

## APPENDIX C – REPORT ON THE FLORA AND FAUNA

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# DixonBrosnan

environmental consultants

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Assessment of the ecological impacts of discharging treated wastewater from Carrigwohill, Co. Cork				
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T.J. O' Connor & Associates				
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## 1. Introduction

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DixonBrosnan environmental consultants were commissioned by T.J. O'Connor & Associates to assess the possible ecological impacts of constructing a new wastewater treatment plant and associated pipeline to discharge treated wastewater to Cork Harbour. This report will form part of an environmental impact statement (EIS). The treated wastewater will be discharged into a narrow estuarine creek (Slatty Water), which is adjoined by extensive estuarine mudflats. The existing wastewater treatment plant (WWTP) services a population equivalent of 8,500 p.e. however the load often exceeds the capacity. This treatment plant discharges at Slatty Bridge. It is proposed to build a new WWTP which will have a final design capacity of 67,000 p.e. A tertiary level of treatment will be provided by the new plant.

This assessment follows the structure and protocols detailed in *Advice notes on current practice in the preparation of Environmental Impact Statements* (EPA, 2003) and *Guidelines on the information to be contained in Environmental Impact Statements* (EPA, 2002). The local representative of the National Parks and Wildlife Service (NPWS) and South Western Regional Fisheries Board were contacted during this process.

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## 2. Site designation

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The area of Cork Harbour into which the treated wastewater will be discharged is a candidate Special Area of Conservation (cSAC) (Great Island Channel site 001058) and is part of the Special Protected Area (SAC) (Cork Harbour 004030). A site description of these protected areas is included in **Appendix 1**.

Cork Harbour is an internationally important wetland site, regularly supporting in excess of 20,000 wintering waterfowl, for which it is amongst the top five sites in the country. There are a number of important and interconnected areas of importance for birds within the overall harbour area. The harbour supports internationally important numbers of redshank and nationally important numbers of a further fifteen species (great crested grebe, cormorant, shelduck, wigeon, gadwall, teal, pintail, shoveler, red breasted merganser, oystercatcher, lapwing, dunlin, black tailed godwit, curlew and greenshank). There are also important numbers of shelduck, shoveler, pintail, whooper, pochard, golden plover, grey plover, turnstone, common gull, lesser black backed gull and black-headed gull. A nationally important population of common tern is also located within the harbour.

The Great Island Channel is an important ecological component of Cork Harbour and stretches from Little Island to Middleton. It forms the eastern section of a limestone basin and is relatively undisturbed. Habitats of high value found within the site include sheltered tidal sand and mudflats and Atlantic salt meadows both of which are included in Annex

1 of the Habitats Directive. The mud flats support a variety of invertebrate species, which in turn are an important food source for birds. Within the salt marsh habitats a variety of typical plant species occur.

The Great Island Channel is extremely important for wintering waterfowl and is considered to contain three of the top five areas within Cork Harbour, namely North Channel, Harper's Island and Belvelly-Marino Point. Important species in this area include shelduck, teal, wigeon, dunlin, godwit, curlew, golden plover, gray plover, black-tailed godwit, redshank and lapwing. There are important roosting sites at Weir Island, Brown Island, Killacloyne and Harpers Island.

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### 3. Surrounding landscape

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#### 3.1 Site of WWTP

It is proposed that the existing treatment plant will be extended to the east and primarily to the west of the existing site of the wastewater treatment plant. The area to the east has been stripped of its vegetation and is of minimal ecological value at the present time. The site of the current treatment plant is surrounded by planted hedges, which include non-native species. To the west of the existing treatment plant the land consists of a mixture of wet woodland with reed beds associated with the watercourse/lake along the southern boundary of the site. This area is located within the proposed Natural Heritage Area and candidate Special Area of Conservation (cSAC) (Great Island Channel site 001058) and is part of the Special Protected Area (SAC) (Cork Harbour 004030). A minor road runs along the northern boundary of the site.

#### 3.2. Proposed pipeline route

It is proposed that the pipeline will discharge to a small creek at the low water mark to the west of Slatty Bridge. This area is characterised by uniform mudflats, which are exposed at low tide. The creek is formed by a small watercourse, which discharges at Slatty Bridge via a small brackish lake. There are sluice gates at the Slatty Bridge, which controls the influx of salt water into the lake. The mudflats are bounded to the north by the N25 and roundabouts at Tullagreen, as well as roadside grassy verges and rock armour associated with the road. The southern boundary of this area of mudflats is formed by Fota Island. Due to the presence of the N25 along the northern boundary and the R624 road to Cobh along the eastern boundary, current traffic noise levels are considerable. Direct disturbance of the site by walkers etc is low for the same reason. The area of Fota Island which adjoins the mudflats is also relatively undisturbed as there is a band of mixed woodland which separates the rest of the island from the shoreline.

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### 4. Marine ecology

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#### 4.1 Cork Harbour

Cork harbour is a large natural harbour which receives treated effluent from a number of small and large, scattered settlements including Cork city and Midleton. Studies on the water quality of Cork Harbour have been carried out previously and deteriorations in water quality have been recorded in the past. Following completion of the Cork Main Drainage scheme, wastewater from Cork City is treated to a high standard and discharged at Carrigrenan, Little Island. This new facility is expected to significantly improve water quality within Cork Harbour.

Slatty Water into which the treated wastewater will be discharged is 150-250m wide and 2950m long pipeline from Slatty Bridge to the railway bridge near Harpers Island. This relatively small inlet is predominantly saline and tidal with only a limited freshwater influence.

#### 4.2 Habitat classification

The classification of marine habitat follows the scheme outlined in the Heritage Council publication *A Guide to Habitats in Ireland* (Fossit, 2000). The area of estuarine habitat affected by the proposed development is classified as *Estuaries MW4 / Littoral (Intertidal) Mud shores LS4*.

The treated wastewater will be discharged to a small brackish creek which runs entirely through mudflats downstream of Slatty Bridge. Thus it discharges into an estuarine environment despite the relatively small size of the freshwater input from this small stream. Estuaries differ from other coastal inlets in that sea water is measurably diluted by inputs of freshwater and this, combined with tidal movement, means that salinity is permanently variable. The mixing of two very different water masses gives rise to complex sedimentological and biological processes and patterns. Estuaries are loosely linked with the Annex I habitat 'estuaries (1130)'. This small brackish creek is only accessible at low tide as this area is flooded in its entirety at high tide. The creek lacks flora as it runs through mudflats with no rocky substratum. On the upper shore this is small amounts of algae i.e. bladder wrack.

The primary habitat type within this estuarine environment is Mud Shores LS4. Mudflats which on a macro-scale are relatively uniform are the dominant habitat within the shallow bay through which the creek runs. Small rivulets of freshwater discharge to the creek and form shallow channels within the mudflats. As is typical in the upper reaches of estuaries the mudflats are dominated by fine silt and clay (>95%). Algae is largely absent. The surface of the mud is brown in colour with a black to grey anoxic zone approximately 2 cm below the surface.

#### 4.3 Sediment survey – macroinvertebrates

Sediment samples were taken from mudflats adjoining the discharge point to assess macroinvertebrate populations. The mudflats in this area provide a relatively uniform habitat and there is virtually no natural rocky shore habitat along the upper shore. However there will be a greater freshwater influence close to the creek which may reduce macroinvertebrate diversity. Due to the absence of significant variation in habitat type, transects from upper to lower shore were not considered necessary. Therefore samples were taken from upstream/east of the discharge point

(sample 1), at the approximate discharge point (sample 2) and downstream/west of the discharge point (sample 3). These samples are considered representative of habitats in the vicinity of the proposed discharge.

Core samples were taken at low tide using a standard corer. Sediment samples were taken for analysis of benthos and a sub-sample was then taken for particle size analysis (PSA). Samples were kept cool in a cooler box to prevent decomposition from affecting grain size. Sediments were sieved through a full set of sand sieves and fractionated to gather fauna using a sprinkler. Samples were sorted using a white squared tray. Sediments were classified according to the Wentworth scale (Wentworth, 1922). Identification was carried out using a binocular viewer (x100) and identified using Hayward and Ryland (1998). Specimens were not fixed but identified live.

#### 4.4 Results

Mudflats are typically productive environments, which are characterised by high biomass but relatively low species diversity. Rare species of macro-invertebrates are generally not present. Observations on the samples indicate that the surface of the mud was brown, however a black anoxic layer was recorded close to the surface. The results of invertebrate analysis indicate that diversity and biomass is low within the mud samples taken at and adjacent to the proposed discharge point. The only species recorded was king ragworm (*Nereis virens*). This is a large species which can survive in brackish conditions. The low diversity of species may reflect toxic impacts in the past or high levels of nutrient enrichment. The results of this survey are difficult to interpret as they were taken close the existing creek where freshwater may be impacting on species distribution. However the low diversity may be indicative of habitat deterioration.

