"> - The construction of the culvert at Bray Bridge will require temporary road closures during construction. This will have a temporary negative impact on traffic. - There will be a significant temporary impact on access to properties within a localised and wider area during construction and a potential negative impact on businesses operating along Main Street. - There will be a negative impact on the residential amenity of properties along Coburg due to the construction of the new retaining wall and due to the construction of an earthen embankment. - Along the Rehills Lands, the southern bank of the river will be

	excavated during construction resulting in the loss of part of the landbank.
Cultural Heritage	<ul style="list-style-type: none"> - The works at Bray Bridge will result in the complete or almost complete, removal of the former bridge remains. Although the works will result in a general negative, significant and permanent direct impact, the cumulative character of such can be lessened by the adoption of a suitable and specific mitigation strategy.

7.0 MITIGATION MEASURES

The mitigation measures in relation to each environmental aspect are set out hereunder:

Environmental Aspect	Mitigation Measures
Human Beings	<ul style="list-style-type: none"> - The flood defence scheme is in itself a mitigation measure against the risk of flooding along the River Dargle. - Once the flood defence scheme is constructed, rigorous monitoring and maintenance will be carried out by Bray Town Council to ensure that the flood defences do not deteriorate.
Terrestrial Ecology	<ul style="list-style-type: none"> - Planting and/or re-instatement of native tree and shrub species along the disturbed banks of the river. - Measures to minimise the invasion of alien species. - Transplantation, storage and translocation of the Greater Yellow Cress from its current location along the south bank of the river adjacent to Seapoint Court. - Prior to any works commencing, a preconstruction survey for otter holts and badgers will be constructed by experts at appropriate season (winter). - Where practical, mitigation measures would aim to reduce the impact on otters by limiting duration of works on site to daylight hours to allow otters to forage along the watercourse at dawn, dusk, and during the night. - Bat roosts may be present in mature or ivy-covered trees present on site. Any such trees that require felling will be felled under the supervision of a bat specialist during specified months. - If works are planned during the nesting season, survey will need to establish the exact locations of kingfisher nests and works at active nest sites will be avoided until after the nesting season. - An appropriate habitat re-instatement programme is required to restore riparian habitats so as to provide suitable habitat for kingfisher.
Aquatic Ecology	<ul style="list-style-type: none"> - Measures will be implemented to reduce the release of sediment into the watercourse. - All fuels or chemicals kept on the construction site will be stored in bunded containers. - Where possible, natural banks and riparian vegetation should be left in place, and flood defence structures constructed back from the immediate banks. - Works in-stream should be kept to the minimum area possible and machinery should operate within the previously disturbed areas as the works progress along the channel. - Any works to widen the channel should ensure that, even in times of low flow, there is sufficient depth of water for the passage of salmonids upstream. - The river works should be carried out in sections in a downstream direction from the N11 Bridge to allow recolonisation of the altered

	<p>habitat from upstream as works are completed.</p> <ul style="list-style-type: none"> - The Code of Practice for the management, destruction and disposal of Japanese Knotweed will be the basis of any management plan developed for the control of Japanese Knotweed along the river.
Soils, Geology and Hydrogeology	<ul style="list-style-type: none"> - A construction management plan will be established prior to commencement on site. - A fuel/chemicals handling and storage management plan will be implemented at the outset of the construction phase and rigidly adhered to throughout, in order to minimise the risk of adversely impacting the soils, geology and hydrogeology. - Any soil that is to be excavated and disposed of shall be sampled, analysed and classified to determine the most suitable disposal outlet. - Any soil that is to be reused on-site shall be sampled and analysed to confirm its suitability.
Water	<ul style="list-style-type: none"> - The engineering measures presented in detail in Section 2.4 will ensure that the design flood will be confined within the river channel and therefore, no further mitigation measures are necessary in the context of the predicted changes to the river's flow regime. - A number of mitigation measures should be implemented to reduce or remove any potential negative impacts on the River Dargle as a result of the proposed scheme. - A full list of mitigation measures is provided in relation to water quality in section 5.5.6 of the EIS.
Air Quality and Climate	<ul style="list-style-type: none"> - It should be verified that there is no potential for contaminated soil before excavation commences. - Soiling of roads can be minimised by use of truck wheel washes at the four proposed site compounds, covering of trucks carrying fine materials and surfacing of the site exit roads. - Active management is required to monitor and minimise the generation of dust. During dry periods, water sprays may be required. Any temporary stockpiling of soil should be designed to minimise exposure to wind.
Noise and Vibration	<ul style="list-style-type: none"> - Special consideration must be taken when undertaking piling works near sensitive locations with predicted noise levels in excess of 80 dB(A). - The NRA guideline construction noise limits are considered appropriate limits for this project. The contractors will be responsible for implementing the appropriate mitigation measures, based on their detailed quantitative assessment of noise emissions from each work activity. - Continuous vibration monitoring should be undertaken when piling and rockbreaking within 20m of houses.
Landscape and Visual	<ul style="list-style-type: none"> - Quality management system to be part of the construction works to ensure high quality finish to walls. - Storing of materials in a neat manner in compounds and, where possible, out of view from the public - Replacement of existing planting removed due to the construction works to be replaced with similar native species. - Implementation of tree protection measures to protect trees to be retained in, or around, site as necessary. - Damage to property, grassland, planting and roads will be minimised through management procedures. - Establishment of the proposed planting around the areas of the proposed walls to soften the visual appearance of these walls. - Implementation of a plant maintenance scheme to ensure establishment of the proposed planting and replacement of plants as necessary. - Proper maintenance of areas accessible to the public to ensure that they do not become areas of degradation or become the subject of anti-social behaviour.

