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Administration,
Environmental Licencing Programme,
Office of Climate, Licencing & Resource Use,
Environmental Protection Agency,
Headquarters,
PO Box 3000,
Johnstown Castle Estate,
County Wexford

15th April 2010

Re: Application Register No. D0298-01

Notice in accordance with Regulation 20(1) of the Waste Water Discharge (Authorisation) Regulations 2007.

Dear Sir/Madam

Please find attached the Appropriate Assessment report and supporting documentation carried out by Cork Co Council on the impact of discharges from the Cloyne agglomeration on the Cork Harbour SPA.

I attach as requested an original and copy of the data along with two copies in PDF format.

Yours Sincerely

Patricia Power
Director of Services
Area Operations South
Cork Co Council
Co Hall
Cork

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	Cloyne Habitats Directive Assessment
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Habitats Directive Assessment (Screening Report) in respect of

Application by Cork County Council to the EPA

for Wastewater Discharge License

for Cloyne Agglomeration.

April, 2010

1 Introduction

1.1 The Cloyne Waste Water Treatment Plant is located on the north western boundary of the Cloyne agglomeration. Cloyne Village is located approx. 7km south of Midleton on the Regional Route R629 which connects Midleton to Ballycotton. The existing WWTP is designed to treat waste for a 1400 population equivalent. Current figures indicate the plant is treating waste of a PE of 1100-1200 approximately. The Waste is treated to a tertiary treatment standard. Having undergone treatment in a conventional aeration system the treated effluent is further treated by passing through reed beds. The discharged waste is in compliance with the Urban Wastewater Treatment Regulations. The treated waste discharges into a local stream running along the Northern Boundary of the Site. This unknown stream has been named as the Spital Stream due to the adjacent townland name. This stream flows in a northwesterly direction for approx. 1km before its confluence with the Cloyne Stream which flows westerly for approx 2km before flowing into Cork Harbour.

1.2 The plant is located approx. 3km to the East of Saleen Creek. Saleen Creek is the name given to the tidal portion of the Cloyne Stream and forms part of the Cork Harbour Special Protection Area which is designated under the **EU Birds Directive (79/409/EEC)** as transposed into Irish Law under the European Union (Natural Habitats) Regulations SI 94/1997. As this is the case, and in accordance with requirements under this Directive, the potential impacts of proposed developments that have the potential to impact on Special Protection Areas must be assessed. The procedure to do this is called a **Habitats Directive Assessment**. The purpose of such an assessment is to identify whether there may be potential for elements of the project to have a significant impact on nature conservation sites within its impact zone, and if so, to predict the potential for such impacts to affect the overall integrity of such nature conservation sites. The European Union has provided guidance as to how to make a Habitats Directive Assessment which identifies four main stages in the process as follows:

Stage One: Screening
The process which identifies the likely impacts upon a Natura 2000 site of a project or plan, wither alone or in combination with other projects or plans, and considers whether these impacts are likely to be significant.

Stage Two: Appropriate assessment
The consideration of the impact on the integrity of the Natura 2000 site of the project or plan, either alone or in combination with other projects or plans, with respect to the site's structure and function and its conservation objectives. Additionally, where there are adverse impacts, an assessment of the potential mitigation of those impacts.

Stage Three: Assessment of alternative solutions

The process which examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the Natura 2000 site.

Stage Four: Assessment where no alternative solutions exist and where adverse impacts remain.
An assessment of compensatory measures, where in the light of an assessment of imperative reasons of overriding public interest, it is deemed that the project or plan should proceed.

1.3 This document brings together all of the information necessary to make determination as to whether there are likely to be significant impacts arising from the discharge from Cloyne Waste Water Treatment Plant on the adjacent Cork Harbour Special Protection Area and represents the first stage of this process (Screening).

Step 1:
Provide a description of the plan and other plans and projects that, in combination, have the potential to have significant effects on Natura 2000 sites within the potential impact zone;

Step 2:
Identify Natura 2000 sites which may be impacted by the plan, and compile information on their qualifying interests and conservation objectives;

Step 3:
Determine whether the plan needs to be screened for potential impacts on Natura 2000 sites;

Step 4 :
Carry out an assessment of likely effects - direct, indirect and cumulative - undertaken on the basis of available information as a desk study or field survey or primary research as necessary;

Step 5:
Assess the significance of any such effects on the Natura 2000 sites within the impact zone.

1.4 The assessment has been prepared in accordance with the following guidance:

European Commission (2000) Managing Natura 2000 sites: the provisions of Article 6 of the Habitats Dreictive 92/43/EEC.

European Commission (2001) Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habtiats Directive 92/43/EEC.

Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities. Environment, Heritage and Local Government, 2009.

2 Appropriate Assessment Screening Matrix

2.1 Description of project	
Location	Cloyne WWTP, Cloyne, East Cork. See attached Map.
Description of the key components of the project	Cloyne WWTP was constructed in 1997 and consists of a conventional aeration treatment system which treats the waste generated to the standards set down by the Urban Wastewater Treatment Regulations. The waste is then sent for further treatment by passing it through a reed bed system. This treated waste combines with any excess screened volumes overflowed from the inlet works and discharges to the Spital Stream. On average approx. 440cu.m./day is discharged to the stream.
Distance from designated sites in potential impact zone*	Approx. 2.7Km

2.2 Description of the Natura 2000 sites within the potential impact zone[1]	
Name	Cork Harbour Special Protection Area
Site Code	4030
Site Description	The Cork Harbour SPA is an estuarine complex which is primarily comprised of intertidal habitats, mainly mudflats as well as some other coastal and marine habitats. These habitats support very high numbers of wintering waterfowl, that feed on the macroinvertebrates inhabiting the mudflats. The Harbour regularly supports in excess of 20,000 wintering birds, making it an internationally important site and the fifth most important wintering waterfowl site in the country. Discharges from the Cloyne Wastewater Treatment Plant enter Saleen Creek (Poulnabibe Inlet) in the east of Cork Harbour. This small relatively enclosed estuary supports mudshores, mixed sediment shores and areas of saltmarsh habitat. The main habitats of importance within the creek are mudshores and mixed sediment shores which are used by waders, while the upper shore and saltmarsh habitats provide important high tide water roosts. The open water within the creek and adjacent to it is important for grebes and sea ducks.

[1] Natura 2000 sites within the potential impact zone of the proposed development have been identified in accordance with guidance provided in the NPWS circular L8/08.

	More information on the Cork Harbour SPA and on Saleen Creek (Poulnabibe Inlet) is contained appendix 1 of this document. Bird count data is provided in appendix 4.
Qualifying Interests of Cork Harbour SPA.	Internationally important numbers of Black-tailed Godwit and Redshank; Nationally important numbers of Cormorant, Shelduck, Oystercatcher, Golden Plover, Lapwing, Dunlin, Curlew and Common Tern; 20,000 wintering waterbirds. *Source - National Parks and Wildlife Service* All of these species excepting Golden Plover and Common Tern are regularly recorded at Saleen Creek. Of these species, Saleen Creek holds >5% of the mean and/or peak totals for Cork Harbour for Redshank, Oystercatcher and Curlew. See appendix 4 for bird count data for Saleen 1998/2000 – 2007/2008.
Other Notable Features of Cork Harbour SPA and Saleen Creek.	Little Grebe, Great-crested Grebe, Grey Heron, Wigeon, Teal, Pintail, Shoveler, Red-breasted Merganser, Grey Plover, Black-headed Gull, Common Gull, Lesser Black-backed Gull, wetland and water birds. Source - *National Parks and Wildlife Service* Of these species, Saleen Creek holds >5% of the mean and/or peak totals for Cork Harbour for Little Grebe, Great-crested Grebe, Grey Heron, Wigeon, Teal, Shoveler, Red-breasted Merganser, Black-headed Gull and Common Gull Source I-WeBS Data. Other species frequently recorded at Saleen in numbers > 5% of the mean and/or peak totals for the harbour include Mallard, Little Egret, Ringed Plover, Mediterranean Gull, Bonapartes Gull, Black-headed Gull, Common Gull, Herring Gull and Kingfisher. See appendix 4 for bird count data for Saleen 1998/2000 – 2007/2008.
Conservation Objectives	To avoid deterioration of the habitats of the qualifying species and species of special conservation interest, or significant disturbance to these species, thus ensuring that the integrity of the site is maintained. To ensure for the qualifying species and species of special conservation interest that the following are maintained in the long-term. o the population of the species as a viable component of the site; o the distribution and extent of habitats supporting the species; o the structure, function and supporting processes of habitats supporting the species; *Source - National Parks and Wildlife Service*

2.3 Assessment Criteria	
Describe the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 site.	**Discharge from Cloyne WWTP:** *Treated effluent from the Cloyne Waste Water Treatment Plant is discharged to Spital Stream. This stream enters Saleen Creek (within the Cork Harbour SPA) approx 2.7km from the point of discharge.* *The discharge consists primarily of treated effluent from the Cloyne Waste Water Treatment Plant but can also include screened but untreated overflow volumes in times of heavy rain.* **Other Discharges in the East of the Harbour:** *Wastewater collected in the village of Saleen discharges via a septic tank into Saleen Creek approx. 2.7km downstream of the Cloyne Discharge Location.* *Untreated waste from Aghada and Whitegate discharge directly into the Harbour along the southern boundary of the SPA.* *Treated waste from a combination of two sources (Midleton WWTP and Irish Distillers Ltd) discharges into the East Channel of the Harbour at Rathcoursey.* *See Map in Appendix 3 for discharge locations.*
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site taking into account the following: o Size and scale o Land-take o Distance from the Natura 2000 site or key features of the site: o Resource requirements (water abstraction etc.) o Emissions (disposal to land, water or air) o Excavation Requirements o Transportation Requirements o Duration of construction, operation, decommissioning o Other.	Discharges could give rise to elevated nutrients entering Saleen Creek and the eastern portion of Cork Harbour. Increased nutrient levels may impact on the ecology of an area by changing the composition of floral communities and reducing the ability of less robust plants to survive. Increased nutrient levels may also result in increasing the invertebrate populations in the estuary, thereby increasing bird population levels. However the potential for the treatment plant discharge to result in elevated nutrients within the harbour is reduced by three main factors: 1. The standard of treated effluent is high. 2. From the limited monitoring available there is no deterioration in water quality in the Cloyne Stream from the discharge. 3. The treated effluent enters the Cork Harbour SPA at Poulnabibe which is a large and well exchanged body of water with unlimited dilution capacity. 1 **The standard of treated effluent is high.** Treated effluent from the Cloyne WWTP is monitored by the operator on a weekly basis and by CCC six times per year. Effluent testing demonstrates that treated effluent consistently meets standards set out in the Urban Wastewater Treatment Regulations (see appendix 2 for effluent testing results).

	Note 1: See appendix 2 for effluent quality results for 2008 and 2009. **Note 2:** The samples taken do not take account of the overflow volumes being intermittently discharged as the composite sampler is located upstream of where the overflow volume meets the treated effluent volume. **Note 3**: As overflows occur in times of heavy rain the assumption must be made that what is discharged is diluted as well as screened. **2 No deterioration in water quality in Cloyne Stream** According to the upstream and downstream monitoring already carried out as part of the WWDL application process, there is no deterioration in water quality associated with the Cloyne discharge. **3 Treated effluent discharges into Harbour body** The treated effluent enters the Cork Harbour SPA at Poulnabibe which is a large and well exchanged body of water with unlimited dilution capacity. The Poulnabibe Inlet to which the effluent discharges is long, narrow and shallow which is thoroughly mixed (Dixon Brosnan, 2003). This along with the endless dilution capability of the harbour body of water means that the discharge is properly diluted once within the SPA.
Describe any likely changes to the site arising as a result of: ○ Reduction in habitat area ○ Disturbance to key species ○ Habitat or species fragmentation ○ Reduction in species density ○ Changes in key indicators of conservation value (water quality etc) ○ Climate Change	**Reduction in habitat area:** *Treated effluent complies with standards laid down in the Urban Waste Water Treatment Regulations and is discharging to a large well-exchanged body of water where dilution and dispersion potential is high. No significant impacts are evident or predicted on habitats within Saleen Creek or Cork Harbour or the Great Island Channel arising from the operation of this facility.* **Disturbance to key species:** *The operation of the WWTP does not cause any disturbance to species within the SPA.* **Habitat or species fragmentation:** *No habitat fragmentation has been caused as a result of the operation of this facility.* **Reduction in species density:** *Treated effluent complies with standards laid down in the Urban Waste Water Treatment Regulations and is discharging to a large well-exchanged body of water where dilution and dispersion potential is high. No significant impacts are evident or predicted on species for which the SPA is designated.* *Some reduction in bird species density may occur on completion of the WWTP at Saleen which will further*

	reduce nutrient inputs to this part of Cork Harbour. However this potential impact is uncertain and could only be confirmed by ongoing monitoring and study. The reduction of nutrient inputs to the system would be likely to reduce the trophic status of the harbour and have a positive impact on the environment generally. **Changes in key indicators of conservation value eg water quality:** *While there is no ongoing monitoring of water quality for either the Spital or Cloyne streams, some sampling and testing were done and submitted as part of the Wastewater Licence Application. This testing, while insufficient for a complete analysis indicates that there is no deterioration in water quality associated with the Cloyne discharge.*
Describe any likely impacts on the Natura 2000 site as a whole in terms of: ○ Interference with the key relationships that define the structure of the site ○ Interference with key relationships that define the function of the site	**Interference with the key relationships that define the structure of the site:** *The structure of the SPA is not impacted by the operation of this facility.* **Interference with key relationships that define the function of the site:** *The function of the SPA is not impacted by the operation of this facility.*
Describe from the above those elements of the project of plan, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts is not known.	No significant impacts are predicted.