#### 4.5 Fish

Cork Harbour is an important spawning area for marine fish species and both commercial and recreational fishing are carried out within the harbour. Larger species found within the greater harbour area include dogfish, codling, conger, pollack, turbot, plaice, blond ray, thornback ray, ballan wrasse, cuckoo wrasse, rockling, blue shark, ling, whiting, bass and grey mullet. Smaller species include flounder, goby species, fifteen spined stickleback, pipefish, blenny species and butterfish. The harbour waters also provide important spawning and nursery areas for sea fish species such as herring and salmon. Sea trout migrate through the harbour from rivers such as the Lee, Glashaboy, Owenboy and Owennacurra.

It is noted that Slatty Water is a small tidal inlet and it therefore does not have significant value in terms of the larger and more commercial fish species. However it does have the potential to support a variety of fish species including mullet, bass, flounder, common eel, gobies and blenny species. The presence of sluice gates may preclude salmon or sea trout from the area. The only species noted in the absence of dedicated fish surveys were mullet, which utilise the creek at low tide.

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## 5. Terrestrial ecology

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### 5.1 Methodology

Site visits were conducted in February and April 2007. All habitats were classified to level 3 of the classification scheme outlined in A Guide to Habitats in Ireland (Fossitt, 2000) and a list of the species on which the habitat classifications are based is included in **Appendix 4**. These habitats are also outlined on **Figure 1** in broad terms the habitat map is based on the methodology outlined in the British JNCC publication (1993) on Phase 1 habitat surveys. It should be noted that some of the habitats are transitional and where this occurs they are placed in the category they most resemble.

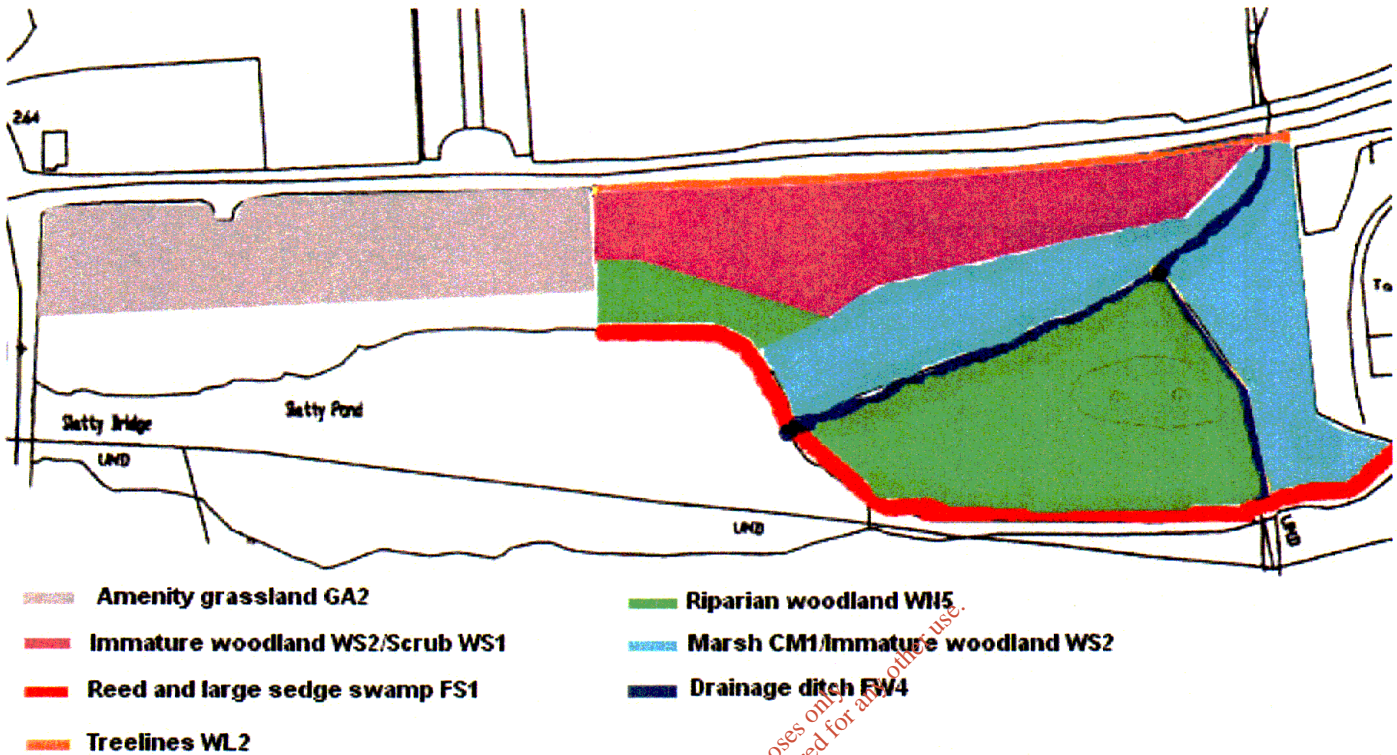
The areas to the west and east of the existing WWTP, the section of the discharge pipe located between the WWTP and Slatty Bridge are included in the candidate Special Area of Conservation (Great Island Channel site 001058) which is part of the Special Protected Area (Cork Harbour 004030).

### 5.2 Terrestrial Habitat types

The habitats listed below are shown on **Figure 1** and a list of the species detected is given in **Appendix.x**. The survey area was divided into the following habitat types:

- Riparian woodland WN5
- Marsh CM1/Immature woodland WS2
- Reed and large sedge swamp FS1.
- Amenity grassland GA2
- Drainage ditch FW4
- Treeline WL2

**Fig.1 Habitat Map. Areas overlap and are approximate. Not to scale.**



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**5.2.1 Riparian woodland WN5**

Within the vegetated area to the west of the existing treatment plant there is a low-lying area/island which is subject to frequent flooding. The dominant trees are willow and alder. It appears to be former grazing land which has been abandoned and trees are either immature or semi-mature. The diversity of plant species is generally high and includes typical species of wetland habitats including hemlock water dropwort, remote sedge, valerian, meadowsweet and early purple orchid.

**5.2.2 Marsh CM1/Immature woodland WS2**

These two habitat types form a mosaic within an area to the west of the existing WWTP. Generally the immature woodland occurs on drier areas where oak and ash are becoming established. These drier areas have an understorey of coarse and tussocky grasses such as cocksfoot and meadow foxtail. Areas of marsh support a mixture of common wetland species including meadowsweet and yellow flag. Wetter marsh areas adjacent to drainage ditches are gradually being colonised by riparian woodland species such as willow.



### **5.2.3 Immature woodland WS2/Scrub WS1 and Treelines WL2**

To the west of the existing treatment plant there is a strip of land between the roadside treeline and the wetter marsh area/riparian woodland. Ground levels along much of this strip have been raised by imported spoil/infill. This area is now overgrown and scrub is developing. Within this are there a number of planted trees (i.e. white poplar) and exotic species such as Cotoneaster species and red currant.

### **5.2.4 Reed and large sedge swamp FS1.**

This occurs on the southern and western boundaries proposed WWTP site. The reed beds fringe a small lake which discharges via sluice to Cork harbour. The dominant species is common reed although other typical species such as water mint and meadowsweet were also recorded.

### **5.2.5 Drainage ditch FW4**

Two drainage ditches cross through the area west of the existing treatment plant. They are both small and support limited amounts of typical wetland species such as hemlock water dropwort. However the ditches are of insufficient size to be of value for fisheries although they could conceivably support eels or stickleback. Due to the operation of the sluice gates at Slatty Bridge it is expected that both of these drains will back up and contribute to water-logging within the adjacent habitats.

### **5.2.6 Amenity grassland GA2**

The pipeline route will pass through an area of grassland between the extended treatment plant and Slatty Bridge. This area is dominated by common agricultural species with a car park area and planted trees.

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## 6. Mammals

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### 6.1 Otters

Otters are found around the Irish coast and utilise both freshwater and marine habitats. The following are considered to be indicators of otter activity:

1. Spraints and anal glands
2. Footprints and sign heaps
3. Runs or paths
4. Feeding sites and prey item remains
5. Couches (resting areas) and holts (tunnel systems).

No evidence of the presence of otters was found in the area to be directly affected. However signs of their presence were noted on the edge of the Slatty Water at Fota Island and otters will almost certainly use the lake upstream of the bridge. Otters can be found throughout Cork Harbour and previously the author has observed signs of otter on the upstream side of Slatty Bridge and to the east of the existing treatment plant.