Material Assets	<ul style="list-style-type: none"> - The deliveries to and from site will be undertaken to a programme agreed between the contractor prior to works commencing to minimise disruption to the roads network particularly during times of peak traffic flow. - The temporary closure of carriageways on Castle Street will take place at night or other off peak hours to minimise impacts on traffic. - The Contractor will liaise with relevant local authority and residents groups and advance notice will be given to the general public through local media before any road closures take place. - Once the flood defence scheme is constructed, rigorous monitoring and maintenance will be carried out by Bray Town Council to ensure that the flood defences do not deteriorate. - In the event of flooding during construction it is proposed that an "Emergency Procedure in the Event of Flooding" will be implemented by Bray Town Council to ensure that health and safety is not compromised during the construction period. - In order to minimise disruption during construction, a phased programme for construction will be implemented, as described in Section 2.5.2 of the EIS.
Cultural Assets	<ul style="list-style-type: none"> - A programme of archaeological investigations/excavations will be undertaken with respect to the bridge piers/foundations of the former bridge at Bray Bridge. - A pre-development wading and metal detecting survey of the existing river channel within the Zone of Archaeological Potential and at the confluence of Swan and County Brook streams and in the areas of Engineering Measure D9 (Debris Trap) should be undertaken in advance of the commencement of works. - A pre-development metal detecting survey should be undertaken of the existing river bank where it is proposed to undertake ground reduction/excavation works. - All topsoil stripping/general ground reduction works of the areas outlined in Item 3 above, as well as all such works within the Zone of Archaeological Potential and Bray Golf Course lands, should be monitored by an archaeologist. - The removal of the top 300mm of river bed material from all of the area upstream of Bray Bridge should be monitored by an archaeologist. - In the event of archaeological features being uncovered during the course of such works, then the advice of the National Monuments Section, Heritage and Planning Division, Department of the Environment, Heritage and Local Government should be sought. - Extreme care should be taken during the underpinning works at Bray Bridge in order that the existing structure/fabric of the bridge is not accidentally damaged by machinery. - Consideration should be given to the removal of vegetation on the facades of Bray Bridge and remedial works such as re-pointing. - A full architectural survey of Ravenswell Road Bridge should be undertaken in advance of the construction of the box culvert. - The stonework of the northern façade should be numbered and recorded on the survey plans and consideration should be given to the reinstatement of this façade upon completion of the box culvert.

8.0 RESIDUAL IMPACTS

The residual impacts in relation to each environmental aspect are set out hereunder:

Environmental Aspect	Residual Impacts
Human Beings	<ul style="list-style-type: none"> - The residual impact is considered to be a significant positive impact on Human Beings.
Terrestrial Ecology	<ul style="list-style-type: none"> - It is considered that the residual impacts by the scheme will be at most Minor negative, and probably Neutral, in the medium to long term. - It is considered that the residual impacts will be Minor negative, and probably Neutral, in the long-term.
Aquatic Ecology	<ul style="list-style-type: none"> - With the reinstatement of the existing substratum, the impact on the macroinvertebrate populations and the impact of any fish feeding on these macroinvertebrates this will be a significant negative impact of short-term duration. - The impact on the flow character of the river will be a significant, negative impact of short-term duration. - The control and eradication of Japanese knotweed from the River Dargle will be a significant positive impact. - Areas where the existing natural/semi-natural banks will be replaced by retaining walls will be permanently negatively impacted. - The removal of the weir will return the lower River Dargle channel to a more natural state, allowing the establishment of estuarine species of flora and fauna further up the channel and improved movement of salmonids migrating through the lower reaches.
Soils, Geology and Hydrogeology	<ul style="list-style-type: none"> - Approximately 50% of the excavated material will be placed at the Slang, resulting in its increased level by approximately 1m to 1.25 m. The significance of this impact is slight. - As part of Engineering Measure R1, an area of bedrock may be excavated and removed from the base of the riverbed in the vicinity of La Vallee. The removal of bedrock in this area will not have a significant impact. - The local groundwater flow may be affected due to the installation of sheetpile walls. However, this is not considered to be a significant impact. - No residual impacts to Soil and Geology Environments are foreseen during the Operation Phase of the proposed scheme.
Water	<ul style="list-style-type: none"> - There are no residual impacts in relation to Water.
Air Quality and Climate	<ul style="list-style-type: none"> - If effective mitigation measures are implemented both on the site and along the haul routes, dust deposition will be minimised. There may be a residual minor adverse impact at properties fronting the haul routes adjacent to the site access points. This impact is short term in nature. - There will be a negligible residual impact on climate.
Noise and Vibration	<ul style="list-style-type: none"> - The residual daytime noise impact during sheetpiling is predicted to be “significant” at residences in The Maltings and Coburg, “moderate” at Seapoint Court and Killarney Glen and “slight” at Glenwood and Lower Dargle Road. - The residual impact during the night-time construction of the Culvert at Bray Bridge would be severe at the nearby residences at Ravenswell Road, Lower Dargle Road and the Maltings. - By implementing the vibration mitigation measures the residual vibration impact is deemed to be slight. - The residual impacts of all other proposed works are deemed to be negligible.
Landscape and Visual	<ul style="list-style-type: none"> - Areas along the river which are at present derelict will be cleaned up and maintained, and therefore the visual and landscape impacts in these areas will be significant and positive.

Material Assets	<ul style="list-style-type: none"> - Mitigation will minimise the impact on traffic, however, there will remain a temporary negative impact on traffic during construction. - Overall the proposed scheme will have a positive impact on property by reducing the risk of flooding within the town. - The provision of a new Dargle Walkway is considered to be a significant positive and permanent impact which will benefit the entire town. - Direct access to the river for a small number of properties will be restricted as a result of the proposed defence scheme. This impact is considered to be significant, permanent but localised.
Cultural Assets	<ul style="list-style-type: none"> - In terms of archaeological heritage, the implementation of the mitigation strategy will result in a long term positive impact in that any previously unrecorded features and artefacts that will be discovered and investigated as a result of the works will be recorded for use in future studies. - In terms of architectural heritage, the implementation of the mitigation strategy will result in a largely positive long-term impact in that the nature of the feature will be recorded and archived for future study.

9.0 THE DO-NOTHING SCENARIO

9.1 HUMAN BEINGS

Human Beings are assessed in terms of the impacts on a) local residents; b) commercial activity; and c) visitors to Bray.

The 'do nothing' scenario is assessed in terms of the impacts of:-

- a) a 1 in 100 year flood event; and
- b) a 1 in 200 year tidal event.

While the 1 in 200 year tidal event would have a significant impact, the impact would be more localised, affecting lands to the north and south of the river, between the Harbour and Bray Bridge. The impact of the 1 in 100 year river flood event would be more widespread, affecting lands to the north and south of the river, between the Harbour and the N11 Interchange.

1:100 Year River Flood Event

The occurrence of a one in one hundred year river flood event would result in extensive flooding of residential lands along the river including Seapoint Court; Ravenswell Road; Belton Terrace; Dwyer Park; Barboza Terrace; St Laurences Terrace; Adelaide Villas; Loretto Terrace; Fairgreen Court; Fairgreen Terrace; Fairgreen Road; Gertrude Terrace; Herbert View; Sutton Road; Sutton Villas; Matland Street; Ardee Court; Dangan Street; Pearse Road; Pearse Square; the Maltings; Glenburgh Terrace; Coburg; Dargle Road; Killarney Glen and River Vale. Therefore, the occurrence of such an event in an area occupied by residential development could potentially result in damage to property and possibly loss of life.

A 1 in 100 year flood event would also cause significant damage to commercial property along Castle Street, between Bray Bridge and Cronan's Road, including Castle Street Shopping Centre and commercial property to the north of People's Park. As Bray Bridge would also be affected, access to and egress from the town would be severely limited, therefore impacting upon commercial activity within the town as a whole.

Therefore, in the event of a 1 in 100 year flood event, there would be extensive damage to the town. This would have a significant impact on day-to-day activity within the town and access to and egress from the town. Such an event would therefore have a significant negative impact on visitors to the town.