3. Finding of No Significant Effects Report Matrix

Name of project or plan	Cloyne WWTP discharge
Name and location of Natura 2000 site	Cork Harbour Special protection Area
Description of the project or plan	Cloyne WWTP was constructed in 1997 and consists of a conventional aeration treatment system which treats the waste generated to the standards set down by the Urban Wastewater Treatment Regulations. The waste is then sent for further treatment by passing it through a reed bed system. This treated waste combines with any excess screened volumes overflowed from the inlet works and discharges to the Spital Stream. On average approx. 440cu.m./day is discharged to the stream.
Is the project or plan	No

directly connected with or necessary to the management of the site (provide details)?	
The assessment of significance of effects	
Describe how the project or plan (alone or in combination) is likely to affect the Natura 2000 Site.	Discharges from the Cloyne WWTP either alone or in combination with discharges from other sources could give rise to elevated nutrients entering Saleen Creek and the eastern portion of Cork Harbour. Increased nutrient levels may impact on the ecology of an area by changing the composition of floral communities and reducing the ability of less robust plants to survive. Increased nutrient levels may also result in increasing the invertebrate populations in the estuary, thereby increasing bird population levels. Though the effluent discharged from Cloyne is to a high standard the same cannot be said of the effluent discharged from Saleen Septic tank or from the discharge points from the Whitegate/Aghada agglomeration. While such discharges may be having a negative impact on the Cork Harbour SPA, it is considered that the discharge from Cloyne is not contributing to this impact.
Explain why these effects are not considered significant.	Treated effluent complies with standards laid down in the Urban Waste Water Treatment Regulations and is discharging to a large well-exchanged body of water where dilution and dispersion potential is high. No significant impacts are evident or predicted on species for which the SPA is designated.
List of agencies consulted: provide contact name and telephone or email address	National Parks and Wildlife Service – Natureconservation@environ.ie, cyril.saich@environ.ie Birdwatch Ireland – Data request.
Response to consultation	Draft Conservation Objectives were sent from NPWS and also sent copy of Intention to Designate Cork Harbour as SPA Cyril Saich acknowledged request for meeting and passed on request to his superiors. No meeting held to date. Birdwatch Ireland sent on Bird count data.

Data collected to carry out the assessment			
Who carried out the assessment	**Sources of data**	**Level of assessment completed**	**Where can the full results of the assessment be accessed and viewed**
Madeleine Healy and Sharon Casey, Cork County Council	IWebs Bird Data supplied by BirdWatch Ireland; Water Quality Monitoring Data CCC; Waste water Discharge Assessment Report at Saleen, Report prepared by Cork County Council by Dixon Brosnan 2003; O'Donoghue, P. et al (2009). Midleton Area Habitat Survey and Mapping Project 2009. Final Report prepared for Cork County Council, Atkins, Cork.	Desktop review of cited data.	This report.

Appendix 1: Ecological Data

1 Cork Harbour SPA – Site Synopsis (National Parks and Wildlife Service)

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, theDouglas Estuary, inner Lough Mahon, Lough Beg, Whitegate Bay and the Rostellaninlet. 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*, *Nepthys hombergi*, *Nereis diversicolor* and *Corophium volutator*. Green algae species occur on the flats, especially *Ulva lactua* 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*), Laxflowered 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.

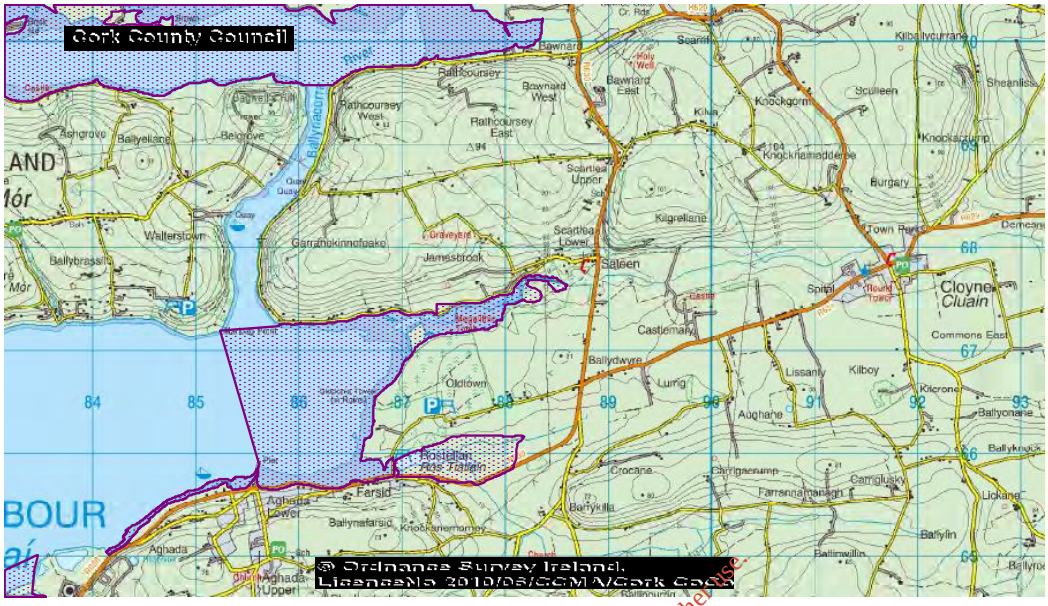
A range of passage waders occur regularly in autumn, including Ruff (5-10), Spotted Redshank (1-5) and Green Sandpiper (1-5). Numbers vary between years and usually a few of each of these species over-winter.
The wintering birds in Cork Harbour have been monitored since the 1970s and are counted annually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

2 Map of section of Cork Harbour Special Protection Area showing area of discharge from Cloyne Waste Water Treatment Plant, Saleen Creek.



3 Saleen Creek and Aghada Shore Description and evaluation of Local Area of Biodiversity Value (O'Donoghue, P *et. al* (2009).

Description

This area of local biodiversity value comprises the intertidal and marine water body habitats along the eastern side of Cork Harbour, extending from Saleen Creek (Poulnabibe Inlet) to the eastern side of the Aghada ESB Power Station. Saleen Creek is a small estuary (MW4) which discharges into the large sea inlet and bay (MW2) that forms the large open water body of the lower part of Cork Harbour. A small freshwater stream also enters this area of local biodiversity value at Rostellan (via Rostellan Lake) but the demarcation between the MW2 and MW4 habitats is not clear.

The intertidal habitat mainly comprises narrow strips of sheltered rocky shores (LR3), mixed substrata shores (LR4) and mixed sediment shores (LS5) along the upper shoreline with extensive areas of mud shores (LS4) and some mixed sediment shores (LS5) in Saleen Creek extending around the shoreline to Aghada Pier and in Whitegate Bay. The sheletered rocky shores (LR3) and mixed substrata shores (LR4) habitats have dense cover of attached seaweeds, typically dominated by knotted wrack with bladder wrack, serrated wrack and spiral wrack and with channel wrack on the upper shore. Seawalls (CC2) run along most of the shoreline along the northern side of Saleen Creek and the southern side of Aghada Shore. The LR3 habitat includes areas of stable accumulations of boulders, cobbles and pebbles, as well as bedrock shores (see Fossitt, 2000). Areas of saltmarsh habitat (CM1 and CM2) occur in Saleen Creek in three main patches, as well as scattered small fragments. This saltmarsh was included in the NPWS saltmarsh monitoring project (SMP site code SMP0056) and the following description is based on the results of that survey, with Fossitt habitat codes assigned from the present survey. The NPWS saltmarsh monitoring project mapped 4.65 ha of saltmarsh habitat here, comprising 0.08 ha of Salicornia and otherannuals colonising mud and sand (1310), 4.14 ha of

Atlantic salt meadows (1330), 0.29 ha of *Mediterraneansalt meadows (1410)* and 0.14 ha of non-annex *Spartina* swards. All three areas of saltmarsh occur behind seawalls, but the seawalls have been breached. The central saltmarsh has a well-developed network ofcreeks (modified by attempted reclamation in the past) and large salt pans. Patches of common cord-grass occur in both the western and central saltmarshes, as well as on the LS4 habitat in the upper eastern section of the creek. The eastern saltmarsh contains mainly CM2 habitat dominated by rank red fescue grassland with some sea-milkwort, sea arrowgrass, sea plantain and sea rush. Where sea rush is prominent, the habitat has been classified as *Mediterranean salt meadows* by the NPWS saltmarsh monitoring project. Red fescues remain dominant in these areas with some creeping bent, saltmarsh rush, sea arrowgrass and spear-leaved orache. The central saltmarsh is contains a short sward community dominated by sea arrowgrass, sea plantain and thrift with some common saltmarsh-grass, lax-flowered sea-lavender, red fescues and saltmarsh rush. Around the margins of this saltmarsh, the vegetation is characterised by a greater dominance of red fescues and saltmarsh rush. Patches with sea rush have been classified as *Mediterranean salt meadows* by the NPWS saltmarsh monitoring project. The entire central saltmarsh was classified as CM2 by the present survey, because scattered patches of red fescues and saltmarsh rush occur throughout while common saltmarsh-grass is largely confined to the edges of creeks. The western saltmarsh contains mainly CM1 habitat dominated by common saltmarsh-grass and sea-purslane with some common scurvygrass, lax-flowered sea-lavender, sea aster and thrift. Small areas of glassworts occur along the edges of this saltmarsh.

The western saltmarsh in Saleen Creek is backed on its western side by a vegetated shingle ridge (CB1). This habitat was not surveyed in detail. Other smaller areas of CB1 habitat occur on the northern side of Saleen Creek and just to the west of Aghada Pier. These shingle ridges have closed swards of dry grassland on top of the ridge dominated by false oat-grass, red fescues, with more patchy vegetation of curled dock, sea beet, sea mayweed, spearleaved/Babington's orache, wild carrot, etc. along the sides. The shingle ridge on the northern side of Saleen Creek encloses a small lagoon (CW1), which has an outlet with tidal exchange through the shingle ridge at high tide.

Evaluation

Most of the intertidal habitat in this area of local biodiversity value is part of the Cork Harbour SPA (4030) and the Rostellan Lough, Aghada Shore and Poulnabibe Inlet pNHA (site code 1076), and is, therefore rated as of International importance. The subtidal habitat to the east of Aghada Pier is included in the SPA, but mainly excluded from the pNHA, and is, therefore also rated as of international importance. This International importance rating refers to the value of this area, as part of the overall Cork Harbour SPA, for wintering waterbirds. The main habitats of importance for wintering waterbirds are the LS4 and LS5 mudflats, which are used by waders and dabbling ducks, and the MW2/MW4 habitat between Aghada Pier and the mouth of Saleen Creek, which hold the main concentrations of grebes and sea duck in Cork Harbour. The upper shore and saltmarsh habitats are of lesser importance for wintering waterbirds, but particular areas are important as high tide wader roosts. However, as all areas of the intertidal habitat are used to some extent by the wintering waterbirds, the international importance rating has been retained as their actual value.

The saltmarsh and vegetated shingle habitats are of particular significance in their own right, as they represent annexed habitat types that are scarce in Cork

Harbour, and throughout Co. Cork. The saltmarsh habitat is of relatively small size and its naturalness has been diminished by past attempts at reclamation that continue to affect its morphology. The NPWS saltmarsh monitoring project report states that the saltmarsh "has few features of significant conservation importance", and there are a considerable number of larger and better quality saltmarsh habitats in Co. Cork, so it is probably not of national or county importance as a saltmarsh habitat.

The vegetated shingle habitat on the southern side of the mouth of Saleen Creek is one of the larger shingle ridges in Cork Harbour and could possibly be of County Importance as a shingle ridge habitat. However, it is not included in the inventory of sites listed in the conservation status assessment for perennial vegetation of stony banks (Anonymous, 2007).

Threats

Alien invasive species: Common Cord-grass is present in small patches in LS4, CM1 and CM2 habitat in Saleen Creek. It has not increased significantly in extent over the last 15 years (T. Gittings, pers. obs.), The NPWS saltmarsh monitoring project considered that it is a threat to the small area of *Salicornia* and other annuals colonising mud and sand (1310) habitat in Saleen Creek, although the report states that "there are no indications that it is spreading at the moment".

Development: there has been historical loss of upper shore habitat due to road construction along the northern side of Saleen Creek and the southern side of Aghada Shore. There has been recent loss of a small area of upper shore habitat adjacent to Aghada Pier, which has been infilled and is now used for car parking (see photo no. 2496). A house is being constructed adjacent to the CB1 habitat to the west of Aghada Pier, and this habitat may be threatened by associated impacts (e.g., inclusion as part of the garden). Other: there is some aquaculture development in the intertidal zone and this has effectively removed a section of intertidal habitat.

Recommendations

Common Cord-grass does not appear to pose a current threat. No management intervention is required. Monitoring will presumably continue to be carried out by the NPWS saltmarsh
monitoring project.

A lot of the uppermost parts of the upper shore habitat have been lost to historical development. Small remaining patches of valuable habitat, such as CB1 habitat, may be threatened because their value is not appreciated and they can be affected by small-scale development that does not require planning consent.