### 6.2 Seals and cetaceans

Although individual grey and common seals have been recorded in Cork Harbour, the area outlined for development is not of value for seals. Cetaceans, such as pilot whales and killer whales, have been recorded in Cork Harbour and species such as bottlenose dolphin, common dolphin and harbour porpoise may also occur. However no cetacean species will habitually utilise this area.

### 6.3 Bats

Bats will feed along the woodland at the Fota side of the estuary and in proximity to the brackish lake habitat and the species most likely to occur are soprano and common pipistrelle, Leislars and brown long eared. The habitats to be removed are unlikely to be of significant value for bats although they may feed along woodland edge and along treelines. There are no large trees which would be of sufficient size to support significant bat roosts in the area to be affected. Thus no significant impact on bat roosts is expected to occur.

## 6.4 Badgers

Evidence of badger activity was noted on the Fota side of Slatty Waters in woodland. However this area will not be affected. The woodland directly affected by this development is wet and is therefore unsuitable for badger setts. No impact on this species is therefore expected to occur.

## 6.5 Other Mammals

Some rodent species are ubiquitous in the Irish countryside and both brown rat and field mouse are almost certainly present within hedges and scrub. The area directly to be affected is waterlogged and not of high value for other mammal species although fox may occur periodically.

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## 7. Birds

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### 7.1 Terrestrial/brackish lake habitat

The wet/woodland area which will be affected by the provision of the new WWTP is unlikely to support rare or uncommon species. However this habitat supports a variety of relatively common countryside birds including blackbird, wren, moorhen, great tit and rook all of which were noted. The lagoon and reedbed fringe and the agricultural land at the edge of the lake are utilised by a number of species including black-tailed godwits, curlews, wigeon, mute swans, shelduck, little grebe and teal. Green sandpipers and wood sandpipers occur periodically and American wigeon has been observed here in the past.

### 7.2 Slatty Waters

Parts of Cork Harbour including this area are extremely important for birds particularly during the winter period. A survey of birds in the area of mudflats to be affected by the development was carried out in April 2007 to determine usage of the site during the spring period. The full report is detailed in **Appendix 2**. The report makes the following conclusions:

**7.2.1** The observations made in April 2007 showed that the Slatty's Bridge mudflat is used as a feeding area and a high tide roost site by several species of wildfowl and waders. The main roost areas were at the north western end of the study site and along the southern bank. Species observed roosting in these areas included oystercatcher, black-tailed godwit, redshank, teal, shelduck and little egret.

7.2.2 At low tide, most feeding activity was focused on the area of exposed mudflats and the central channel that dissected the study area. Species utilising the mudflats and central channel for food included black-tailed godwit, oystercatcher, shelduck, redshank, greenshank, cormorant and curlew.

7.2.3 Although only one species was recorded in nationally important numbers (i.e. Black-tailed Godwit: >80 birds) during the April visits, the Slatty's Bridge mudflat may support greater numbers of birds at other times of year, such as the autumn passage, winter and the breeding season (i.e. May to July).

7.2.4 Most terrestrial species were recorded in small numbers along the northern and southern perimeters of the study site or in transit flying across the mudflat. The Hooded Crow was the only terrestrial bird species actively using the mudflat as a feeding site. All terrestrial species seen were typical of the habitats found on site.

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## 8. Impact of proposed development on flora and fauna

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### 8.1 Proposed development

The extension of the site of the WWTP will result in the complete removal of the habitat located to the west of the existing site. There will be no direct impact on the brackish lake. The pipeline route will affect low value habitats east of the Slatty Bridge and will run entirely through mudflats on the western side of the same bridge.

### 8.2 Ecological succession in the absence of development

It is expected that willow, alder woodland will continue to colonise the area to the west of the existing site. No significant changes in the status of the mud flats are expected to occur in the absence of this development.

### 8.3 Habitat values

The relative value of each habitat type is detailed in Table 1. It should be noted that the value of a habitat is site specific, and will be partially related to the amount of that habitat in the surrounding landscape. The classification scheme used in Table 1 for the value of habitats and the impacts on them is detailed in the NRA publication *Guidelines for assessment of ecological impacts of National Road Schemes* (NRA, 2006). This classification scheme is outlined in Appendix 3.

Table 10.1. Habitat and species values

Habitat Type/Species	Relative Habitat Value	Comments	Impacts
<p><b>Estuaries MW4 / Littoral (Intertidal) Mud shores LS4</b></p>	<p>Part of the Special Area of Conservation and Natural Heritage Area (Great Island Channel site 001058) and is part of the Special Protected Area (Cork Harbour 004030).</p> <p>This site is considered to be <b>Internationally Important (Category A)</b></p>	<p>Slatty Water is an important part of the network of bird habitats in Cork Harbour.</p>	<p>This habitat is of primary value for birds which feed on macroinvertebrates within the mudflats. Initial surveys indicate that macroinvertebrate diversity and density is relatively low close to the discharge point which may be due to the influence of freshwater and/or nutrient enrichment or toxic impacts in the past.</p> <p>The increase in population equivalent discharging to Slatty Water will increase the total nutrient loading over time despite the improved treatment standard. It is difficult to predict how this may impact on mudflat habitats given there may be significant nutrients already bound up in the sediments, the available dilution, the movement of the discharge point and large scale changes to nutrient levels in the harbour due to the main drainage scheme for Cork City and improvements to treatment standards at Midleton in recent years.</p> <p>It is also probable that the movement of the discharge point will allow much greater dispersal of nutrients and in a report prepared by HMRC for this EIS it was noted that <i>"The effect of any local nutrient enrichment within the confines of the Slatty Waters inlet is greatly ameliorated by the tidal exchange with Lough Mahon, which reduces the average water residence time in the Slatty Waters inlet. The tidal nature of the channel results in frequent changes of the water mass indicating that the receiving water in the channel is refreshed on a regular basis. As a result the concentrations of the dispersed effluent parameters are removed from the channel frequently."</i></p> <p>It is noted that that bird usage of the area is relatively high at present despite the existing discharge from Carrigtwohill. Overall it is expected that effective dispersal of treated wastewater from Carrigtwohill will prevent any significant changes in macroinvertebrate composition which would impact significantly on bird populations. However due to the difficulties associated with accurately predicting impacts on macroinvertebrate populations an ongoing monitoring programme is required.</p> <p>The provision of a discharge pipe will require the disturbance of the intertidal mudflats along the pipeline route. The discharge pipe can impact</p>

Habitat Type/Species	Relative Habitat Value	Comments	Impacts
			<p>on intertidal mudflats via removal of mud from the site and direct impacts on fauna living within the sediment. Loss of habitat will be reduced by maintaining the dredged sediment and using it to cover the discharge pipe. Therefore the loss of habitat will be limited to the volume occupied by the pipe. This is a small proportion of the overall habitat within the site. Fauna within dredged sediments will be killed if the sediment dries out. Some of the more mobile species such as polychaete worms will escape in such circumstances. Once work complete it is expected that the affected area will be recolonised relatively quickly.</p>
<p><b>Riparian Woodland WN5</b></p>	<p>Part of the Special Area of Conservation and Natural Heritage Area (Great Island Channel site 001058) and is part of the Special Protected Area (Cork Harbour 004030). Overall this part of Cork Harbour is considered to be <b>Internationally Important (Category A)</b></p>	<p>The designated areas include the wooded area to the west of the existing WWTP. Although this area is designated, it is a small part of a much larger site. This habitat though of local interest is of considerably less value than the estuarine habitats which form the bulk of the designated site.</p>	<p>No rare species were detected in this habitat however it is part of a mosaic of habitats including reedbeds, brackish lake and watercourse. The total area to be affected is approximately 2.33 ha and in this area vegetation will be completely removed.</p> <p>Overall despite its designation the site is considered to be of moderate, local value and is not of particular value in the context of the cSAC/SPA. Any impact on a designated cSAC/SPA under the NRA classification scheme is classed as severe and negative.</p>
<p><b>Marsh CM1/Immature woodland WS2</b></p>	<p>Part of the Special Area of Conservation (Great Island Channel site 001058) and is part of the</p>	<p>Moderate range of species noted although none were rare or uncommon. This habitat is evolving into woodland. Part of a mosaic of habitats with</p>	<p>This area will be removed by the development of the WWTP. Overall this habitat is of local value and the impact of its removal is not considered to be of high significance. Any impact on a designated cSAC/SPA under the NRA classification scheme is classed as severe and negative.</p>