1:200 Year Tidal Flood Event

In the event of a one in two hundred year tidal flood event, there would be extensive flooding of the residential areas of Seapoint Court; Ravenswell Road; Belton Terrace; Dwyer Park; and Milton Terrace. Therefore, if such an event were to occur, there would be potential for significant flooding damage and possibly loss of life.

Such an event would also have an impact on commercial activity. Lands affected would include the Harbour Area; the former Abattoir site; the Golf Club Lands; and Castle Street.

Visitors to Bray would also be affected by such an event. Flooding of the Harbour Area would make tourist activity inoperable from this location.

9.2 TERRESTRIAL ECOLOGY

9.2.1 FLORA

Without the proposed works, the existing conditions would be expected to remain more or less stable (assuming no other influencing developments take place or significant flood events).

However, future flood events (either a 1:100 Year River Flood Event or 1:200 Year Tidal Flood Event) would alter the existing physical conditions within the river valley, which would result in habitat change through erosion, soil exposure and tree death, followed by re-colonisation, initially mostly of weedy, invasive species including the alien Japanese knotweed.

There would also be the probable loss of the small population of Greater yellow cress on the south side of the river adjacent to the sewerage treatment works.

9.2.2 FAUNA

With a 'Do-Nothing' Scenario, it is to be expected that the species recorded on site will persist into the long-term. Occasional flood events could wipe out local populations of some animals but these would be expected to recolonise naturally as animals living in proximity to watercourses are adapted for such events.

It is noted that the present situation may change anyway, as Bray town is expanding and additional development will undoubtedly take place in the vicinity of the proposed scheme. These will have some, probably limited, negative impact on wildlife in the area over time, especially if these developments cause loss of riparian and other vegetated habitats along or near the Dargle River.

9.3 AQUATIC ECOLOGY

Should this project not proceed, the 'do nothing' scenario' with regard to aquatic ecology would result in the aquatic ecology of the lower River Dargle remaining the same in the absence of any new impact. The impact of two flood cycles was considered during the preparation of this proposal. Firstly a 1:100 year river flood event and secondly a 1:200 year tidal flood event. The impact that either of these events would have on the aquatic ecology of the River Dargle would be similar in many ways, though would vary in magnitude.

1:100 year river flood event

The main impact this flood event would have on the aquatic ecology of the river would be the release of a variety of pollutants into the water. Flood waters would cause sewers to overflow and release their load, having a major impact on the quality of the water, and subsequent knock on effects on fish and macroinvertebrate communities. Flood waters would also carry pollutants from road and car park surfaces, such as oil, petrol, diesel, heavy metals, etc., into the river, as well as quantities of soil. These substances all impact negatively on the water quality and its suitability for the survival of aquatic organisms.

The lower three kilometres of the river would be significantly, negatively impacted upon in this scenario, with the impact increasing downstream.

1:200 year tidal flood event

This flood even would have a similar impact on the river as the 1:100 year river flood event, however the impact is likely to be reduced owing to the smaller area affected by the flood waters, and the shorter length of river channel affected. Waters carrying sewage, hydrocarbons, heavy metals, chemicals, soils, etc. would flow in to the river, causing a significant reduction in the water quality along this section of river. These substances have toxic lethal and sub-lethal effects on aquatic organisms. The incursion of marine floodwater would impact negatively on the macroinvertebrate community, though this impact would be temporary in nature as recolonisation would occur from upstream areas.

A combination of these two flood event types would results in greater negative impact owing to the greater area of the flood plain affected by the floodwaters.

9.4 SOILS, GEOLOGY AND HYDROGEOLOGY

The "Do Nothing Scenario" assesses the environmental impact of not developing the proposed development site in respect of the existing impacts to Soils, Geology and Hydrogeology at the proposed development site.

Under the "Do Nothing Scenario" there would be no change in the current land use of the site. The Soil, Geology and Hydrogeology Environments would remain in their current state.

9.5 WATER

The 'do nothing' scenario (Option 1) for the proposed flood defence scheme involves leaving the River Dargle through Bray as it currently exists. The discharge capacity of this channel is approximately 200m³/s and consequently, the 'do nothing' scenario will leave residents of significant parts of Bray being continuously exposed to a very real flood risk from extreme conditions in the river or from extreme tides in the Irish Sea.

9.6 AIR AND NOISE

AIR AND CLIMATE

There will be neither a positive or negative impact on air quality under the do-nothing scenario.

NOISE AND VIBRATION

There will be neither a positive or negative impact on noise and vibration under the do-nothing scenario.

9.7 LANDSCAPE AND VISUAL

In the event of none of the flood protection measures being put in place the receiving environment will remain in its present state. Therefore, unless a flood happens, there will be no visual or landscape impacts.