CLOYNE WASTWATER EFFLUENT RESULTS

Influent Readings

Parameter	03/01/2008	04/01/2008	07/01/2008	11/01/2008	14/01/2008	18/01/2008	21/01/2008	25/01/2008	28/01/2008	Jan Average
pH	8.1		8.02				7.65		7.72	7.87
COD (mg/l)	625		657				405		526	553.25
BOD (mg/l)		290.00		283.00		228.00		148		237.25
TP (mg/l)									4.5	4.5
Suspended	234		208				156		248	211.50

Effluent Readings

Location: Before Reed Bed

Parameter	03/01/2008	04/01/2008	07/01/2008	11/01/2008	14/01/2008	18/01/2008	21/01/2008	25/01/2008	28/01/2008	Jan Average	Urban WWT Standards
pH	7.67	7.6	7.73		7.61		7.49		7.72	7.64	
COD (mg/l)	54.5	24	31.4		25.3		18.2		32.2	30.93	125
BOD (mg/l)		3.00		2.00		4.00		4		3.25	25
TP (mg/l)										3.39	
Suspended	4	5	8		4		8		4	5.50	35

Effluent Readings

Location: After Reed Bed

Month: January 2008

Parameter	03/01/2008	04/01/2008	07/01/2008	11/01/2008	14/01/2008	18/01/2008	21/01/2008	25/01/2008	28/01/2008	Jan Average	
pH	7.89	7.6	7.61		7.77		7.83		7.75	7.74	
COD (mg/l)	50.6	24	30.7		24.2		19.8		30.2	29.92	125
BOD (mg/l)		3.00		4.00		4.00		4		3.75	25
TP (mg/l)		3.39								3.39	
Suspended	4	5	12		12		10		4	8.67	35

Influent Readings

Parameter	01/02/2008	05/02/2008	08/02/2008	12/02/2008	15/02/2008	18/02/2008	22/02/2008	26/02/2008	29/02/2008	Feb Average
pH		7.94		7.58		7.99		7.64		7.79
COD (mg/l)		400		551		792		544		571.75
BOD (mg/l	168.00		170.00		860.00		268		430	379.20
TP (mg/l)									4	4
Suspende		84		258		298		190		207.50

Effluent Readings

Location: Before Reed Bed

Parameter	01/02/2008	05/02/2008	08/02/2008	12/02/2008	15/02/2008	18/02/2008	22/02/2008	26/02/2008	29/02/2008	Feb Average	Urban WWT Standards
pH		7.59	7.6	7.57		7.22		7.31		7.46	
COD (mg/l)		37.2	19	15.9		28		50.8		30.18	125
BOD (mg/l	4.00		4.00		4.00		6		4	4.40	25
TP (mg/l)											
Suspende		4	5	6		16		24		11.40	35

Effluent Readings

Location: After Reed Bed

Month: January 2008

Parameter	01/02/2008	05/02/2008	08/02/2008	12/02/2008	15/02/2008	18/02/2008	22/02/2008	26/02/2008	29/02/2008	Feb Average	
pH		7.78	7.5	7.63		7.61		7.23		7.55	
COD (mg/l)		12.2	28	24.6		14.5		18.2		19.50	125
BOD (mg/l	4.00		6.00		12.00		2		4	5.60	25
TP (mg/l)											
Suspende		6	11	6		14		10		10.00	35

Influent Readings

Parameter	04/03/2008	07/03/2008	11/03/2008	14/03/2008	18/03/2008	21/03/2008	25/03/2008	28/03/2008	31/03/2008	March Average
pH	8.01		7.83		7.95		7.94		7.86	7.92
COD (mg/l)	830		404		446		459		399	507.60
BOD (mg/l)		170.00		860.00		268.00		325		405.75
TP (mg/l)									5.25	5.25
Suspended	310		230		264		184		156	228.80

Effluent Readings

Location: Before Reed Bed

Parameter	04/03/2008	07/03/2008	11/03/2008	14/03/2008	18/03/2008	21/03/2008	25/03/2008	28/03/2008	31/03/2008	March Averag	Urban WWT Standards
pH	7.53	7.7	7.6		7.64		7.62		7.52	7.60	
COD (mg/l)	56.6	26	35.2		39.8		43.4		40	40.17	125
BOD (mg/l)		4.00		9.00		5.00		13		7.75	25
TP (mg/l)		1.36									
Suspended	22	6	30		4		18		10	15.00	35

Effluent Readings

Location: After Reed Bed

Month: March 2008

Parameter	04/03/2008	07/03/2008	11/03/2008	14/03/2008	18/03/2008	21/03/2008	25/03/2008	28/03/2008	31/03/2008	March Average	
pH	7.71	7.8	7.62		7.88		7.91		7.84	7.79	
COD (mg/l)	36	20	24.5		31.7		20.8		18.3	25.22	125
BOD (mg/l)		4.00		2.00		2.00		4		3.00	25
TP (mg/l)		2.86									
Suspended	10	5	6		4		6		10	6.67	35

Influent Readings

Parameter	04/04/2008	07/04/2008	11/04/2008	14/04/2008	18/04/2008	21/04/2008	25/04/2008	28/04/2008	April Average
pH		7.86		7.46		7.39		7.62	7.58
COD (mg/l)		847		577		1102		672	799.50
BOD (mg/l	390.00		238.00		290.00		225		285.75
TP (mg/l)								10	10
Suspende		296		216		614		294	355.00

Effluent Readings

Location: Before Reed Bed

Parameter	04/04/2008	07/04/2008	11/04/2008	14/04/2008	18/04/2008	21/04/2008	25/04/2008	28/04/2008	April Average	Urban WWT Standards
pH	7.5	7.32		7.29		7.47		7.32	7.38	
COD (mg/l	21	10.2		21.6		28.3		38.88	23.996	125
BOD (mg/l	2.00		2.00		4.00		4		3	25
TP (mg/l)	1.52								1.52	
Suspende	7	6		4		14		8	7.8	35

Effluent Readings

Location: After Reed Bed

Month: April 2008

Parameter	04/04/2008	07/04/2008	11/04/2008	14/04/2008	18/04/2008	21/04/2008	25/04/2008	28/04/2008	April Average	
pH	7.3	7.76		7.31		7.62		7.44	7.486	
COD (mg/l	31	28.6		24.2		23.7		18.5	25.2	125
BOD (mg/l	7.00		4.00		4.00		4		4.75	25
TP (mg/l)	2.3								2.3	
Suspende	14	10		4		12		4	8.8	35

Influent Readings

Parameter	02/05/2008	06/05/2008	09/05/2008	12/05/2008	16/05/2008	19/05/2008	23/05/2008	26/05/2008	30/05/2008	May Average
pH		7.7		7.72		7.45		7.53		7.6
COD (mg/l)		408		542		778		945		668.25
BOD (mg/l)	240.00		85.00		170.00		190		190.00	175
TP (mg/l)								9.25		9.25
Suspended		308		284		526		408		381.5

Effluent Readings

Location: Before Reed Bed

Parameter	02/05/2008	06/05/2008	09/05/2008	12/05/2008	16/05/2008	19/05/2008	23/05/2008	26/05/2008	30/05/2008	May Average	UWW Standards
pH	7.6	7.37		7.28		7.31		7.2		7.352	
COD (mg/l)	24	26.5		33.1		34.4		22.8		28.16	125
BOD (mg/l)	3.00		4.00		5.00		4		3	3.8	25
TP (mg/l)	1.26									1.26	
Suspended	5	12		6		2		4		5.8	35

Effluent Readings

Location: After Reed Bed

Month: May 2008

Parameter	02/05/2008	06/05/2008	09/05/2008	12/05/2008	16/05/2008	19/05/2008	23/05/2008	26/05/2008	30/05/2008	May Average	UWW Standards
pH	7.7	7.26		7.28		7.31		7.16		7.342	
COD (mg/l)	15	26.6		33.1		34.4		22.8		26.38	125
BOD (mg/l)	4.00		3.00		2.00		11		4	4.8	25
TP (mg/l)	3.39									3.39	
Suspended	5	14		20		12		10		12.2	35

Influent Readings

Parameter	04/06/2008	06/06/2008	09/06/2008	13/06/2008	16/06/2008	20/06/2008	23/06/2008	27/06/2008	30/06/2008	June Average
pH	7.84		7.72		7.62		7.54		7.82	7.708
COD (mg/l)	333		336		430		487		284.00	374
BOD (mg/l)		220.00		185.00		148.00		200		188.25
TP (mg/l)							5.75			5.75
Suspended	176		198		206		192		128.00	180

Effluent Readings

Location: Before Reed Bed

Parameter	04/06/2008	06/06/2008	09/06/2008	13/06/2008	16/06/2008	20/06/2008	23/06/2008	27/06/2008	30/06/2008	June Average	UWW Standards
pH		7.8	7.42		7.45		7.78		7.3	7.55	
COD (mg/l)	44.1	27	42.9		60.8		39.1		47.8	43.61666667	125
BOD (mg/l)		3.00		3.00		2.00		3		2.75	25
TP (mg/l)		1.61								1.61	
Suspended	14	5	14		6		8		4	8.5	35

Effluent Readings

Location: After Reed Bed

Month: May 2008

Parameter	04/06/2008	06/06/2008	09/06/2008	13/06/2008	16/06/2008	20/06/2008	23/06/2008	27/06/2008	30/06/2008	June Average	UWW Standards
pH	7.61	7.9	7.53				7.84		7.32	7.64	
COD (mg/l)	38.5	15	20.3				33.5		36.3	28.72	125
BOD (mg/l)		3.00		2.00		5.00		3		3.25	25
TP (mg/l)		2.92								2.92	
Suspended	8	7	14				8		8	9	35

Influent Readings

Parameter	04/07/2008	07/07/2008	11/07/2008	14/07/2008	18/07/2008	21/07/2008	25/07/2008	28/07/2008	July Average
pH		7.62		7.82		7.62		7.86	7.73
COD (mg/l)		369		413		352		470	401
BOD (mg/l	230.00		215.00		193.00		129		191.75
TP (mg/l)								7.25	7.25
Suspende		208		176		172		174	182.5

Effluent Readings

Location: Before Reed Bed

Parameter	04/07/2008	07/07/2008	11/07/2008	14/07/2008	18/07/2008	21/07/2008	25/07/2008	28/07/2008	July Average	UWW Standards
pH	7.8	7.31		7.3		7.27		7.41	7.418	
COD (mg/l	26	37.9		42		38.7		34.3	35.78	125
BOD (mg/l	5.00		4.00		3.00		4		4	25
TP (mg/l)	1.47								1.47	
Suspende	6	10		10		2		18	9.2	35

Effluent Readings

Location: After Reed Bed

Month: May 2008

Parameter	04/07/2008	07/07/2008	11/07/2008	14/07/2008	18/07/2008	21/07/2008	25/07/2008	28/07/2008	July Average	UWW Standards
pH	7.8	7.26		7.33		7.32		7.44	7.43	
COD (mg/l	23	49.6		33.5		70.3		23.7	40.02	125
BOD (mg/l	3.00		4.00		3.00		2		3	25
TP (mg/l)	4.56								4.56	
Suspende	9	14		4		2		18	9.4	35

Influent Readings

Parameter	05/08/2008	08/08/2008	11/08/2008	15/08/2008	18/08/2008	22/08/2008	25/08/2008	29/08/2008	August Average
pH	7.75		7.75		7.43		7.52		7.61
COD (mg/l)	282		545		461		343		407.75
BOD (mg/l)		200.00		178.00		110.00		185	168.25
TP (mg/l)							8		8.00
Suspended	140		254		244		236		218.50

Effluent Readings

Location: Before Reed Bed

Parameter	05/08/2008	08/08/2008	11/08/2008	15/08/2008	18/08/2008	22/08/2008	25/08/2008	29/08/2008	August Averag	UWW Standards
pH	7.38	7.8	7.3		7.36		7.4		7.45	
COD (mg/l)	20.3	22	24.2		28.5		23.2		23.64	125
BOD (mg/l)		2.00		27.00		3.00		2	8.50	25
TP (mg/l)		0.49							0.49	
Suspended	12	5	6		6		14		8.60	35

Effluent Readings

Location: After Reed Bed

Month: August 2008

Parameter	05/08/2008	08/08/2008	11/08/2008	15/08/2008	18/08/2008	22/08/2008	25/08/2008	29/08/2008	August Averag	UWW Standards
pH	7.42	7.6	7.36		7.4		7.48		7.45	
COD (mg/l)	18.4	17	26.3		10.8		23.2		19.14	125
BOD (mg/l)		2.00		4.00		2.00		2	2.50	25
TP (mg/l)		4.21							4.21	
Suspended	10	5	4		4		8		6.20	35

Influent Readings

Parameter	02/09/2008	05/09/2008	09/09/2008	12/09/2008	15/09/2008	19/09/2008	22/09/2008	26/09/2008	29/09/2008	September Average
pH	7.68		7.32		7.83		7.34		7.52	7.54
COD (mg/l)	258		381		497		542		280	391.60
BOD (mg/l)		70.00		120.00		215.00		198		150.75
TP (mg/l)									5	5.00
Suspended	104		224		342		382		112	232.80

Effluent Readings

Location: Before Reed Bed

Parameter	02/09/2008	05/09/2008	09/09/2008	12/09/2008	15/09/2008	19/09/2008	22/09/2008	26/09/2008	29/09/2008	September Average	UWW Standards
pH	7.5	8	7.3		7.13		7.29		7.3	7.42	
COD (mg/l)	6	27	33.4		24.5		15.6		26.1	22.10	125
BOD (mg/l)		3.00		2.00		2.00		2		2.25	25
TP (mg/l)		1.8								1.80	
Suspended	14	5	12		4		22		6	10.50	35

Effluent Readings

Location: After Reed Bed

Month: September 2008

Parameter	02/09/2008	05/09/2008	09/09/2008	12/09/2008	15/09/2008	19/09/2008	22/09/2008	26/09/2008	29/09/2008	September Average	UWW Standards
pH	7.52	7.5	7.29		7.1		7.29		7.25	7.33	
COD (mg/l)	19.7	19	20.5		23.1		6.8		13.6	17.12	125
BOD (mg/l)		3.00		2.00		2.00		2		2.25	25
TP (mg/l)		1.22								1.22	
Suspended	6	7	4		2		6		4	4.83	35

Influent Readings

Parameter	03/10/2008	07/10/2008	10/10/2008	14/10/2008	17/10/2008	21/10/2008	24/10/2008	28/10/2008	31/10/2008	October Average
pH		7.52		7.52		7.5		7.6		7.54
COD (mg/l)		570		459		440		1650		779.75
BOD (mg/l)	218.00		305.00		180.00		215		670	317.60
TP (mg/l)								19.5		19.50
Suspended		180		258		224		852		378.50