Habitat Type/Species	Relative Habitat Value	Comments	Impacts
	<p>Special Protected Area (Cork Harbour 004030). Overall this part of Cork Harbour is considered to be <b>Internationally Important (Category A)</b></p>	<p>riparian woodland and reedbeds</p>	
<p><b>Reed and large sedge swamp FS1.</b></p>	<p>Part of the Special Area of Conservation (Great Island Channel site 001058) and is part of the Special Protected Area (Cork Harbour 004030). Overall this part of Cork Harbour is considered to be <b>Internationally Important (Category A)</b></p>	<p>Relatively uniform with a low diversity of plant species. However this fringe of reedbed does form a buffer zone at the edge of the lake and may be used by nesting birds and otters.</p>	<p>The extension of the WWTP site will result in the removal of a small proportion of this habitat which is considered of moderate, local value. Overall this habitat is of local value and the impact of its removal is not considered to be of high significance. Any impact on a designated cSAC/SPA under the NRA classification scheme is classed as severe and negative.</p>
<p><b>Drainage ditch FW4</b></p>	<p>Part of the Special Area of Conservation (Great Island Channel site</p>	<p>Small and with no significant fisheries value.</p>	<p>This habitat is of moderate local value and is not an important component of the cSAC. Any impact on a designated cSAC/SPA under the NRA classification scheme is classed as severe and negative.</p>

Habitat Type/Species	Relative Habitat Value	Comments	Impacts
	001058) and is part of the Special Protected Area (Cork Harbour 004030). Overall this part of Cork Harbour is considered to be <b>Internationally Important (Category A)</b>		
<b>Amenity grassland GA2</b>	Part of the Special Area of Conservation (Great Island Channel site 001058) and is part of the Special Protected Area (Cork Harbour 004030). Overall this part of Cork Harbour is considered to be <b>Internationally Important (Category A)</b>	Low value habitat with some planted trees and small areas of scrub.	The pipeline route will pass through this habitat which is of low local value despite its inclusion within the designated site boundary. Any impact on a designated cSAC/SPA under the NRA classification scheme is classed as severe and negative.

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#### 8.4 Impacts on Mammals

Noise impacts are likely to be significant during the construction phase, which will involve the dredging of a trench. However it is noted that due to the presence of existing roads this is already a high noise environment. There is no



evidence to suggest that otters breed within the area to be affected, although they do occur within this area. Due to the current high levels of traffic noise some habituation to increased noise levels is likely for resident species. In this context the increase in noise levels is unlikely to have a significant impact. Otters are highly mobile and can move quickly away from external disturbance. It is not expected that the discharge will have a significant impact on this species.

Evidence of badgers was noted in woodland at the Fota side of Slatty Water. However given the distance between this area and the works any significant impact is considered highly unlikely.

### **8.5 Direct impacts on birds**

The removal of vegetation will result in a net loss of habitat within the woodland/scrub/marsh habitat located to the west of the site. It is not expected that the development will significantly impact on reedbed habitats.

As detailed in this report and in the site synopsis the area into which the pipe will discharge is of extremely high value for birds and in particular for wintering populations of waterfowl. Any works during the wintering period (approximately October to March) will have a negative impact on birds and therefore will be avoided.

### **8.6 Indirect impacts on birds**

The birds, which feed on the mudflats, are reliant on populations of macroinvertebrates as a food source. Any changes to the density and distribution of macroinvertebrates could potentially impact on bird populations. The low diversity of macro-invertebrates within at least part of the habitat to be affected and the anoxic appearance of mud samples may be indicative of habitat deterioration. Due to the complexity of the estuarine environment and changes in discharges elsewhere in the harbour the impact of an increased discharge is hard to determine. It is also noted that the use of the marine macroinvertebrates as indicators of eutrophication/toxic impacts can be unreliable.

Although I-WeBS bird counts do cover this area of Cork Harbour the counts at Slatty Water have been included in the overall counts for Slatty Water/ Glounthane since 2003. Thus it is not possible to determine if localised changes in bird distribution have occurred in recent years.

Based on the comments outlined above an accurate prediction of possible impacts on birds is difficult. Therefore it is recommended therefore that detailed monitoring be carried out on an ongoing basis.

### **8.7 Fish**

Although some fish such as mullet utilise the creek at low tide, most fish species utilising this area are likely to be present at high tide. Due to the presence of sluice gates the creek is not an important migratory route for sensitive salmonids such as sea-trout and salmon. Significant dilution at this stage of the tide should prevent any direct impact on fish from high nutrient loadings. Indirect effects on macroinvertebrates could conceivably impact on fish by reducing prey availability. Although it is difficult to accurately predict this impact it is not expected to be significant.

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## 9. Mitigation measures

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Any works which impact on estuarine habitats during the wintering period (approximately October to March) will have a negative impact on the local bird community and therefore will be avoided. Works should be confined to the period from June to August.

Due to the difficulties associated with predicting the effect of increased nutrient loadings on the nutrient status of estuarine mudflats it is recommended that detailed monitoring of nutrient levels, macroinvertebrates and wintering birds be carried out. The results of these surveys should be considered in tandem with available I-WeBS data to accurately determine if changes detrimental to the ecology of the area are occurring. Initially accurate baseline winter data should be obtained with surveys repeated every two years until 4 years after the plant reaches its full capacity.

If feasible, scope should be provided within the design of the treatment plant to upgrade the treatment standard and/or move the discharge point should survey results indicate that important bird populations are being adversely affected.

Removal of natural vegetation and in particular reedbeds which fringe the brackish lake should be kept to a minimum. To prevent incidental damage by machinery or by the deposition of spoil, it is recommended that habitats earmarked for retention be securely fenced early in the development process. The fencing should be clearly visible to machine operators. No work should take place outside the lands made available for construction, and all materials and liquids associated with the work should be stored in a manner that will not result in pollution or habitat deterioration. Particular care should be taken at the boundary between the development site and the cSAC, SPA and pNHA and so that construction activities do not cause damage to habitats in this area. Consultation should be undertaken with National Parks & Wildlife Service with regard to the nature of proposed works along this boundary.

During construction, siltation of water bodies must be minimized by the appropriate use of settlement ponds, silt traps and bunds particularly during any diversion of the drainage ditches currently running through the site. Grit interceptors will also be put in place, as appropriate, to control pollution and run off.

The cSAC and SPA bordering the development area are, by definition, nationally important for their habitats and the species they support. *It is essential* that all construction staff, including all sub-contracted workers, be notified of the boundaries of the cSAC and SPA and be made aware that no construction waste of any kind (rubble, soil, etc.) is to be deposited in these protected areas outside the landtake area and that care must be taken with liquids or other materials to avoid spillage. A Construction and Demolition Waste Management Plan will be developed for the site, with particular emphasis placed on preventing any materials being palced in the pNHA, cSAC and SPA.

The Wildlife Amendment Act 2000 (S.46.1) provides that it is an offence to cut, grub, burn or destroy any vegetation on uncultivated land or such growing in any hedge or ditch from the 1<sup>st</sup> of March to the 31<sup>st</sup> of August. Exemptions include the clearance of vegetation in the course of road or other construction works or in the development or preparation of sites on which any building or other structure is intended to be provided. None the less it is recommended that vegetation be removed outside of the breeding season where possible. In particular, removal during the peak-breeding season (March-June) should be avoided. If possible, boundary hedges should be retained and enhanced. Any trees or hedgerows scheduled for retention should be protected from damaging construction activities by the erection of appropriate fencing. NRA guidelines on the protection of trees and hedges prior to and during construction should be followed (NRA, 2006).

Where feasible, within the scope of the development, landscaping should replace some of the native species, which have been removed. Landscaping proposals are detailed in Chapter 11 of the EIS. It is recommended that new hedgerows be planted as soon as possible to connect with existing hedgerows in the wider environment. Where practicable, the boundary landscape planting should be predominantly of Irish native species that reflect the existing vegetation of the area. It is recommended that the final landscape plans are designed in consultation with a qualified ecologist.

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## 9. Residual impacts

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Overall there will be a net loss of designated terrestrial habitats. No long-term significant impact on otters and bats is likely to occur. After construction, benthic communities should recolonise disturbed estuarine areas, with an accompanying re-establishment of fish in these areas. The increased nutrient levels could impact on the distribution of macroinvertebrate populations which in turn could impact on populations of birds and fish. However it is expected that effective dispersal of nutrients will occur.

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## Appendix 1: Description of Designated Areas

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### SITE NAME: CORK HARBOUR SPA SITE CODE: 004030

Cork Harbour is a large, sheltered bay system, with several river estuaries - principally those of the Rivers Lee, Douglas and Owenacurra. The SPA site comprises most of the main intertidal areas of Cork Harbour, including all of the North Channel, the Douglas Estuary, inner Lough Mahon, Lough Beg, Whitegate Bay and the Rostellan inlet.