However in the event of a 1 in 100 year or a 1 in 200 year flood event occurring there is the likelihood that the river, without the necessary flood protection measures being implemented, would flood. This will result in the river overflowing its embankments and the surrounding low lying areas being flooded, causing major structural damage to boundary walls, railings, houses, other structures etc in the path of the flood. This would be similar or maybe even greater to the damage caused during the 'Hurricane Charlie' flood in 1986.

The visual impact, therefore, will be significant and negative given the amount of damage that would probably occur.

There would be an extensive amount of loss of tree planting and vegetation due to the flood waters, both along the river banks and in the gardens of the residences flooded. Therefore the landscape impact would be significant and negative.

Mitigation would be achieved by ensuring that the necessary flood defences are implemented along the river corridor.

9.8 MATERIAL ASSETS

9.8.1 TRAFFIC AND TRANSPORTATION DURING CONSTRUCTION

The 'do nothing scenario' (where no construction takes place) will have no impact upon traffic and transportation.

9.8.2 PROPERTY

The occurrence of a 1 in 100 year flood event would have a profound negative impact on all lands along the river. Lands affected would include the residences of Seapoint Court; Ravenswell Road; Belton Terrace; Dwyer Park; Barboza Terrace; St Laurences Terrace; Adelaide Villas; Loretto Terrace; Fairgreen Terrace; Fairgreen Terrace; Fairgreen Road; Gertrude Terrace; Herbert View; Sutton Road; Sutton Villas; Matland Street; Ardee Court; Dangan Street; Pearse Road; Pearse Square; the Maltings; Glenburgh Terrace; Coburg; Dargle Road; Killarney Glen and River Vale.

A 1 in 100 year river flood event would also result in extensive flooding of the Golf Club Lands and Rehills Lands, which are zoned for mix use development.

A 1 in 200 year tidal flood event would have a profound negative impact on property along the river between the Harbour and Bray Bridge. Lands worst affected would include residential and commercial property within the immediate vicinity of the Harbour; Seapoint Court; the former Abattoir site; Milton Terrace; the Golf Club Lands; No.'s 1-4 Ravenswell Road; Belton Terrace; and Dwyer Park.

9.8.3 ACCESS AND RIGHTS OF WAY

In the event of a 1 in 100 year flood event there would be extensive damage to lands along the north and south of the River. Therefore, there would be a profound negative impact on access to property during such an event. Lands affected would include the residences of Seapoint Court; Ravenswell Road; Belton Terrace; Dwyer Park; Barboza Terrace; St Laurences Terrace; Adelaide Villas; Loretto Terrace; Fairgreen Terrace; Fairgreen Terrace; Fairgreen Road; Gertrude Terrace; Herbert View; Sutton Road; Sutton Villas; Matland Street; Ardee Court; Dangan Street; Pearse Road; Pearse Square; the Maltings; Glenburgh Terrace; Coburg; Dargle Road; Killarney Glen and River Vale.

A 1 in 100 year river flood event would also result in extensive flooding of the Golf Club Lands and Rehills Lands, which although currently undeveloped, are zoned for mix use development.

In the event of a 1 in 200 year tidal flood event, there would be extensive damage to lands to the north and south of the river between the Harbour and Bray Bridge. Therefore, there would be a profound negative impact on access to property during such an event. Lands worst affected would include residential and commercial property within the immediate vicinity of the Harbour; Seapoint Court; the former Abattoir site; Milton Terrace; the Golf Club Lands; No.'s 1-4 Ravenswell Road; Belton Terrace; and Dwyer Park.

9.8.4 TOURISM AND RECREATION

In the event of a 1 in 100 year flood event, there would be extensive damage to lands to the north and south of the river. During such an event there would be extensive damage to People's Park and property along the river. Bray Bridge would also be inaccessible during such an event. Such destruction would have a significant negative impact on tourism and recreation within Bray.

9.9 CULTURAL HERITAGE

Under particular weather and other conditions, the 'do nothing' scenario could result in extensive flooding to Bray (e.g. similar or worse than 1986). In this case, damage could be caused to Bray Bridge and/or the pier remains of the former bridge both by flooding and the flow of debris down the river. While none of the existing Protected Structures might be damaged, there may exist structures within the 'flood zone' area which may be designated Protected Structures in future Development Plans (e.g. bridges at harbour, river walls, etc. In addition, any archaeological artifactual material that might exist on existing river banks or in the river bed layers would, most likely,

be further displaced by the forces of the initial flooding, the subsequent receding of water and any emergency works that might be required in order to alleviate the floods.