Effluent Readings

Location: Before Reed Bed

Parameter	03/10/2008	07/10/2008	10/10/2008	14/10/2008	17/10/2008	21/10/2008	24/10/2008	28/10/2008	31/10/2008	October Average	UWW Standards
pH	7.6	7.26		7.26		7.36		7.25		7.35	
COD (mg/l)	23	39.1		14		15.8		16.7		21.72	125
BOD (mg/l)	3.00		3.00		5.00		2		5	3.60	25
TP (mg/l)	1.14									1.14	
Suspended	5	6		5		6		14		7.20	35

Effluent Readings

Location: After Reed Bed

Month: October 2008

Parameter	03/10/2008	07/10/2008	10/10/2008	14/10/2008	17/10/2008	21/10/2008	24/10/2008	28/10/2008	31/10/2008	October Average	UWW Standards
pH	7.7	7.3		7.24		7.37		7.48		7.42	
COD (mg/l)	18	23.3		12.8		19.4		13.4		17.38	125
BOD (mg/l)	4.00		2.00		4.00		2		2	2.80	25
TP (mg/l)	3.05									3.05	
Suspended	5	4		10		4		10		6.60	35

Influent Readings

Parameter	03/11/2008	06/11/2008	10/11/2008	13/11/2008	17/11/2008	20/11/2008	24/11/2008	27/11/2008	November Average
pH	7.42		7.4		7.35		7.4		7.39
COD (mg/l)	580		739		481		968		692.00
BOD (mg/l)		290.00		228.00		360.00		300	294.50
TP (mg/l)							8.5		8.50
Suspended	474		560		206		386		406.50

Effluent Readings

Location: Before Reed Bed

Parameter	03/11/2008	06/11/2008	10/11/2008	13/11/2008	17/11/2008	20/11/2008	24/11/2008	27/11/2008	November Average	UWW Standards
pH	7.18	7.6	7.3		7.27		7.3		7.33	
COD (mg/l)	13.7	18	40.8		12.6		35.5		24.12	125
BOD (mg/l)		2.00		5.00		2.00		7	4.00	25
TP (mg/l)		0.45							0.45	
Suspended	12	9	8		4		10		8.60	35

Effluent Readings

Location: After Reed Bed

Month: November 2008

Parameter	03/11/2008	06/11/2008	10/11/2008	13/11/2008	17/11/2008	20/11/2008	24/11/2008	27/11/2008	November Average	UWW Standards
pH	7.2	7.9	7.31		7.3		7.32		7.41	
COD (mg/l)	5.4	15	22.9		20.4		12.5		15.24	125
BOD (mg/l)		4.00		2.00		2.00		4	3.00	25
TP (mg/l)		2.23							2.23	
Suspended	2	5	2		4		12		5.00	35

Influent Readings

Parameter	02/12/2008	05/12/2008	09/12/2008	12/12/2008	15/12/2008	19/12/2008	22/12/2008	December Average
pH	7.49		7.38		7.26		7.24	7.34
COD (mg/l)	1050		1240		792		536	904.50
BOD (mg/l)		465.00		198.00		240.00		301.00
TP (mg/l)							10	10.00
Suspended S	746		652		520		138	514.00

Effluent Readings

Location: Before Reed Bed

Parameter	02/12/2008	05/12/2008	09/12/2008	12/12/2008	15/12/2008	19/12/2008	22/12/2008	December Average	UWW Standards
pH	7.26	7.5	7.29		7.41		7.35	7.36	
COD (mg/l)	84.7	25	42.3		27		20	39.80	125
BOD (mg/l)		5.00		4.00		2.00		3.67	25
TP (mg/l)		1.48						1.48	
Suspended S	4	10	22		40		14	18.00	35

Effluent Readings

Location: After Reed Bed

Month: December 2008

Parameter	02/12/2008	05/12/2008	09/12/2008	12/12/2008	15/12/2008	19/12/2008	22/12/2008	December Average	UWW Standards
pH	7.22	7.8	7.3		7.6		7.4	7.46	
COD (mg/l)	18.2	15	18.1		17		10	15.66	125
BOD (mg/l)		4.00		2.00		2.00		2.67	25
TP (mg/l)		1.72						1.72	
Suspended S	4	5	4		10		8	6.20	35

Cloyne WWTP Sampling Data

Influent Readings

Parameter	02/01/2009	05/01/2009	08/01/2009	12/01/2009	15/01/2009	19/01/2009	22/01/2009	26/01/2009	29/01/2009	Jan Average
pH		7.42		7.37		7.35		7.42		7.39
COD (mg/l)		1344		820		169		345		669.50
BOD (mg/l)	240.00		430.00		208.00		120		100	219.60
TP (mg/l)								6.75		6.75
Suspended Solids (mg/l)		634		300		136		222		323.00

Effluent Readings

Location: Before Reed Bed

Parameter	02/01/2009	05/01/2009	08/01/2009	12/01/2009	15/01/2009	19/01/2009	22/01/2009	26/01/2009	29/01/2009	Jan Average
pH	7.7	7.3		7.26		7.22		7.26		7.35
COD (mg/l)	27	34		27.5		102		52.2		48.54
BOD (mg/l)	5.00		4.00		3.00		11		4	5.40
TP (mg/l)	2.71									3.39
Suspended Solids (mg/l)	6	18		10		60		4		19.60

Effluent Readings

Location: After Reed Bed

Month: January 2009

Parameter	02/01/2009	05/01/2009	08/01/2009	12/01/2009	15/01/2009	19/01/2009	22/01/2009	26/01/2009	29/01/2009	Jan Average
pH	8	7.38		7.37		7.35		7.39		7.50
COD (mg/l)	19	22		19.8		13		14.4		17.64
BOD (mg/l)	3.00		2.00		2.00		2		4	2.60
TP (mg/l)	2.39									3.39
Suspended Solids (mg/l)	6	12		4		6		4		4.67

Influent Readings

Parameter	03/02/2009	06/02/2009	10/02/2009	13/02/2009	17/02/2009	20/02/2009	24/02/2009	27/02/2009	Feb Average
pH	7.4		7.32		7.48		7.42		7.41
COD (mg/l)	232		312		716		500		440.00
BOD (mg/l)		110.00		179.00		360.00		145	198.50
TP (mg/l)							6.5		6.50
Suspended Solids (mg/l)	160		156		664		170		287.50

Effluent Readings

Location: Before Reed Bed

Parameter	03/02/2009	06/02/2009	10/02/2009	13/02/2009	17/02/2009	20/02/2009	24/02/2009	27/02/2009	Feb Average
pH	7.29	7.7	7.18		7.29		7.22		7.34
COD (mg/l)	18.8	29	27.6		102.6		38.3		43.26
BOD (mg/l)		5.00		10.00		2.00		3	5.00
TP (mg/l)		0.11							0.11
Suspended Solids (mg/l)	34	11	32		18		2		19.40

Effluent Readings

Location: After Reed Bed

Month: February 2009

Parameter	03/02/2009	06/02/2009	10/02/2009	13/02/2009	17/02/2009	20/02/2009	24/02/2009	27/02/2009	Feb Average
pH	7.31	8	7.2		7.3		7.31		7.42
COD (mg/l)	9.3	15	10.6		14.2		17.9		13.40
BOD (mg/l)		4.00		2.00		2.00		2	2.50
TP (mg/l)		1.19					6.5		6.5
Suspended Solids (mg/l)	4	5	4		4		12		8.00

Influent Readings

Parameter	03/03/2009	06/03/2009	10/03/2009	13/03/2009	18/03/2009	19/03/2009	24/03/2009	27/03/2009	31/03/2009	Mar Average
pH			7.58		7.59		7.32		7.65	7.54
COD (mg/l)	403		486		413		675		464	488.20
BOD (mg/l)		160.00		230.00		320.00		210		230.00
TP (mg/l)									5.5	5.50
Suspended Solids (mg/l)	162		290		430		220		108	242.00

Effluent Readings

Location: Before Reed Bed

Parameter	03/03/2009	06/03/2009	10/03/2009	13/03/2009	18/03/2009	19/03/2009	24/03/2009	27/03/2009	31/03/2009	Mar Average
pH		7.6	7.3		7.23		7.27		7.28	7.34
COD (mg/l)	28.1	40	30.2		14.1		107.2		32.7	42.05
BOD (mg/l)		6.00		3.00		2.00		15		6.50
TP (mg/l)		1.55								1.55
Suspended Solids (mg/l)	6	21	18		2		92		18	26.17

Effluent Readings

Location: After Reed Bed

Month: March 2009

Parameter	03/03/2009	06/03/2009	10/03/2009	13/03/2009	18/03/2009	19/03/2009	24/03/2009	27/03/2009	31/03/2009	Mar Average
pH		8	7.34		7.21		7.3		7.21	7.46
COD (mg/l)	25.1	18	33.3		13.9		26.2		16.5	23.30
BOD (mg/l)		4.00		2.00		2.00		2		2.50
TP (mg/l)		2.11								2.11
Suspended Solids (mg/l)	8	5	10		10		4		18	7.00

Influent Readings

Parameter	02/04/2009	06/04/2009	09/04/2009	14/04/2009	16/04/2009	20/04/2009	23/04/2009	27/04/2009	30/04/2009	Apr Average
pH		7.36		7.34		7.59		7.59		7.47
COD (mg/l)		584		1650		828		510		893.00
BOD (mg/l)	235.00		230.00		234.00		330		273	260.40
TP (mg/l)								7.95		7.95
Suspended Solids (mg/l)		336		1338		268		234		544.00

Effluent Readings

Location: Before Reed Bed

Parameter	02/04/2009	06/04/2009	09/04/2009	14/04/2009	16/04/2009	20/04/2009	23/04/2009	27/04/2009	30/04/2009	Apr Average
pH	7.5	7.22		7.26		7.21		7.62		7.36
COD (mg/l)	18	15.5		20.4		149.8		33.3		47.40
BOD (mg/l)	6.00		5.00		5.00		2		2	4.00
TP (mg/l)	3.4									3.40
Suspended Solids (mg/l)	5	30		10		14		14		14.60

Effluent Readings

Location: After Reed Bed

Month: April 2009

Parameter	02/04/2009	06/04/2009	09/04/2009	14/04/2009	16/04/2009	20/04/2009	23/04/2009	27/04/2009	30/04/2009	Apr Average
pH	7.5	7.14		7.1		7.21		7.32		7.25
COD (mg/l)	18	18.3		26.9		42.9		22.22		25.66
BOD (mg/l)	6.00		5.00		4.00		2		2	4.25
TP (mg/l)	3.6									3.60
Suspended Solids (mg/l)	5	10		8		4		8		6.67

Influent Readings

Parameter	05/05/2009	07/05/2009	11/05/2009	14/05/2009	18/05/2009	21/05/2009	25/05/2009	28/05/2009	May Average
pH	7.25		7.44		7.62		7.54		7.46
COD (mg/l)	923		878		575		1300		919.00
BOD (mg/l)		273.00		193.00		203.00		260	232.25
TP (mg/l)							7.95		7.95
Suspended Solids (mg/l)	242		270		192		196		225.00

Effluent Readings

Location: Before Reed Bed

Parameter	05/05/2009	07/05/2009	11/05/2009	14/05/2009	18/05/2009	21/05/2009	25/05/2009	28/05/2009	May Average
pH	7.32		7.21		7.23		7.2		7.24
COD (mg/l)	51.2		70.2		51.8		33.1		51.58
BOD (mg/l)		5.00		3.00		2.00			3.33
TP (mg/l)									
Suspended Solids (mg/l)	10		36		24		6		19.00

Effluent Readings

Location: After Reed Bed

Month: May 2009

Parameter	05/05/2009	07/05/2009	11/05/2009	14/05/2009	18/05/2009	21/05/2009	25/05/2009	28/05/2009	May Average
pH	7.45		7.2		7.28		7.21		7.29
COD (mg/l)	34.2		19.1		26.6		16		23.98
BOD (mg/l)		3.00		4.00		2.00		3	3.00
TP (mg/l)									
Suspended Solids (mg/l)	2		26		18		8		13.00

Influent Readings

Parameter	02/06/2009	04/06/2009	08/06/2009	11/06/2009	15/06/2009	18/06/2009	22/06/2009	24/06/2009	30/06/2009	June Average
pH	7.53		7.25				7.72		7.65	7.54
COD (mg/l)	880		770		689		954		644	787.40
BOD (mg/l)		156.00				265.00		290		237.00
TP (mg/l)									5.75	5.75
Suspended Solids (mg/l)	324		420		210		206		154	262.80

Effluent Readings

Location: Before Reed Bed

Parameter	02/06/2009	04/06/2009	08/06/2009	11/06/2009	15/06/2009	18/06/2009	22/06/2009	24/06/2009	30/06/2009	June Average
pH	7.23	7.9	7.24		7.23		7.29		7.23	7.35
COD (mg/l)	38.8	35	19.5		17.9		19.7		27.6	26.42
BOD (mg/l)		5.00				2.00		2		3.00
TP (mg/l)		1.85								1.85
Suspended Solids (mg/l)	14	5	18		12		20		28	16.17

Effluent Readings

Location: After Reed Bed

Month: June 2009

Parameter	02/06/2009	04/06/2009	08/06/2009	11/06/2009	15/06/2009	18/06/2009	22/06/2009	24/06/2009	30/06/2009	June Average
pH	7.25	7.9	7.22		7.23		7.25		7.54	7.40
COD (mg/l)	18.5	21	21		22.1		13.6		20.6	19.47
BOD (mg/l)		4.00				3.00		3		3.33
TP (mg/l)		2.44								2.44
Suspended Solids (mg/l)	12	5	42		12		20		28	19.83

Influent Readings

Parameter	02/07/2009	06/07/2009	09/07/2009	13/07/2009	16/07/2009	20/07/2009	23/07/2009	27/07/2009	30/07/2009	July Average
pH		7.45		7.62		7.4		7.62		7.52
COD (mg/l)		396		525		531		381		458.25
BOD (mg/l)	75.00		188.00		560.00		145		165	226.60
TP (mg/l)								5.75		5.75
Suspended Solids (mg/l)		94		460		218		108		220.00