Owing to the sheltered conditions, the intertidal flats are often muddy in character. These muds support a range of macro-invertebrates, notably *Macoma balthica*, *Scrobicularia plana*, *Hydrobia ulvae*, *Nephtys hombergi*, *Nereis diversicolor* and *Corophium volutator*. Green algae species occur on the flats, especially *Ulva lactuca* and *Enteromorpha* spp. Cordgrass (*Spartina* spp.) has colonised the intertidal flats in places, especially where good shelter exists, such as at Rossleague and Belvelly in the North Channel. Salt marshes are scattered through the site and these provide high tide roosts for the birds. Salt marsh species present include Sea Purslane (*Halimione portulacoides*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Common Saltmarsh-grass (*Puccinellia maritima*), Sea Plantain (*Plantago maritima*), Lax-flowered Sea-lavender (*Limonium humile*) and Sea Arrowgrass (*Triglochin maritima*). Some shallow bay water is included in the site. Cork Harbour is adjacent to a major urban centre and a major industrial centre. Rostellan lake is a small brackish lake that is used by swans throughout the winter. The site also includes some marginal wet grassland areas used by feeding and roosting birds.

Cork Harbour is an internationally important wetland site, regularly supporting in excess of 20,000 wintering waterfowl, for which it is amongst the top five sites in the country. The five-year average annual core count for the entire harbour complex was 34,661 for the period 1996/97-2000/01. Of particular note is that the site supports an internationally important population of Redshank (1,614) - all figures given are average winter means for the 5 winters 1995/96-1999/00. A further 15 species have populations of national importance, as follows: Great Crested Grebe (218), Cormorant (620), Shelduck (1,426), Wigeon (1,750), Gadwall (15), Teal (807), Pintail (84), Shoveler (135), Red-breasted Merganser (90), Oystercatcher (791), Lapwing (3,614), Dunlin (4,936), Black-tailed Godwit (412), Curlew (1,345) and Greenshank (36). The Shelduck population is the largest in the country (9.6% of national total), while those of Shoveler (4.5% of total) and Pintail (4.2% of total) are also very substantial. The site has regionally or locally important populations of a range of other species, including Whooper Swan (10), Pochard (145), Golden Plover (805), Grey Plover (66) and Turnstone (99). Other species using the site include Bat-tailed Godwit (45), Mallard (456), Tufted Duck (97), Goldeneye (15), Coot (77), Mute Swan (39), Ringed Plover (51), Knot (31), Little Grebe (68) and Grey Heron (47). Cork Harbour is an important site for gulls in winter and autumn, especially Common Gull (2,630) and Lesser Black-backed Gull (261); Black-headed Gull (948) also occurs.

A range of passage waders occur regularly in autumn, including Ruff (5-10), Spotted Redshank (1-5) and Green Sandpiper (1-5). Numbers vary between years and usually a few of each of these species over-winter. The wintering birds in Cork Harbour have been monitored since the 1970s and are counted annually as part of the I-WeBS scheme.

Cork Harbour has a nationally important breeding colony of Common Tern (3-year mean of 69 pairs for the period 1998-2000, with a maximum of 102 pairs in 1995). The birds have nested in Cork Harbour since about 1970, and since 1983 on various artificial structures, notably derelict steel barges and the roof of a Martello Tower. The birds are monitored annually and the chicks are ringed.

Extensive areas of estuarine habitat have been reclaimed since about the 1950s for industrial, port-related and road projects, and further reclamation remains a threat. As Cork Harbour is adjacent to a major urban centre and a major industrial centre, water quality is variable, with the estuary of the River Lee and parts of the Inner Harbour being somewhat eutrophic. However, the polluted conditions may not be having significant impacts on the bird populations. Oil pollution from shipping in Cork Harbour is a general threat. Recreational activities are high in some areas of the harbour, including jet skiing which causes disturbance to roosting birds.

Cork Harbour has is of major ornithological significance, being of international importance both for the total numbers of wintering birds (i.e. > 20,000) and also for its population of Redshank. In addition, there are at least 15 wintering species that have populations of national importance, as well as a nationally important breeding colony of Common Tern. Several of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Whooper Swan, Golden Plover, Bar-tailed Godwit, Ruff and Common Tern. The site provides both feeding and roosting sites for the various bird species that use it.

**SITE NAME: GREAT ISLAND CHANNEL SITE CODE: 001058**

The Great Island Channel stretches from Little Island to Midleton, with its southern boundary being formed by Great Island. It is an integral part of Cork Harbour which contains several other sites of conservation interest. Geologically, Cork Harbour consists of two large areas of open water in a limestone basin, separated from each other and the open sea by ridges of Old Red Sandstone. Within this system, Great Island Channel forms the eastern stretch of the river basin and, compared to the rest of Cork Harbour, is relatively undisturbed. Within the site is the estuary of the Owennacurra and Dungourney Rivers. These rivers, which flow through Midleton, provide the main source of freshwater to the North Channel.

The main habitats of conservation interest are the sheltered tidal sand and mudflats and Atlantic salt meadows, both habitats listed on Annex I of the EU Habitats Directive. Owing to the sheltered conditions, the intertidal flats are composed mainly of soft muds. These muds support a range of macro-invertebrates, notably *Macoma balthica*, *Scrobicularia plana*, *Hydrobia ulvae*, *Nephtys hombergi*, *Nereis diversicolor* and *Corophium volutator*. Green algal species occur on the flats, especially *Ulva lactuca* and *Enteromorpha* spp. Cordgrass (*Spartina* spp.) has colonised the intertidal flats in places, especially at Rossleague and Belvelly. The salt marshes are scattered through the site and are all of the estuarine type on mud substrate. Species present include Sea Purslane (*Halimione portulacoides*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Common Saltmarsh-grass (*Puccinellia maritima*), Sea Plantain (*Plantago maritima*), Greater Sea-spurry (*Spergularia media*), Sea Lavender (*Limonium humile*), Sea Arrowgrass (*Triglochin*

*maritimum*), Mayweed (*Matricaria maritima*) and Red Fescue (*Festuca rubra*). The site is extremely important for wintering waterfowl and is considered to contain three of the top five areas within Cork Harbour, namely North Channel, Harper's Island and Belvelly-Marino Point. Shelduck are the most frequent duck species with 800-1000 birds centred on the Fota/Marino Point area. There are also large flocks of Teal and Wigeon, especially at the eastern end. Waders occur in the greatest density north of Rosslare, with Dunlin, Godwit, Curlew and Golden Plover the commonest species. A population of about 80 Grey Plover is a notable feature of the area. All the mudflats support feeding birds; the main roost sites are at Weir Island and Brown Island and to the north of Fota at Killacloyne and Harper's Island. Ahanesk supports a roost also but is subject to disturbance. The numbers of Grey Plover and Shelduck, as given above, are of national importance. The site is an integral part of Cork Harbour which is a wetland of international importance for the birds it supports.

Overall, Cork Harbour regularly holds over 20,000 waterfowl and contains internationally important numbers of Black-tailed Godwit (1,181) and Redshank (1,896) along with Nationally important numbers of nineteen other species. Furthermore, it contains the large Dunlin (12,019) and Lapwing (12,528) flocks. All counts are average peaks, 1994/95 – 1996/97. Much of the site forms part of Cork Harbour Special Protection Area, an important bird area designated under the EU Birds Directive.

While the main land use within the site is aquaculture (Oyster farming), the greatest threats to its conservation significance come from road works, infilling, sewage outflows and possible marina developments.

The site is of major importance for the two habitats listed on the EU Habitats Directive that it contains, as well as for its important numbers of wintering waders and wildfowl. It also supports a good invertebrate fauna.

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## Appendix 2: Carrigtwohill Bird Survey

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# Baseline Spring Bird Surveys at Slatty's Bridge mudflat, Co. Cork

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## Introduction

A baseline spring bird assessment of a mudflat site that lies to the west of Slatty's Bridge, Co. Cork was carried out by Mick Mackey at the request of DixonBrosnan Environmental Consultants.

The aim of the survey was to assess the bird species likely to occur in the area during the early spring period. The bird survey forms part of an ecological assessment of the mudflat as a proposed site for the instalment of a wastewater outfall pipeline, as part of the Carrigtwohill Sewerage Scheme.

## Location

The study site is a tidal mudflat located to the west of Slatty's Bridge, along the northern bank of Fota Island, Co. Cork. The eastern limit of the study area is marked by Slatty's Bridge, the northern edge abuts the Midleton Road and the western boundary lies north of the Nursery Wood. The location of the proposed outfall pipeline lies in the central channel, which actively flows at low tide. The total study site area is approximately 4 ha.