Effluent Readings

Location: Before Reed Bed

Parameter	02/07/2009	06/07/2009	09/07/2009	13/07/2009	16/07/2009	20/07/2009	23/07/2009	27/07/2009	30/07/2009	July Average
pH	7.9	7.24		7.26		7.2		7.3		7.38
COD (mg/l)	27	20.4		18.8		34.7		28.6		25.90
BOD (mg/l)	4.00		2.00		2.00		3		3	2.80
TP (mg/l)	4.23									4.23
Suspended Solids (mg/l)	5	4		4		2		2		3.40

Effluent Readings

Location: After Reed Bed

Month: July 2009

Parameter	02/07/2009	06/07/2009	09/07/2009	13/07/2009	16/07/2009	20/07/2009	23/07/2009	27/07/2009	30/07/2009	July Average
pH	7	7.39		7.3		7.22		7.32		7.25
COD (mg/l)	24	18.4		21.2		12.6		35.1		22.26
BOD (mg/l)	4.00		3.00		3.00		2		2	3.00
TP (mg/l)	4.96									4.96
Suspended Solids (mg/l)	8	2		14		10		6		10.00

Influent Readings

Parameter	04/08/2009	06/08/2009	10/08/2009	13/08/2009	17/08/2009	20/08/2009	24/08/2009	27/08/2009	Aug Average
pH	7.62		7.52		7.45		7.65		7.56
COD (mg/l)	361		561		638		573		533.25
BOD (mg/l)		225.00		170.00		125.00		265	196.25
TP (mg/l)							6.75		6.75
Suspended Solids (mg/l)	120		212		222		248		200.50

Effluent Readings

Location: Before Reed Bed

Parameter	04/08/2009	06/08/2009	10/08/2009	13/08/2009	17/08/2009	20/08/2009	24/08/2009	27/08/2009	Aug Average
pH	7.3	7.6	7.33		7.25		7.3		7.36
COD (mg/l)	55.2	25	24		42.2		26.6		34.60
BOD (mg/l)		4.00				2.00		5	3.67
TP (mg/l)		1.26							1.26
Suspended Solids (mg/l)	18	12	10		16		2		11.60

Effluent Readings

Location: After Reed Bed

Month: August 2009

Parameter	04/08/2009	06/08/2009	10/08/2009	13/08/2009	17/08/2009	20/08/2009	24/08/2009	27/08/2009	Aug Average
pH	7.42	7.7	7.3		7.21		7.42		7.41
COD (mg/l)	19.5	34	24.2		31.7		12.2		24.32
BOD (mg/l)		4.00		2.00		2.00		4	3.00
TP (mg/l)									n/a
Suspended Solids (mg/l)	4	21	10		8		10		9.00

Influent Readings

Parameter	01/09/2009	03/09/2009	07/09/2009	10/09/2009	14/09/2009	17/09/2009	21/09/2009	24/09/2009	28/09/2009	Sept Average
pH	7.45		7.42		7.51		7.48		7.48	7.47
COD (mg/l)	509		376				478		499	465.50
BOD (mg/l)		85.00		160.00		138.00		130		128.25
TP (mg/l)									7.25	7.25
Suspended	204		116				160		168	162.00

Effluent Readings

Location: Before Reed Bed

Parameter	01/09/2009	03/09/2009	07/09/2009	10/09/2009	14/09/2009	17/09/2009	21/09/2009	24/09/2009	28/09/2009	Sept Average
pH	7.2	7.7	7.28		7.23		7.18		7.2	7.30
COD (mg/l)	16	24	27.8		10.4		38		17.4	22.27
BOD (mg/l)		5.00		3.00		4.00		2		3.50
TP (mg/l)		1.29								1.29
Suspended	16	7	6		4		20		4	9.50

Effluent Readings

Location: After Reed Bed

Month: August 2009

Parameter	01/09/2009	03/09/2009	07/09/2009	10/09/2009	14/09/2009	17/09/2009	21/09/2009	24/09/2009	28/09/2009	Aug Average
pH	7.2	7.8	7.62		7.44		7.1		7.14	7.38
COD (mg/l)	17.5	22	31.3		14		11		12.8	18.10
BOD (mg/l)		3.00		2.00		4.00		2		2.75
TP (mg/l)		2.62								2.62
Suspended	6	5	6		12		8		30	16.67

Influent Readings

Parameter	01/10/2009	05/10/2009	08/10/2009	12/10/2009	15/10/2009	19/10/2009	22/10/2009	27/10/2009	29/10/2009	Oct Average
pH		7.49		7.42		7.42		7.52		7.46
COD (mg/l)		304		283		379		462		357.00
BOD (mg/l)	243.00		278.00		155.00		170		200	209.20
TP (mg/l)								6		6.00
Suspended		120		128		150		142		135.00

Effluent Readings

Location: Before Reed Bed

Parameter	01/10/2009	05/10/2009	08/10/2009	12/10/2009	15/10/2009	19/10/2009	22/10/2009	27/10/2009	29/10/2009	Oct Average
pH	7.6	7.3		7.2		7.25		7.2		7.31
COD (mg/l)	24	93.8		13		24.2		56.8		42.36
BOD (mg/l)	5.00		9.00		3.00		7		9	6.60
TP (mg/l)	2.16									2.16
Suspended	14	36		2		6		36		18.80

Effluent Readings

Location: After Reed Bed

Month: Oct 2009

Parameter	01/10/2009	05/10/2009	08/10/2009	12/10/2009	15/10/2009	19/10/2009	22/10/2009	27/10/2009	29/10/2009	Oct Average
pH	8	7.32		7.32		7.35		7.2		7.44
COD (mg/l)	15	33		15.1		19		11		18.62
BOD (mg/l)	4.00		2.00		2.00		2		2	2.40
TP (mg/l)	2.02									2.62
Suspended	5	8		18		6		6		10.00

Influent Readings

Parameter	02/11/2009	05/11/2009	09/11/2009	12/11/2009	16/11/2009	19/11/2009	23/11/2009	26/11/2009	Nov Average
pH	7.42		7.3		7.56		7.48		7.44
COD (mg/l)	409		251		153		141		238.50
BOD (mg/l)		81.00		124.00		29.00		90	81.00
TP (mg/l)							3		3.00
Suspended	226		70		22		30		87.00

Effluent Readings

Location: Before Reed Bed

Parameter	02/11/2009	05/11/2009	09/11/2009	12/11/2009	16/11/2009	19/11/2009	23/11/2009	26/11/2009	Nov Average
pH	7.25	7.7	7.21						7.39
COD (mg/l)	32.8	41	23.6						32.47
BOD (mg/l)		6.00		2.00					4.00
TP (mg/l)		1.38							1.38
Suspended	10	27	68						35.00

Effluent Readings

Location: After Reed Bed

Month: Nov 2009

Parameter	02/11/2009	05/11/2009	09/11/2009	12/11/2009	16/11/2009	19/11/2009	23/11/2009	26/11/2009	Nov Average
pH	7.32	8	7.27		7.26		7.25		7.42
COD (mg/l)	15	15	8.8		15.5		19.2		14.70
BOD (mg/l)		2.00		2.00		2.00		2	2.00
TP (mg/l)		1.18							2.62
Suspended	6	5	4		4		4		4.00

Influent Readings

Parameter	03/12/2009	08/12/2009	10/12/2009	15/12/2009	17/12/2009	22/12/2009	23/12/2009	30/12/2009	Dec Average
pH		7.33		7.79		7.63		7.54	7.57
COD (mg/l)		166		282		379		350	294.25
BOD (mg/l)	205.00		82.00		88.00		285	151	162.20
TP (mg/l)								8	8.00
Suspended Solids (mg/l		26		88		202		228	136.00

Effluent Readings

Location: Before Reed Bed

Parameter	03/12/2009	08/12/2009	10/12/2009	15/12/2009	17/12/2009	22/12/2009	23/12/2009	30/12/2009	Dec Average
pH		7.21		7.27		7.21		7.23	7.23
COD (mg/l)		98		30.2		107.6		148.2	96.00
BOD (mg/l)	4.00		3.00		2.00		17	28	10.80
TP (mg/l)									
Suspended Solids (mg/l		38		10		64		26	34.50

Effluent Readings

Location: After Reed Bed

Month: Dec 2009

Parameter	03/12/2009	08/12/2009	10/12/2009	15/12/2009	17/12/2009	22/12/2009	23/12/2009	30/12/2009	Dec Average
pH	7.8	7.24		7.58		7.24		7.2	7.41
COD (mg/l)	18	21.1		28.2		17		18.6	20.58
BOD (mg/l)	3.00		2.00		2.00		2	2	2.20
TP (mg/l)	0.94								2.62
Suspended	9	20		6		2		14	7.33

SW01MIDL
PRIMARY DISCHARGE POINT
E: 186,177
N: 069,506

SW01CLYN
PRIMARY DISCHARGE POINT
E :191059.9581
N :67821.0976

WASTE WATER TREATMENT PLANT BOUNDARY

SW1SLEN
PRIMARY DISCHARGE POINT
E: 188,585
N: 067,641

SW02WGAG
SECONDARY DISCHARGE POINT
E: 186,873
N: 065,803

SW03WGAG
SECONDARY DISCHARGE POINT
E: 185,465
N: 065,780

NOTES:

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4. DO NOT SCALE , use figured dimensions only, if in doubt ask.

Special Areas of Conservation (S.A.C.)

Special Protected Areas (S.P.A.)

Distance:
SWO1CLYN to SW1SLEN = 2.6914 km

N

Rev.	Date	By	Description

CORK COUNTY COUNCIL
SOUTHERN DIVISION

Noel O Keeffe, B.E. C.Eng. Eur.Ing F.I.E.I.MICE
County Engineer
County Hall, Cork.

Patricia Power,
Director of Services,
Area Operations South

Project: CLOYNE WWTP
WASTE WATER
DISCHARGE LICENCE APPLICATION
APPROPRIATE ASSESSMENT

Title: Cork Harbour SPA
Location of SurroundingDischarge Points

Designed: ER/MS	Checked: MH	Scales: NTS @ A3	Drawing No: Map001
Drawn: MM	Approved: MH	Date: Nov '09	
File Path:		Status: _	Rev: 0

Appendix 4: Bird Count Data, Saleen Creek and Cork Harbour 1998/1009 – 2007/2008 from I-WeBS

	National	Internati-onal	1998/ 1999	1999/ 2000	2000/ 2001	2001/ 2002	2002/2003	2003/2004	2004/ 2005	2005/ 2006	2006/ 2007	2007 /2008	Saleen Mean	Saleen Peak	Cork Harbour Mean	Cork Harbour Peak	% of mean total occurring at Saleen	% of peak total occurring at Saleen
Mute Swan	110	110	1	2	2	2	1	1		3			1	3	64	73	1.56	4.11
Canada Goose									13				3	13	18	23	17	57
Shelduck	**150**	**3,000**	**59**	**75**	**42**	**52**	**30**	**41**	**60**	**44**	**34**	**29**	**42**	**60**	**1,286**	**1,946**	**3.27**	**3.08**
Wigeon	**820**	**15,000**	**129**	**95**	**122**	**73**	**173**	**102**	**97**	**179**	**149**	**124**	**130**	**179**	**2,010**	**2,926**	**6.46**	**6.11**
Teal	**450**	**5,000**	**72**	**101**	**81**	**168**	**199**	**223**	**188**	**248**	**184**	**226**	**214**	**248**	**1,079**	**1,611**	**19.83**	**15.39**
Mallard	380	20,000	29	26	28	56	41	46	39	46	91	82	61	91	496	628	12.3	14.49
Shoveler	**25**	**400**					**4**	**7**		**4**			**2**	**7**	**43**	**62**	**4.65**	**11.29**
Red-breasted Merganser	**35**	**1,700**			**2**	**8**	**8**	**9**	**2**	**1**	**2**		**3**	**9**	**79**	**88**	**3.8**	**10.22**
Red-throated Diver	20	3,000								1			0	1	0	1	0	100
Little Grebe	**25**	**4,000**	**11**	**13**	**9**	**11**	**9**	**9**	**5**	**8**	**14**	**8**	**9**	**14**	**72**	**88**	**12.5**	**15.9**
Great Crested Grebe	**55**	**3,600**	**13**	**6**	**5**	**8**	**6**	**16**	**7**	**13**	**4**	**5**	**9**	**16**	**109**	**137**	**8.25**	**11.68**
Cormorant	**140**	**1,200**	**7**	**7**	**6**	**4**	**6**	**3**	**6**	**6**	**7**	**7**	**6**	**7**	**297**	**370**	**2.02**	**1.89**
Little Egret		1,300	9	4	7	10	10	10	23	17	17	18	17	23	134	166	12.68	13.86
Grey Heron	**30**	**2,700**	**7**	**4**	**8**	**6**	**5**	**7**	**6**	**6**	**4**	**5**	**6**	**7**	**87**	**135**	**6.9**	**5.18**
Moorhen	**20**						**2**			**1**			**0**	**1**	**37**	**55**	**0**	**1.81**
Oystercatcher	**680**	**10,200**	**129**	**172**	**136**	**150**	**175**	**147**	**135**	**137**	**94**	**176**	**138**	**176**	**1,721**	**2,076**	**8.02**	**8.48**
Ringed Plover	150	730	14		14		19		13	41			11	41	41	68	26.83	60.29
Lapwing	**2,100**	**20,000**	**36**	**8**	**7**	**2**		**2**	**12**		**1**		**3**	**12**	**3,947**	**4,864**	**0.08**	**0.25**
Knot	190	4,500								5		1	1	5	110	124	0.9	4.03
Dunlin	**880**	**13,300**	**256**	**31**	**26**	**10**	**164**	**28**	**64**	**6**	**37**	**54**	**38**	**64**	**4,204**	**4,785**	**0.09**	**1.34**
Ruff		12,500										1	0	1	1	3	0	33
Snipe		20,000						2	6	2	5	1	3	6	45	75	6.67	1.33
Black-tailed Godwit	**140**	**470**	**61**	**22**	**16**	**55**	**75**	**52**	**121**	**72**	**129**	**101**	**95**	**129**	**2,410**	**3,337**	**3.94**	**3.87**
Bar-tailed Godwit	**160**	**1,200**	**1**	**2**	**4**	**4**	**2**	**1**	**13**	**5**	**1**	**1**	**4**	**13**	**312**	**405**	**1.28**	**3.2**
Curlew	**550**	**8,500**	**121**	**81**	**82**	**89**	**96**	**91**	**103**	**90**	**115**	**152**	**110**	**152**	**1,636**	**2,317**	**6.72**	**6.56**
Common Sandpiper										1	1		0	1	2	4	0	25
Spotted Redshank		900	3	2								1	0	1	1	2	0	50
Greenshank	**20**	**2,300**	**8**	**10**	**13**	**11**	**12**	**4**	**9**	**12**	**8**	**10**	**9**	**12**	**68**	**83**	**13.23**	**14.46**