## Methodology

All species were counted using the "look-see" method employed by the Irish Wetland Bird Survey (I-WeBS) (Bibby *et al.*, 1992; Colhoun, 2001). Observers using this method count the number of individuals of each species present in a predetermined study area.

Site visits were made on 1<sup>st</sup>, 2<sup>nd</sup>, 13<sup>th</sup> and 14<sup>th</sup> April 2007. The visits on 1<sup>st</sup>, 13<sup>th</sup> and 14<sup>th</sup> April were made at low tide to assess what areas around the site were used as feeding areas for waders and wildfowl. The visit on 2<sup>nd</sup> April was made at high tide to establish what areas of the site are used by roosting waders and wildfowl. On each visit, counts of wildfowl, waders and gulls were made at a series of points along the northern boundary of the tidal mudflat using a combination of binocular (*Leica* 10x42) and telescope (*Swarovski* HD, fitted with a 20x - 60x eyepiece) scans.

In addition, a list of terrestrial species of birds encountered on all four visits was also recorded. All parts of the site were walked and all species seen or heard were recorded. Bird identification follows Mullarney *et al* (1999).

## Weather

The weather encountered during the first three site visits was sunny and clear with good visibility and light, variable winds, force 1 to 2. The weather on the final site survey was overcast and dull with light variable wind, force 1 to 2.

**Figure 1.**  
pipeline.

**Study site for the proposed Carrigtohill Sewerage Scheme outfall**

Results

Survey of tidal area around site

Fifteen species of wildfowl, waders and gulls were noted during the four counts over the tidal mudflat survey site (Table 2.1). Highest species diversity was recorded during the first low tide visit, when 14 species were recorded, compared to 10 species and 9 species over the remaining respective low tide counts. Seven wader and wildfowl species were encountered during the solitary high tide visit. The Little Egret was the only Annex I species of the EU Birds Directive (79/409/EEC) encountered. The Little Egret was observed during each site visit, with the highest number of four being recorded during the second low tide count. The Black-tailed Godwit was the only species recorded in nationally important numbers (i.e. >80 birds). This level was surpassed during each of the low tide surveys and was almost breached during the high tide count. No species were recorded in internationally important numbers in April 2007 (Colhoun, 2001).

**Table 2.1 Total numbers of wildfowl, waders and gulls recorded at the study site, April 2007.**

Species	01/04/07	02/04/07	13/04/07	14/04/07
	Low tide	High tide	Low tide	Low tide
Cormorant	2	1	1	0
Little Egret	3	1	4	1
Grey Heron	1	0	0	0
Shelduck	18	10	8	8
Mallard	2	0	0	2
Wigeon	5	0	0	0
Teal	52	70	21	11
Oystercatcher	9	35	15	30
Redshank	42	31	4	6
Greenshank	3	0	1	0
Black-tailed Godwit	121	75	129	153
Curlew	3	0	0	0
Black-headed Gull	2	0	0	1
Common Gull	7	0	4	0
Great black-backed Gull	0	0	2	2

## Species accounts

### **Cormorant** *Phalacrocorax carbo*

The cormorant is a widespread, commonly encountered seabird that prefers shallow inshore waters. This fishing-eating species was recorded in low numbers during the first three site surveys. At low tides, the cormorant was observed feeding in the central channel towards the eastern end and the centre of the study site. One individual was also observed collecting nesting material during a low tide.

### **Little Egret** *Egretta garzetta*

The Little Egret is a species that has shown a marked increase in local breeding numbers since 1997 (Smiddy, 2002). A total of nine birds were recorded during the study period. At low tides, the Little Egret was observed feeding in close association with the central channel in the eastern half of the study area. At high tide, a single bird was noted roosting along the southern bank of the mudflat.

### **Grey Heron** *Ardea cinerea*

The Grey Heron is a very distinctive species that inhabit estuaries and sea loughs. A single bird was observed feeding in the central channel towards the eastern boundary on the first low tide site assessment.

### **Shelduck** *Tadorna tadorna*

Shelduck are commonly encountered on mudflats where they feed on mud snails and worms (Batten *et al.*, 1990). This large, brightly coloured duck displays day-to-day fluctuations in numbers due to continued immigration and emigration of birds from moulting areas to wintering regions (Murphy *et al.*, 2006). Shelduck were encountered in low to moderate numbers on all four site visits. During the high tide, ten birds were noted roosting along the southern bank, in the eastern half of the mudflat. During the low tides Shelduck were distributed evenly through the study site feeding over the open area of the mudflat. A few birds were also observed sleeping along the central channel in close association with Teal and Black-tailed Godwits.

### **Mallard** *Anas platyrhynchos*

Mallard are one of the most familiar and widespread duck species of the northern hemisphere. Two male-female pairs were observed during two separate low tide site visits. Both pairs were swimming along the central channel close to Slatty's Bridge.

### **Wigeon** *Anas Penelope*

Wigeon are a highly migratory species that winter in Ireland and Britain from their Russian breeding grounds (Murphy *et al.*, 2006). A group of five birds were observed flying west across the mudflat during the first site visit.

### **Teal** *Anas crecca*

Teal frequent areas of shallow water on estuaries and mudflats where they feed on seeds of aquatic plants and small invertebrates such as chironomid larvae and snails (Batten *et al.*, 1990). Teal that winter in Ireland are known to breed in Iceland (Prater, 1981). The largest concentrations of Teal were observed during the low and high tide site visits of the first week (Table 2.1). The majority of the initial low tide birds were located along the central channel at the eastern end of the mudflat. The behaviour included feeding, sleeping, preening and bathing. The 70 birds observed during the high tide were initially observed roosting along the southern bank before they flew as two separate flocks to the waters of the study site's central region. The lower numbers recorded during the final two low tide visits may be due to emigration of birds to their Icelandic breeding grounds.

### **Oystercatcher** *Haematopus ostralegus*

Oystercatchers are ubiquitous coastal birds that feed on molluscs and ragworms (Batten et al., 1990). Oystercatchers were observed in varying numbers on all four site visits (Table 2.1), with the highest numbers being recorded roosting with Black-tailed Godwits on the northern bank at the western end of the mudflat. Low tide observations were largely made in the western half of the study site, where feeding birds were sparsely distributed across the mudflat, in the company of Black-tailed Godwits.

#### **Redshank** *Tringa totanus*

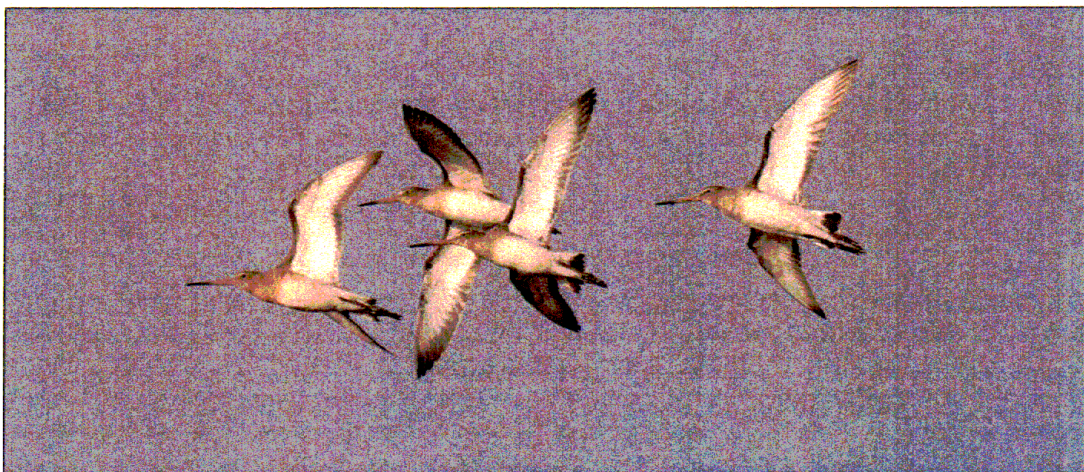
Redshanks are relatively short-distance migrants, whose feeding range extends higher up the shore than most other waders. The majority of Redshank observed during the first low tide site visit were recorded feeding along the northern bank of the mudflat down to the central channel. The high tide assessment reported Redshank roosting along the southern perimeter, towards the eastern half of the mudflat. The sudden reduction in Redshank numbers observed during the final two site visits may be due to the emigration of birds to northern breeding grounds.

#### **Greenshank** *Tringa nebularia*

Greenshanks are passage migrants and winter visitors that feed chiefly on small invertebrates and small fish (Batten *et al.*, 1990; Irish Rare Birds Committee, 1998). Four Greenshanks were observed during low tide visits, feeding along the central channel towards the eastern half of the mudflat.