Redshank	**310**	**3,900**	**123**	**106**	**135**	**129**	**116**	**116**	**144**	**126**	**173**	**161**	**144**	**173**	**1,723**	**2,295**	**8.35**	**7.54**
Turnstone	**120**	**1,500**	**61**	**26**	**52**	**33**	**35**	**12**	**26**	**73**	**54**	**17**	**36**	**73**	**154**	**214**	**23.38**	**34.11**
Mediterranean Gull						1		4	4	5	6	48	13	48	22	48	59	100
Bonaparte's Gull											1			1	0	1	0	100
Black-headed Gull		20,000	190	177	167	107	176	57	187	184	221	212	172	221	2,373	2,954	7.25	7.48
Common Gull		16,000	7	47	41	88	264	39	103	21	65	84	62	103	220	290	28.18	35.51
Lesser Black-backed Gull		4,500	7	42	3	77	1	1	2	1	5	9	4	9	297	630	1.35	1.43
Herring Gull		13,000	2	3	4	1	6	3	7	3	5	3	4	7	56	123	7.14	5.69
Great Black-backed Gull		4,800	1	4	1	14	4	9	8	4	3	4	6	9	185	385	3.24	2.33
Sandwich Tern				2		22			2	6		3	2	6	49	225	4.08	2.66
Kingfisher					1		1		1	1	1	1	1	1	2	3	50	33.33

DixonBrosnan

environmental consultants

Project	
	Wastewater discharge assessment at Saleen, Co. Cork
Client	Cork County Council

Project ref	Report no	Client ref	Pages
02070	02070.1	David Clarke	57

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Dixon.Brosnan
environmental consultants

PROJECT TITLE	Assessment of a wastewater discharge at Saleen, Co. Cork.	
CLIENT	Cork County Council	
CLIENT REF.	-	D.B REF. 02070038
APPROVED BY		DATE April 2003
	Carl Dixon Project Manager	ON BEHALF OF DIXON.BROSNAN

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EXECUTIVE SUMMARY

Dixon.Brosnan were commissioned by Cork County Council to carry out an environmental assessment of a proposed upgrade to the sewage treatment system serving Saleen, Co. Cork. The assessment included the examination of the most suitable means of disposal of treated wastewater and the treatment standard required. The impacts of the proposed development were examined with respect to the existing environment.

Saleen is a small village situated 5km south of Midleton. The village is currently served by a septic tank system located on a site to the southwest of the village. Cork County Council have identified that the existing system is no longer satisfactory and proposes to install an improved wastewater treatment plant near the existing site. The outfall from the proposed plant will be located upstream of the line of high water of ordinary or medium tides, and therefore a foreshore licence under the Foreshore Act, 1933, will not be required.

Saleen village is drained by Saleen Stream which meets the Cloyne River approximately 400m southwest of the village. The existing septic tank is located immediately northeast of their confluence. Cloyne River becomes tidal downstream of the confluence where it becomes Saleen Creek. The study site is included in a Special Protection Area (SPA) under European Council Directive 79/409/EEC on the conservation of wild birds.

The Cloyne River, Saleen Stream and Saleen Creek are not known to be of particular fisheries significance. Information obtained from the Department of Communications, Marine and Natural Resources on current licensed aquaculture sites in proximity to Saleen indicates that all such sites in Cork Harbour are located to the north of Great Island. Oyster trestles observed at the mouth of Saleen Creek are not included in the Department's list of licensed sites.

The Cloyne River catchment is relatively small in area and there are no long term water quality data available. No direct measures of flows are available for either Saleen Stream or the Cloyne River. Flowrates were calculated on the basis of known flow data for an adjacent catchment which matches the Cloyne catchment in many respects. Samples taken at the study site during the preparation of this report indicate that water quality in the Cloyne River was slightly unsatisfactory at the time of sampling, with elevated nutrient levels present.

Following an assessment of disposal options, it is recommended that the proposed upgraded discharge is directed to the Cloyne River. The available dilution capacity is sufficient to treat up to 1500p.e., although dilution is relatively restricted at this loading. Further expansion may be deemed possible in the future, subject to more detailed long-term assessments being undertaken of flow rates and water quality in the Cloyne system.

Minimum treatment standards recommended are as follows: BOD - 15mg/l, SS - 30mg/l, total N -20mg/l and total P - 1mg/l. The quality standards recommended are relatively restrictive, with some degree of both nitrogen and phosphorous removal required. In addition, a high quality effluent will be required from the secondary clarifier (if installed) in order to meet the strict BOD limit recommended. The requirement for a high quality effluent is a product of limited available dilution, moderate background water quality and the complications associated with discharging a nitrogenous waste stream to a saline environment of some ecological importance. A number of other recommendations are made in the report regarding the proposed discharge.

CONTENTS

1. INTRODUCTION

1.1 Dixon.Brosnan were commissioned by Cork County Council to carry out an environmental assessment of a proposed upgrade to the sewage treatment system serving Saleen, Co. Cork. The assessment included the examination of the most suitable means of disposal of treated wastewater and the treatment standard required. The impacts of the proposed development were examined with respect to the existing environment.

1.2 Saleen is a small village situated 5km south of Midleton (Figure 1). The village is currently served by a septic tank system located on a site 300m southwest of the village. Cork County Council have identified that the existing system is no longer satisfactory and proposes to install an improved wastewater treatment plant (WWTP) near the existing site. The location of the existing site is indicated in Figure 1. The outfall from the proposed WWTP will be located upstream of the line of high water of ordinary or medium tides, and therefore a foreshore licence under the Foreshore Act, 1933, will not be required.

1.3 The upgraded plant will facilitate the construction of new housing developments in Saleen, a number of which may be permitted following the installation of improved treatment.

1.4 The proposed development is below the threshold above which an Environmental Impact Assessment is required under the European Communities (Environmental Impact Assessment) Regulations, 1989 (S.I. No. 349 of 1989), and accordingly this report does not purport to be an Environmental Impact Statement. However the Environmental Protection Agency documents *Guidelines on the information to be contained in Environmental Impact Statements* (2002) and *Advice notes on current practice in the preparation of Environmental Impact Statements* (1995) were consulted during the preparation of the report.

1.5 The report is presented in three parts as follows:

Part 1: Existing environment
Part 2: Legislation & standards
Part 3: Treatment, impacts & recommendations.

Figure 1.

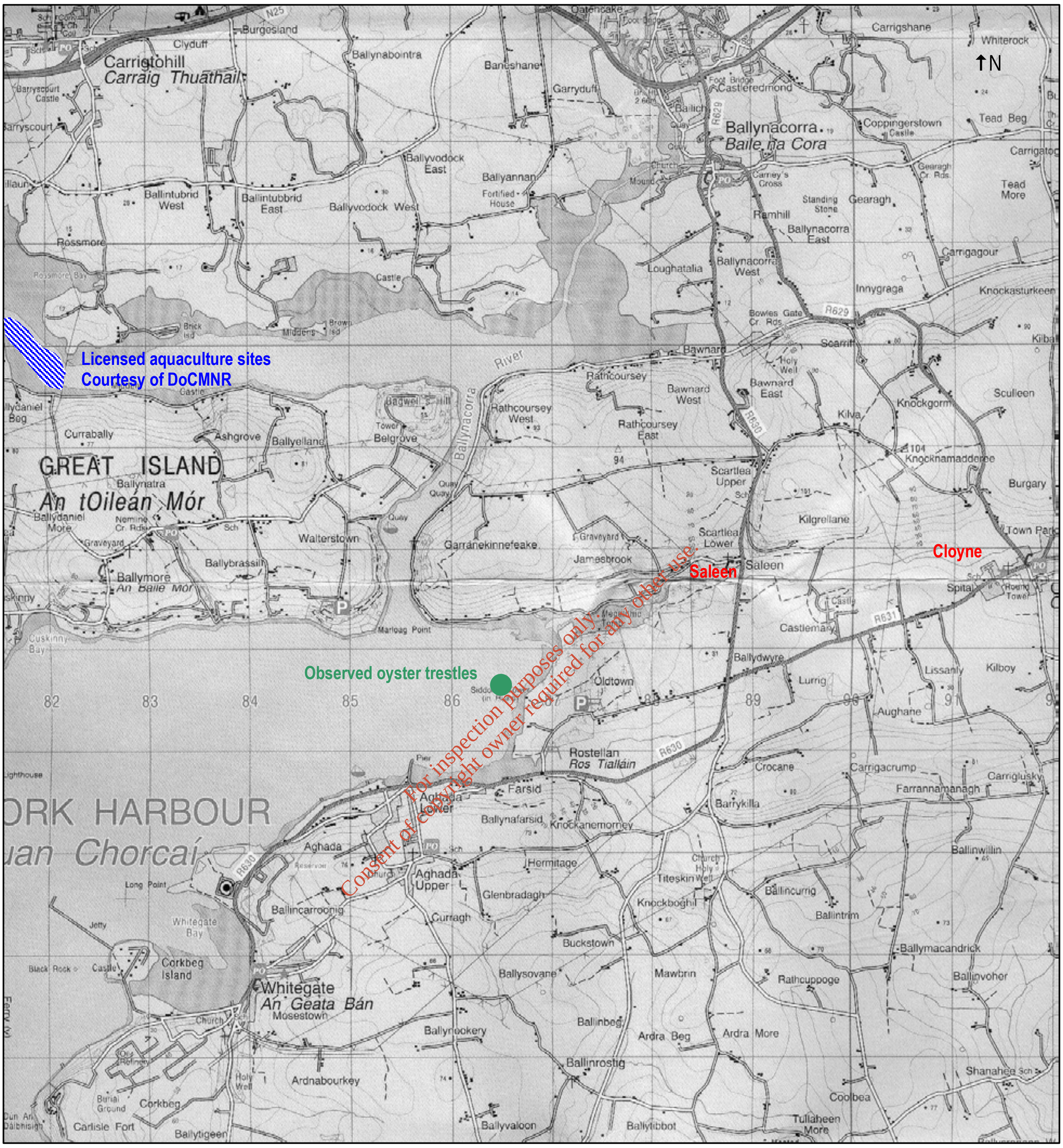
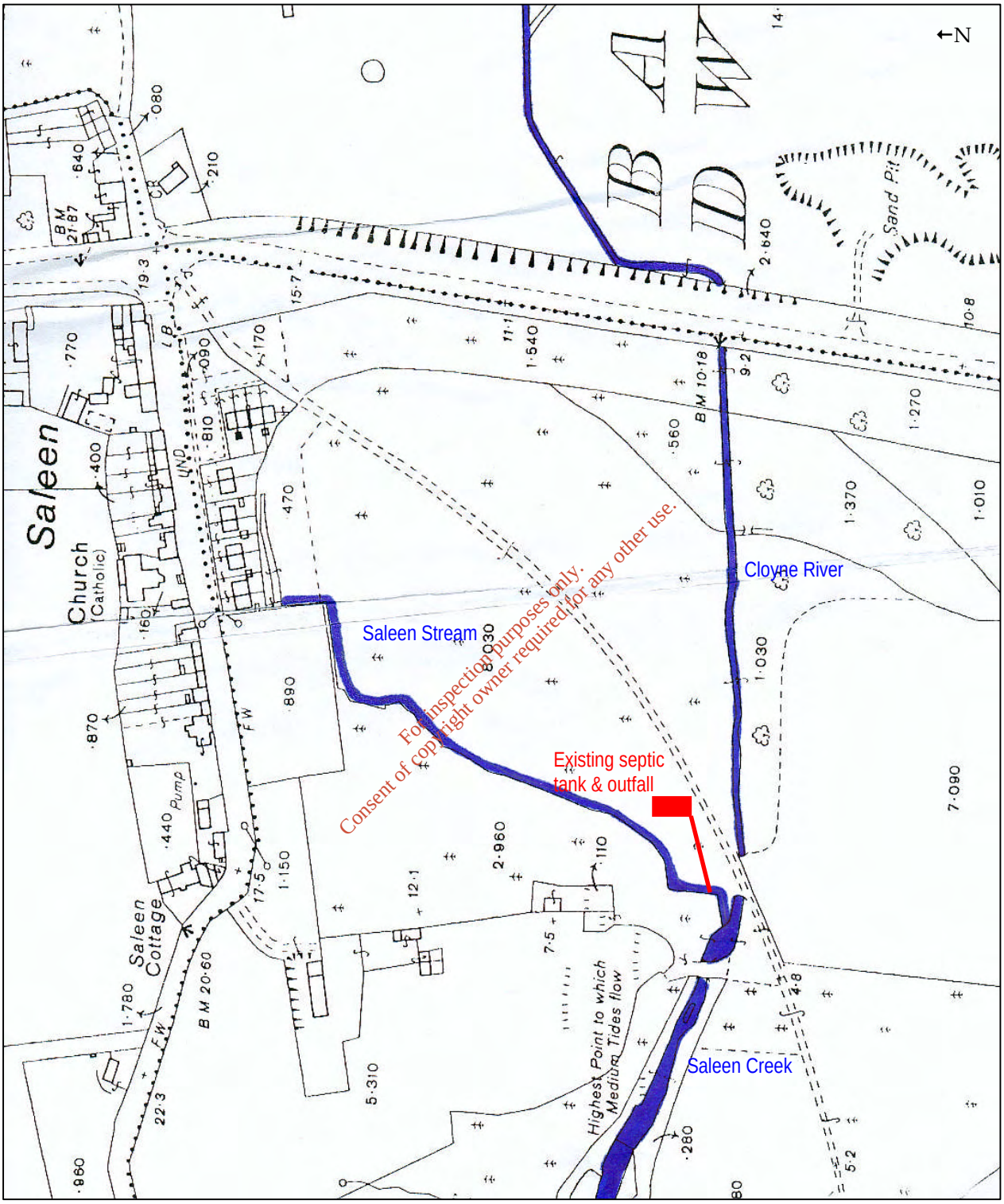


Figure 2.



PART 1: EXISTING ENVIRONMENT

2. CATCHMENT OVERVIEW

2.1 GEOLOGY & SOILS

2.1.1 Geologically, Saleen lies on the northern border of the Cloyne syncline. The geology of the area is characterised by the Gyleen and Ballytrasna formations to the north and the Waulsortian limestone of the Cloyne syncline to the south. The Ballytrasna formation is typically composed of 90% dusky red mudstone while the remainder comprises pale red fine-medium grained sandstone. The Gyleen formation is typically comprised of 20% medium grained sandstone with large and small scale cross lamination and about 80% mudstones. The Waulsortian limestones are largely calcareous mudstones, wackestones and packstones, many of them containing original cavities filled with internal sediments. The facies is some 420m thick in the Cloyne Syncline. The site of the WWTP is situated over Waulsortian limestone.

2.1.2 The subsoils in the catchment identified on the 1905 Drift Map of Cork are till, gravel and alluvium. Till is restricted to low-lying ground and is described as a massive grey-brown diamicton, rich in clays and silts. Till is generally assumed to have a moderate permeability. The Cloyne esker runs from Cloyne to Saleen and in parts is composed of deep gravel. Sand and gravel deposits have a high permeability. Deposits of white clayey sand and clay also occur on the karst limestone surface in the Cloyne and Rostellan areas. The coast at Saleen is characterised by alluvium which underlies the WWTP site.

2.1.3 Subsoil cover is thin in the vicinity of Cloyne village but limited bore hole data indicate that thickness varies from almost zero to over ten metres and that lateral changes can be sharp. Similarly, the thickness of silica, sand and clay deposits are variable. No information is available on the depth of alluvial soils.

2.2 AQUIFER CLASSIFICATION & GROUNDWATER VULNERABILITY

2.2.1 The Geological Survey of Ireland was consulted regarding percolation characteristics of the rock types and soils in the Saleen area. The Draft Vulnerability Classification Map prepared for the South County Cork Groundwater Protection Scheme gives vulnerability classifications for this area. The geology in the immediate vicinity of the existing WWTP is classified as 'High Vulnerability'. A narrow strip of land running adjacent to the south shore of Saleen Creek has been awarded an 'Extreme Vulnerability' classification. This strip of ground is immediately west of the WWTP site.

2.2.2 The Draft Aquifer and Hydrogeological Data Map prepared for the South County Cork Groundwater Protection Scheme provides a classification scheme for aquifers. The site of the treatment plant at Saleen lies over an area classified as a

'Regionally Important Aquifer', reflecting the underlying karst limestone geology. Saleen village and the area to its north overlay a 'Locally Important Aquifer - Moderately Productive only in Local Zones'. This corresponds to an underlying geology of sandstone/mudstone rocks which underlie the upland ridges between the limestone valleys.

2.3 HYDROLOGY

2.3.1 Surface water and ground water arising at Saleen village flows through an unnamed stream which runs in a southwesterly direction and is culverted under the village. For ease of reference this stream will be referred to as Saleen Stream throughout this report. Saleen Stream meets an unnamed river 375m southwest of the village; this river will be referred to hereafter as the Cloyne River. The existing WWTP is located in a forested area 300m southwest of the village, immediately northeast of the Cloyne River and Saleen Stream confluence. The WWTP currently discharges into Saleen Stream 20m upstream of this confluence. The local area is indicated in Figure 2.

2.3.2 Saleen Stream is a small watercourse and is heavily shaded by forestry. The stream arises immediately north of the village and derives from groundwater sources. Local knowledge indicates that the stream flows continuously throughout the year. The substrate is generally soft, and aquatic vegetation is absent from the areas immediately upstream and downstream of the existing WWTP discharge point. A visual examination of the stream indicates that the discharge is impacting on the stream, and discharge detritus are visible near the outfall point. Dense growths of sewage fungus are also noticeable.

2.3.3 The Cloyne valley floor, through which the Cloyne River flows, reaches a maximum elevation of 30m near Cloyne village and drops to sea level at the coast. Due to the flat nature of the local terrain, the Cloyne River is slow flowing throughout much of its length. The river substrate is generally soft with large dense mats of aquatic vegetation such as fool's watercress (*Apium nodiflorium*). The adjoining land is of good agricultural quality, consisting of improved pasture and arable crops including sugar beet. The land is intensively managed and will therefore be in receipt of chemical and/or organic fertilisers on a regular basis. This type of management, coupled with access for cattle to drinking points on the river, may result in deteriorations in water quality.

2.3.4 The Cloyne River is fed by a number of tributaries in its upper catchment. The relatively steep hills in the north of the catchment are characterised by poorer quality land with coarse unmanaged vegetation. These hills reach a maximum elevation of 105m north of Cloyne, and represent the remains of old erosion surfaces gradually falling towards a former coastline. Sections of both deciduous and evergreen forestry have been planted on the higher ground. The largest tributary of the Cloyne River drains these upland areas and meets the river 1km west of Cloyne. This tributary is a fast flowing stream with a rocky substrate and therefore differs from the main channel. A cursory examination of the stream suggests that water quality within this tributary is satisfactory. No signs of excessive siltation or macrophyte growth were noted and sensitive macroinvertebrate taxa are present. The main channel is more

likely to receive excessive nutrients due to the intensive management of the surrounding land.

2.3.5 The main channel of the Cloyne River is relatively short, running for 3km from Cloyne village to its confluence with Saleen Stream. Approximately 10-20m downstream of the confluence the river becomes tidal. This point marks the beginning of Saleen Creek, a tidal creek which meanders continuously and is characterised by large mudflats on both sides. The mudflats are normally exposed during low tides, and the river is confined to a narrow channel through the flats. A road runs along the northern margin of the creek while much of the southern shore is wooded. Saleen Creek discharges to Cork Harbour through an enclosed inlet known locally as Poulnabibe.

2.3.6 Cartographic information from the Ordinance Survey (1935 ed. 1:10560 map) indicates that the 'Highest Point to which Ordinary Tides Flow' occurs 100m downstream of the Cloyne River and Saleen Stream confluence. However, a visual examination of the site suggests that tides probably reach a small footbridge located 10m downstream of the confluence. Surveys suggest that high spring tides may reach the confluence, but further penetration inland is unlikely given the local topography.

2.3.7 Salinity readings taken on the Cloyne River during the course of site surveys indicated no saline influence on the river upstream of the footbridge. Some saline influence was detected approximately 40m downstream of the footbridge with salinity values ranging from 0.7 to 1.1ppt detected (normal seawater contains 35ppt salinity). The river widens at this point with extensive mud flats and seaweed becoming evident.

2.3.8 The Cloyne River upstream of Saleen Creek drains a catchment area of 10km^2. An additional 0.5km^2 is drained by Saleen Stream. As the WWTP site is located near the base of these catchments, the complete catchment areas discharge past the WWTP outfall point. Local knowledge and regional surveys undertaken by the Geological Survey of Ireland indicate that the limestone bedrock in this area of Cork is extensively drained by networks of subterranean streams, many of which rise to the surface at springs before disappearing again in swallow holes. It follows that the true extent of individual stream/river catchments is difficult to assess. During site surveys, flow rates observed in both watercourses were larger than their respective catchment sizes would suggest, reflecting the probable influence of groundwater contributions.

3. ABSTRACTIONS & DISCHARGES

3.1 The underlying geology of this area of Cork is such that good quality groundwater is readily available. Consequently public water provided by the local authority to the only settlements in the catchment under consideration (Cloyne and Saleen) is supplied ultimately from groundwater sources. Water supplied to the Cloyne area is abstracted from a number of groundwater wells near the village and currently totals 2000m^3/day. While these wells lie on the fringes of the Cloyne River surface water catchment, they are most likely continuous with the underlying groundwater hydrology. Cloyne village may be considered to be a net contributor to the surface water balance of the catchment.

3.2 Saleen's water supply is taken from the River Dower, located in the Womanagh catchment to the east of Cloyne. The River Dower originates from a significant underground spring, and the daily abstraction rate here is 5900m^3/day. The River Dower abstraction is used to supply a number of settlements and industry in the Cloyne region, a small fraction of which is supplied directly to Saleen. It follows that Saleen is also a net contributor to the water balance of the catchment. Dixon.Brosnan are not aware of any surface water abstraction points in the Cloyne catchment.

3.3 The Cloyne-Saleen catchment is entirely agricultural with little or no industry evident. It has been confirmed by Cork County Council's Environment Department that there are no licensed discharges in the catchment. The catchment area was inspected during the preparation of this report in order to determine the existence of unlicensed discharges. No discharges of significance were observed, although the possibility of agricultural or domestic discharges – whether from point or diffuse sources – cannot be discounted.

3.4 Most wastewater arising in Saleen is currently discharged to the existing septic tank system. It is proposed that all discharges at Saleen – existing and proposed – will be treated at the upgraded facility, and there will be no individual discharges in the village or its environs outside of isolated domestic septic tanks. At Cloyne all wastewater discharges to a modern WWTP and constructed wetland and there are no isolated discharges here. It follows that the only discharges to the Cloyne River of significance are those from Cloyne and Saleen WWTPs. Ongoing monitoring at Cloyne WWTP indicates that wastewater treatment efficiency here is satisfactory. This plant is currently treating a wastewater loading of 800p.e.

3.5 An inspection of the planning history at Saleen indicates that a residential planning development will be commenced in the near future. Due to the village's attractive location on the R630 regional route, it is likely that further developments will be considered in due course. Wastewater arising from such developments will most likely discharge to the upgraded WWTP, and separate discharge points to the Saleen Stream or Cloyne River are unlikely. Accordingly some expansion capacity will be required in the proposed plant.

4. FLOW DATA

4.1 No direct measures of flow are available for either Saleen Stream or the Cloyne River. There are no flow recording devices or staff gauges maintained by any authority on either watercourse. Flow recording devices were not installed during the preparation of this report as winter precipitation would distort flowrates.

4.2 Due to the karstic nature of the limestone bedrock and the presence of springs in the area, estimates of flow based on catchment may be inaccurate. Observations made during site surveys indicate that flows noted exceeded those expected in catchments of this size. In the absence of river-specific flow data, flowrates may be derived from flow data for alternative catchments. It is important that the catchments used are close to the catchment under consideration in order to minimise meteorological differences. Topographical and geological differences should also be minimised. Flow data are available for two catchments in proximity to the Cloyne-Saleen system: the Owenacurra and the Carrigacrump valleys.

4.3 OWENACURRA RIVER

4.3.1 The Owenacurra River is approximately 24km long and flows in a southerly direction through a relatively narrow valley before discharging to an enclosed corner of Cork Harbour north of Saleen. The river drains a catchment of 170km^2.

4.3.2 The EPA Hydrometric Office have registered an automatic flow recorder on the Owenacurra at Ballyedmond (NGR 185900 76600). Flow data recorded over 25 years since 1977 indicate that the average flow rate is 1.82m^3/s, with a 95th percentile of 0.2m^3/s. The catchment area discharging through the recorder station is 75km^2, indicating a unit area 95th percentile flow rate of 2.7l/s/km^2.

4.3.3 The Owenacurra River is considerably different in character to the Cloyne River. Upstream of Ballyedmond the underlying geology consists of mudstone and sandstone. The upper reaches of the Owenacurra drain afforested and marginal agricultural land. The river rises at an elevation of approximately 120m and falls to an elevation of 30m at Ballyedmond. The length of the river from its source to Ballyedmond is 9km. In contrast the Cloyne River drops approximately 30m from source to sea level over a distance of 3km, over an underlying geology primarily of limestone. It follows that flow data from the Owenacurra system will not be representative of the Cloyne catchment.

4.4 CARRIGACRUMP VALLEY

4.4.1 The Carrigacrump valley lies to the south of the Cloyne valley, separated from the latter by a ridge of hills reaching a maximum elevation of 80m. The valley floor elevation does not exceed 30m. The unnamed river draining the valley rises at Ballyfin before meeting a tributary near Titeskin Bridge. The combined rivers flow northeastwards to Cork Harbour at Rostellan.

4.4.2 The EPA Hydrometric Office have maintained a staff gauge previously on the river at Titeskin (NGR 188700 64900). Flow data were obtained for the period December 1979 to September 1992, although the data set is incomplete and only 22 readings are available. The lowest reading recorded was 0.01340m^3/s on October 26 1989. This corresponds to the period when traditionally Irish rivers are at their annual lowest. In the absence of more accurate data, this figure may be used as an approximate value for dry weather flow.

4.4.3 The catchment area of the Carrigacrump valley upstream of the staff gauge is 5.8km^2. The unit area dry weather flow is therefore of 2.31$l/s/km^2$. Interestingly, this figure is consistent with the unit area 95th percentile flowrate recorded in the Owenacurra River.