#### **Black-tailed Godwit** *Limosa limosa*

Cork Harbour holds the largest flocks of wintering Black-tailed Godwits in Ireland (Hutchinson & O'Halloran, 1984). Black-tailed Godwits (Plate 1) were the most numerous species encountered during the April site visits, with figures exceeding nationally important levels (>80 birds) during each of the three low tide assessments (Table 2.1). Prater (1981) suggests that the April peak in Black-tailed Godwit numbers may be due to passage migrants from England, France and Iberia stopping over in Ireland before moving on to their Icelandic breeding grounds. Low tide assessments saw large numbers of Black-tailed Godwit feeding over the exposed mudflat throughout the study area. Other birds were also recorded sleeping and preening at low tide along the central channel towards the eastern half of the mudflat. Similar behaviour patterns were observed by Hutchinson & O'Halloran (1994). The high tide survey reported 75 birds roosting in the company of Oystercatchers on a rocky bank at the north western end of the site. The lower number noted during high tide indicates that the Black-tailed Godwit are using roosting sites outside of the study area (Hutchinson & O'Halloran, 1984).



**Plate 1. Black-tailed Godwits were the most numerous species observed during the April site assessments (© Mick Mackey, 2007).**

#### **Curlew** *Numenius arquata*

Curlew are a resident species regularly found in intertidal habitats, river valleys, damp pasture, heaths and in fields of arable crops where they feed on a wide range of medium to large invertebrates (Prater, 1981; Batten *et al.*, 1990). Three Curlew were observed during the first site assessment feeding on the mudflat region of the study site and subsequently flying southeast.

#### **Black-headed Gull *Larus ridibundus***

Black-headed Gulls are the most commonly encountered gull species in central Cork, along the River Lee. Three birds were observed scanning the mudflat area during low tide.

#### **Common Gull *Larus canus***

Common Gulls (also known as Mew Gulls) are characteristic birds of inland pastures (Prater, 1981). This medium sized gull has spread in Ireland both as breeding bird and winter visitor since 1900 (Whilde, 1984). Eleven birds were observed roosting on a vegetative bank at the north western end of the study site during the first two low tide assessments.

#### **Great Black-backed Gull *Larus marinus***

Great Black-backed Gulls are the largest and most aggressive gull species in Ireland. Two adult-juvenile pairs were observed on separate occasions during the final two low tide assessments standing a grassy bank of the mudflat's north western edge.

Main areas of bird activity at Slatty's Bridge mudflat

#### **Exposed mudflats**

The exposed mudflats were used at low tides as feeding areas for Black-tailed Godwits, Oystercatcher, Shelduck, Curlew, Redshank and Greenshank. The western half of the study site appeared to support higher levels of feeding activity over the mudflats. Nationally important numbers of Black-tailed Godwit were observed utilising the mudflats as a feeding site during all three low tide assessments.

#### **Central Channel**

The central channel that dissects the study site was used by several species as a feeding site, as well as a site for preening, bathing and resting activities. The eastern end of the central channel supported the lion's share of activity. At low tide this area was used by Teal, Little Egret, Grey Heron, Cormorant, Shelduck, Mallard, Black-tailed Godwit and Oystercatcher.

#### **Southern Bank**

At high tide, the southern bank was used as a roosting site for Teal, Shelduck, Little Egret and Redshank.

#### **North Western Bank**

At high tide the north western bank was used as a roosting site for Black-tailed Godwit and Oystercatcher. This area was also used at low tide as a resting site by the three gull species observed during the study.

### Terrestrial species within the site

Eight terrestrial bird species were recorded within the survey site (Table 2.2), with the majority of the birds being recorded in association with the vegetation along the northern and southern edges of the study site. The Hooded Crow was the only terrestrial bird species observed in direct contact with the mudflat region of the study site, where they were observed feeding during low tide site visits.

**Table 2.2. Terrestrial bird species recorded within the study site**

Species	Latin Name	Number recorded
Wood Pigeon	<i>Columba palumbus</i>	1
Pied Wagtail	<i>Motacilla alba</i>	4
Wren	<i>Troglodytes troglodytes</i>	1
Blue tit	<i>Parus caeruleus</i>	2
Blackbird	<i>Turdus merula</i>	5
Magpie	<i>Pica pica</i>	2
Rook	<i>Corvus frugilegus</i>	28
Hooded Crow	<i>Corvus corone</i>	7

### Conclusions

#### Waders & waterfowl in tidal areas

The observations made in April 2007 showed that the Slatty's Bridge mudflat is used as a feeding area and a high tide roost site by several species of wildfowl and waders. The main roost areas were at the north western end of the study site and along the southern bank. Species observed roosting in these areas included Oystercatcher, Black-tailed Godwit, Redshank, Teal, Shelduck and Little Egret.

At low tide, most feeding activity was focused on the area of exposed mudflats and the central channel that dissected the study area. Species utilising the mudflats and central channel for food included Black-tailed Godwit, Oystercatcher, Shelduck, Redshank, Greenshank, Cormorant and Curlew.

Although only one species was recorded in nationally important numbers (i.e. Black-tailed Godwit: >80 birds) during the April visits, the Slatty's Bridge mudflat may support greater numbers of birds at other times of year, such as the autumn passage, winter and the breeding season (i.e. May to July).

#### Terrestrial birds

Most terrestrial species were recorded in small numbers along the northern and southern perimeters of the study site or in transit flying across the mudflat. The Hooded Crow was the only terrestrial bird species actively using the mudflat as a feeding site. All terrestrial species seen were typical of the habitats found on site.

#### Summary of impacts

The detrimental impacts of human activities on estuaries, such as pollution, enrichment, reclamation, disturbance, fisheries, leisure activities, have been well documented (Prater, 1981; Batten *et al.*, 1990; Nairn *et al.*, 1995; Smiddy *et al.*, 1995; Boelens *et al.*, 1999). The main potential impacts resulting from the instalment of a wastewater outflow pipeline at the site would be reclamation, disturbance and subsequent pollution and enrichment.

### Reclamation & Disturbance

Lewis *et al.* (2002) and Lewis *et al.* (2003) looked at the impacts of a pipeline construction on estuarine benthic invertebrate communities and the associated response of estuarine birds in Clonakilty Bay, West Cork. They concluded that although the pipeline construction did impact on the invertebrate community at the time of disturbance, a gradual recolonisation of some species in the study was observed after 6 months (Lewis *et al.*, 2002). The recolonization of an important prey species for waders, *Scrobicularia plana*, showed a recovery after 1 year attributable mainly to settlement of juveniles, but with some evidence of passive or active dispersal by adults. While lower numbers of foraging birds were recorded in the winter following construction, numbers of diurnally roosting birds in the same area increased (Lewis *et al.*, 2003). They go on to suggest that if habitat displacement is coupled with other sources of disturbance, during times of stress (e.g. during late summer when birds are in the process of moulting) the cumulative effect may impact more strongly.

### Pollution & Sediment Enrichment

Increased nutrient concentrations due to discharge loadings will result in increased primary productivity and subsequent secondary productivity (i.e. algal and invertebrate production respectively). Overloading a system with nutrients may encourage the growth of *Enteromorpha* to such an extent that when the plants decay in winter the mud becomes deoxygenated and significantly reduces the diversity or abundance of other plants and invertebrate foods for birds (Prater, 1981). Acute or chronic poisoning of a system can occur when pesticides, heavy metals and other industrial pollutants are introduced via wastewater discharges (Batten *et al.*, 1990).

### Recommendations

Cork Harbour is considered to be an Important Bird Area (IBA) that regularly supports over 20,000 waders and waterfowl (Heath & Evans, 2000). Slatty's Bridge mudflat appears to be of great importance during April as a feeding and roosting site for migratory wader and waterfowl species such as Teal, and spring passage migrants such as Black-tailed Godwit. However, the mudflat appears to be of minimal importance to gulls and terrestrial bird species during April. To gain a true idea of the real importance of the Slatty's Bridge mudflat for autumn passage migrants and wintering populations of waders and waterfowl, a comprehensive series of surveys should be conducted between September and January. It would appear that the study area is of lower importance during the spring-summer period. However, it would be useful to conduct a breeding bird survey prior to any development between May and July to determine what species are breeding within the site.

If the area is found to be of significant importance to wintering populations and passage migrants, then any impacts resulting from reclamation and disturbance could be reduced by concentrating development of the site during between June and July.

The negative effects from pollution and sediment enrichment from the subsequent outflow can be minimised by adequate water treatment prior to discharge. Discharging during high tide will also minimise the effects attributable to nutrient-rich effluents.

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## Appendix 3. Site evaluation scheme

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Rating	Qualifying criteria
<b>A</b>	<b>Internationally important</b> Sites designated (or qualifying for designation) as SAC* or SPA* under the EU Habitats or Birds Directives. Undesignated sites containing good examples of Annex I <u>priority</u> habitats under the EU Habitats Directive. Major salmon river fisheries. Major salmonid (salmon, trout or char) lake fisheries.
<b>B</b>	<b>Nationally important</b> Sites or waters designated or proposed as an NHA* or statutory Nature Reserves. Undesignated sites containing good examples of Annex I habitats (under EU Habitats Directive). Undesignated sites containing <u>significant numbers</u> of resident or regularly occurring populations of Annex II species under the EU Habitats Directive or Annex I species under the EU Birds Directive or species protected under the Wildlife (Amendment) Act 2000. Major trout river fisheries. Water bodies with major amenity fishery value. Commercially important coarse fisheries.
<b>C</b>	<b>High value, locally important</b> Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or significant populations of locally rare species. Small water bodies with known salmonid populations or with good potential salmonid habitat. Sites containing <u>any</u> resident or regularly occurring populations of Annex II species under the EU Habitats Directive or Annex I species under the EU Birds Directive. Large water bodies with some coarse fisheries value.
<b>D</b>	<b>Moderate value, locally important</b> Sites containing some semi-natural habitat or locally important for wildlife. Small water bodies with some coarse fisheries value or some potential salmonid habitat. Any water body with unpolluted water (Q-value rating 4-5).
<b>E</b>	<b>Low value, locally important</b> Artificial or highly modified habitats with low species diversity and low wildlife value. Water bodies with no current fisheries value and no significant potential fisheries value.

\*SAC = Special Area of Conservation  
SPA= Special Protection Area  
NHA= Natural Heritage Area

### Criteria for assessing impact significance

**(a) Terrestrial habitats**

Impact level	Site category*				
	A sites Internationally important	B sites Nationally important	C Sites High value, locally important	D sites Moderate value, locally important	E sites Low value, locally important
<b>Severe negative</b>	Any permanent impacts	Permanent impacts on a large part of a site			
<b>Major negative</b>	Temporary impacts on a large part of a site	Permanent impacts on a small part of a site	Permanent impacts on a large part of a site		
<b>Moderate negative</b>	Temporary impacts on a small part of a site	Temporary impacts on a large part of a site	Permanent impacts on a small part of a site	Permanent impacts on a large part of a site	
<b>Minor negative</b>		Temporary impacts on a small part of a site	Temporary impacts on a large part of a site	Permanent impacts on a small part of a site	Permanent impacts on a large part of a site
<b>Neutral</b>	No impacts	No impacts	No impacts	No impacts	Permanent impacts on a small part of a site
<b>Minor positive</b>				Permanent beneficial impacts on a small part of a site	Permanent beneficial impacts on a large part of a site
<b>Moderate positive</b>			Permanent beneficial impacts on a small part of a site	Permanent beneficial impacts on a large part of a site	
<b>Major positive</b>		Permanent beneficial impacts on a small part of a site	Permanent beneficial impacts on a large part of a site		

**Criteria for assessing impact significance**

(b) Aquatic habitats

A Sites

	Temporary	Short-term	Medium-term	Long-term
Extensive	Major	Severe	Severe	Severe
Localised	Major	Major	Severe	Severe

B Sites

	Temporary	Short-term	Medium-term	Long-term
Extensive	Major	Major	Severe	Severe
Localised	Moderate	Moderate	Major	Major

C Sites

	Temporary	Short-term	Medium-term	Long-term
Extensive	Moderate	Moderate	Major	Major
Localised	Minor	Moderate	Moderate	Moderate

D Sites

	Temporary	Short-term	Medium-term	Long-term
Extensive	Minor	Minor	Moderate	Moderate
Localised	Not significant	Minor	Minor	Minor

E Sites

	Temporary	Short-term	Medium-term	Long-term
Extensive	Not significant	Not significant	Minor	Minor
Localised	Not significant	Not significant	Not significant	Not significant

In line with the EPA Guidelines (EPA 2002), the following terms are defined when quantifying duration:

- Temporary: up to 1 year,
- Short-term: from 1-7 years,
- Medium-term: 7-15 years,
- Long-term: 15-60 years,
- Permanent: over 60 years.

Localised impacts on rivers are loosely defined as impacts measurable no more than 250m from the impact source. Extensive impacts on rivers are defined as impacts measurable more than 250m from the impact source. Any impact on salmonid spawning habitat, or nursery habitat where it is in short supply, would be regarded as an extensive impact as it is likely to have an impact on the salmonid population beyond the immediate vicinity of the impact source.

## Appendix 4 – Terrestrial ecology species list

		Riparian woodland WN5	Immature woodland WS2/Scrub WS1/Treelines WL2	Marsh GM1/Immature woodland WS2	Reed and large sedge swamps FS1
Alder	<i>Alnus glutinosa</i>	X			
Angelica	<i>Angelica archangelica</i>	X			
Ash	<i>Fraxinus excelsior</i>	X	X		
Bindweed	<i>Calystegia spium</i>		X	X	
Blackthorn	<i>Prunus spinosa</i>	X		X	
Bramble	<i>Rubus fruticosus</i>		X	X	
Broad leaved Dock	<i>Rumex obtusifolius</i>		X		
Cleavers	<i>Galium aparine</i>		X		
Cocksfoot	<i>Dactylis glomerata</i>		X		
Common reed	<i>Phragmites communis</i>			X	X
Cotoneaster	<i>Cotoneaster sp.</i>		X		
Crack willow	<i>Salix fragilis</i>	X			
Creeping bent	<i>Agrostis stolonifera</i>			X	
Creeping buttercup	<i>Ranunculus repens</i>	X		X	
Creeping cinquefoil	<i>Potentilla reptans</i>				
Creeping thistle	<i>Cirsium arvenense</i>		X	X	
Dog rose	<i>Rosa canina</i>	X	X		
Elm	<i>Ulmus sp.</i>			X	
Early purple orchid	<i>Orchis mascula</i>	X			
False oat grass	<i>Arrhenatherum elatius</i>	X			
Fools watercress	<i>Apium nodiflorum</i>			X	
Gorse	<i>Ulex europaeus</i>		X		
Hairy brome	<i>Bromopsis ramosa</i>		X		
Hartstongue Fern	<i>Asplenium scolopendrium</i>	X			
Hawthorn	<i>Crataegus monogyna</i>	X	X		
Hemlock water dropwort	<i>Oenanthe crocata</i>	X		X	
Hogweed	<i>Heracleum sphondylium</i>		X		
Horsetail	<i>Equisetum arvense</i>			X	
Ivy	<i>Hedera helix</i>	X	X		
Lesser celandine	<i>Ranunculus ficaria</i>	X			
Ladies Fern	<i>Athyrium filix-femina</i>	X		X	
Lesser sea rush	<i>Juncus maritimus</i>			X	
Lord and Ladies	<i>Avum maculatum</i>		X		
Marsh Foxtail	<i>Alopecurus geniculatus</i>			X	
Mayflower	<i>Cardamine pratensis</i>			X	
Meadow buttercup	<i>Ranunculus acris</i>	X			
Meadow foxtail	<i>Alopecurus pratensis</i>		X		
Meadow sweet	<i>Filiendula ulmaria</i>	X	X	X	X
Nettle	<i>Urtica dioica</i>	X	X	X	
Penduculate oak	<i>Quercus robur</i>			X	
Red current	<i>Ribes rubrum</i>	X			

Reed canary grass	<i>Phalaris arundinacea</i>	X			
Remote sedge	<i>Carex remota</i>	X			X
Rough meadow grass	<i>Poa trivialis</i>				X
Rowan	<i>Sorbus acuparia</i>				
Silver weed	<i>Potentilla anserina</i>				X
Sycamore	<i>Acer pseudoplatanus</i>	X	X		
Tufted vetch	<i>Vicia cracca</i>				X
Valerian	<i>Caleriana officinalis</i>	X			
Water mint	<i>Mentha aquatica</i>				X
White poplar	<i>Populus alba</i>		X		
Wild privet	<i>Ligustrum vulgare</i>			X	
Willow	<i>Salix sp.</i>	X	X		X
Willowherb	<i>Epilobium hirsutum</i>				X
Winter heliotrope	<i>Petasites fragans</i>		X		
Wood avens	<i>Guem urbanum</i>	X			
Wood dock	<i>Rumex saguineus</i>	X			
Wood sedge	<i>Carax sylvatica</i>	X			
Woody nightshade	<i>Solanum dulcamara</i>	X			
Yellow Flag	<i>Iris psuedocorus</i>	X			X

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