4.4.4 The Cloyne and Carrigacrump Rivers pass through valleys with similar topographies. Both have an underlying limestone geology and both are of similar length. The source of both rivers lies at approximately the same elevation. Their proximity minimises precipitation differences. It follows that flowrate data obtained with respect to the Carrigacrump catchment will approximate flowrates in the Cloyne catchment.

4.4.5 Based on a unit area flow rate of 2.31$l/s/km^2$, the dry weather flow in the Cloyne catchment may be estimated at 23.1l/s at its confluence with the Saleen Stream. The catchment area for Saleen Stream was calculated to be 0.5km^2. The dry weather flow in this stream may be estimated at 1.17l/s. As the Saleen stream is largely derived from groundwater, this figure is considered significantly conservative.

4.4.6 It has been noted in 3.4 that a modern WWTP and constructed wetland at Cloyne currently treats a loading of 800p.e. Ongoing monitoring of the wastewater stream indicates that the daily discharge volume varies from 140 to 300m^3/day, inclusive of storm water. Investigations are underway to divert the storm water loading. Storm water arises from precipitation within the catchment and it follows that the volume of storm water discharging to the Cloyne River will be accounted for in the catchment flowrate calculations described above. Potable water at Cloyne, however, is supplied from outside of the surface water catchment (from 3.1), and therefore this portion of the discharge at the WWTP is not accounted for in the calculations. Surveys at the Cloyne WWTP indicate that the dry weather flow of the wastewater portion is 140m^3/day.

4.4.7 From the foregoing, the volume of the Cloyne River downstream of the WWTP discharge at Cloyne village is increased by 140m^3/day over the catchment based flowrate of 23.1l/s noted in 4.4.5. The combined daily flowrate is therefore estimated at 2140m^3/day.

5. HABITAT DESIGNATIONS & FISHERIES

5.1 DESIGNATIONS

5.1.1 The study site does not from part of any Natural Heritage Area (NHA), Special Area of Conservation (SAC), Statutory Nature Reserve or National Park. The site, however, is included in a Special Protection Area (SPA) under European Council Directive 79/409/EEC on the conservation of wild birds (the 'Birds Directive'). Additionally, the site at Saleen lies immediately south of the Great Island Channel SAC designated under European Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive').

5.1.2 The Natural Habitats Regulations, 1997 (S.I. No. 94 of 1997) transposed the Habitats Directive into Irish law. The Regulations specify a number of legal provisions for Special Areas of Conservation including a requirement for the assessment of developments which may have a significant impact on a SAC. This requirement is addressed by the preparation of this report.

5.1.3 The Great Island Channel is an integral part of Cork Harbour and has been designated both as a SAC (site code 1058) and as a SPA (as part of Cork Harbour SPA). A site synopsis for the designated areas in Cork Harbour is presented in Appendix I. Two designated habitats listed in Annex II of the Habitats Directive are found within the channel, namely sheltered tidal sand and mudflats, and Atlantic Salt Meadows. The mudflats support a range of macro-invertebrates and green algal species such as sea lettuce and *Enteromorpha* with occasional invasion by cord grass. The salt marshes are scattered and are estuarine on mud substrate. Typical species include sea purslane, sea lavender and thrift.

5.2 BIRDS

5.2.1 Cork Harbour is significantly important for birds and in particular for wintering wildfowl. The three main areas of bird importance are the North Channel, Harper's Island and Belvelly-Marino Point. A variety of birds can be found within the Great Island Channel including teal, dunlin, godwit, curlew and golden plover. Populations of shelduck and grey plover are considered to be of national importance. Cork Harbour itself holds internationally important numbers of black-tailed godwit and redshank, and nationally important numbers of nineteen other species.

5.2.2 Saleen Creek is an ideal bird watching location, being one of the best sites in Ireland to view little egrets. Large numbers of waterfowl congregate on the mudflats from late summer to early spring. Species include shelduck, whimbrel, curlew, cormorant, black headed gull, golden plover, redshank, lapwing and widgeon. Oystercatchers and ringed plovers also occur at the creek.

5.2.3 As detailed above, the Great Channel SAC and SPA are of considerable ecological value and their protection and conservation are of primary importance. The site synopsis suggests that the main threats to these areas arise from road works, infilling, sewage outflows and possible marina developments.

5.2.4 Estuaries are highly productive environments and the elevated nutrient levels deposited by both freshwater rivers and the sea result in high invertebrate numbers. These invertebrates support the high populations of wading birds that commonly occur on mudflats. The SPA which includes Saleen Creek was designated on the basis of its importance for birds and in particular for waterfowl feeding on the mudflats. Given the high bird numbers currently using Saleen Creek, the poor performance of the existing WWTP does not appear to have detracted from the suitability of this environment for birds and may have indirectly benefited birds by increasing the invertebrate populations on which they feed.

5.2.5 Increased nutrient levels may impact on the ecology of an area by changing the composition of floral communities and reducing the ability of less robust plants to survive. Following a number of site investigations and discussions with Dúchas, no evidence of any such changes has been noted. The provision of an upgraded WWTP will result in a reduction in nutrient levels reaching Saleen Creek. The impact is expected to be neutral to slightly negative on the size of local bird populations. However, a beneficial impact is expected on other forms of aquatic life.

5.3 FISHERIES

5.3.1 Cloyne River, Saleen Stream and the result of their confluence (Saleen Creek) are not known to be of particular fisheries significance. Due to its limited size, Saleen Stream is unlikely to support any fish apart from eels. The larger Cloyne River may contain brown trout, although the river is not a recognised fishery.

5.3.2 Discussions with the South Western Regional Fisheries Board during the preparation of this report indicate that there are no fish stock data available for the river, and the Board have suggested that an assessment of fish stocks should be included in any assessment of the receiving waters. Following further communication with the Board it was agreed that seasonal factors and the possibility of salmonid spawning precluded electro-fishing surveys in time for inclusion in this report. It is recommended therefore that a representative stretch of the Cloyne River upstream of Saleen Creek be assessed using a backpack electrofishing unit in summer 2003.

5.4 SHELLFISH AQUACULTURE

5.4.1 Cork is an important region for mariculture, and both pacific oysters (*Crassostrea gigas*) and native oysters (*Ostrea edulis*) are harvested and sold from Cork Harbour. Information obtained from the Department of Communications, Marine and Natural Resources (DoCMNR) on current licensed aquaculture sites in proximity to Saleen indicates that all such sites are located to the north of Great Island. These sites are not situated in proximity to the discharge point and are unlikely to be affected by the discharge at Saleen. The site locations are indicated in Figure 1.

5.4.2 During site inspections it was noted that a large block of trestles with immature pacific oysters is currently located at the mouth of Saleen Creek as it opens into the bay. The location of same is indicated in Figure 1. The site is not included in the

DoCMNR list of licensed aquaculture sites and it is not known how long these trestles have been in use.

6. WATER QUALITY MANAGEMENT PLAN

6.1 The Local Government (Water Pollution) Act, 1977, provides for one or more local authorities to take co-ordinated action on a river catchment basin by the preparation and implementation of river catchment water quality management plans. No such plans have been formally adopted by Cork County Council for the Cloyne River catchment.

6.2 The above management function has now been superseded by EU Directive 2000/60/EC establishing a framework for Community action in the field of water policy. Under the Water Framework Directive local authorities are obliged to prepare river basin management plans which will include coastal margins. A management programme is currently under preparation for the Cork area.

7. EXISTING WATER QUALITY DATA – CORK COUNTY COUNCIL

7.1 Cork County Council monitors most freshwaters throughout its functional area in accordance with various legal instruments. Due to the limited sizes of the Cloyne River and Saleen Stream, however, these watercourses are not included in any County Council sampling programmes and thus no monitoring data are held on file.

8. EXISTING WATER QUALITY DATA – EPA

8.1 BIOLOGICAL MONITORING PROGRAMME

8.1.1 The Environmental Protection Agency carries out a biological assessment of most river channels in the country on a regular basis. The assessments are used to derive a Q-value - an indication of the biological quality of the water. The EPA Q-value scheme is summarised in Table 8.1. The EPA also undertake chemical monitoring of rivers, chiefly of behalf of a number of local authorities. No biological monitoring has been carried out in the Cloyne River catchment, and there are no chemical data available. Reference is made to the biotic index scheme in Section 10.4.

Table 8.1 EPA Biotic Index Scheme.

Q-VALUE	WATER QUALITY	POLLUTION	CONDITION (likelihood of interference with uses)
5	Good	Unpolluted	Satisfactory
4	Fair	Unpolluted	Satisfactory
3	Doubtful	Moderately polluted	Unsatisfactory
2	Poor	Seriously polluted	Unsatisfactory
1	Bad	Seriously polluted	Unsatisfactory

Source: EPA

8.2 ESTUARINE & COASTAL WATERS MONITORING PROGRAMME

8.2.1 The EPA have been monitoring Ireland's most important inshore coastal waters since 1992. The monitoring programme includes Cork Harbour (referred to as the Lee Estuary). Monitoring is carried out in order to identify sensitive areas in the context of the Nitrates and Urban Waste Water Treatment Directives discussed in Part 2.

8.2.2 On the basis of samples taken, the Lee Estuary has been identified as being eutrophic in the context of the Directives noted in 8.2.1. While most coastal waters considered to be eutrophic were designated as sensitive areas under the Urban Waste Water Treatment Regulations, 2001 (SI No. 254 of 2001), the Lee Estuary was not designated pending the completion of ongoing surveys.

8.2.3 An assessment of the harbour water quality is given in the Agency's *Water Quality in Ireland 1998-2000* (2002) based on results of surveys undertaken during this period. While the surveys included all parts of the harbour inside Roche's Point, the harbour area most relevant to the current proposal – the East Channel and Saleen Creek – is not specifically addressed in the document.

8.2.4 The EPA conclude that oxygen levels in the outer harbour were close to normal during the surveys. It is also noted that oxidised nitrogen, BOD, ammonium and orthophosphate concentrations were generally low during the survey period. Significantly, the waters at Ballinacurra Estuary (north of the study area) were observed to be phosphorous limited. While the dynamics at this estuary do no directly apply to the Saleen Creek area, it is reasonable to assume that the East Channel area may also be phosphorous limited. This assumption is supported by the EPA's observation that outer harbour samples indicated limited phosphorous levels on occasion.

8.2.5 The most recent EPA data on Cork Harbour is presented in the Agency's 2001 document *Measurement and modelling of nutrient dynamics of two estuaries in Ireland – Wexford and Cork Harbours (Synthesis Report)*. The report documents the development of a harbour specific mathematical model of phytoplankton distribution throughout the harbour. It is concluded in the report that Cork Harbour is currently eutrophic, with significant nutrient inputs attributable to catchment run-offs and outfalls. It follows that a reduction in nutrient levels in harbour discharges will benefit the quality of harbour waters.

9. ESTUARIES

9.1 Approximately 50% of Ireland's population lives within 10km of the coastline, and an estimated 80% of sewage and biodegradable wastes are discharged to estuarine and coastal waters in Ireland (Wilson, 1998). Riverine inputs, both natural and anthropomorphic in origin, also contribute high levels of nutrients and estuarine sediments are often major sinks for nitrogen. An overview of monitoring of Irish estuaries by the EPA and others suggests however that '*the quality of estuarine and coastal waters around the country has remained generally high*' (EPA, 2002), despite the fact that most estuaries receive sewage discharges.

9.2 In estuarine environments, the behaviour of discharge plumes and their mixing zones will be influenced by the nature of the estuary and consequent stratification. Department of the Environment Technical Committee on Effluent and Water Quality Standards *Memorandum No. 1: Water Quality Guidelines* (1978) describes three stratification extremes created by estuary topography. Saleen Creek approaches one of these extremes, being long, narrow and shallow. *Memorandum No. 1* notes that such estuaries will be thoroughly mixed, with a salinity gradient from the inland end to the sea.

9.3 No studies have been undertaken on the dynamics of Saleen Creek. Such studies are beyond the scope of this report; indeed Kramer *et al* (1994) state that estuarine studies are onerous in themselves. In the absence of detailed information, *Memorandum No. 1* notes that dilution capacities within an estuary are more safely determined using freshwater flow data only.

9.4 In the assessment of the impact of proposed wastewater discharges to enclosed estuarine environments, *Memorandum No. 1* notes that a limit of 200mg/l BOD may be discharged where the daily discharge does not exceed 100lbs. (45kg) BOD. This limit is increased to 400mg/l in the case of open estuaries and bays.

10. SITE SURVEYS

10.1 A number of surveys were undertaken at and in the environs of the WWTP site as follows: catchment assessment, percolation assessment, chemical survey and biological survey. The results of the catchment assessment have been described in Section 2. The remaining surveys are discussed below.

10.2 PERCOLATION ASSESSMENT

10.2.1 The area surrounding the WWTP site consists of forested land on low-lying ground. There has been significant disturbance in the local area, with concomitant recolonisation by dense bramble. Some sections have been naturally recolonised by trees including alder and birch. Other sections have been replanted with deciduous

species. Due to the dense vegetative growth and the disturbed nature of the soil, accurate percolation tests were not feasible.

10.2.2 As detailed in NSAI Standard Recommendation S.R.6: 1991 *Septic Tank Systems - Recommendations for Domestic Effluent Treatment and Disposal from a Single Dwelling House*, vegetation type can provide an indication of drainage characteristics and the height of the ground water table. Species noted on the site such as rush (*Juncus* sp.) and lesser reedmace (*Typha latifolia*) are generally indicative of poor drainage and possible water-logging during wet weather. Some standing water was noted in channels around the site.

10.2.3 Preliminary surveys during this study indicate that soils are heavy and may have a high clay content in certain areas. Such conditions on a low-lying site will generally preclude on-site disposal via percolation.

10.3 CHEMICAL SURVEY

10.3.1 In order to determine the current water quality of the watercourses within the study area, samples were taken at four locations on January 10 2003. The sampling locations, and results of analyses undertaken by Water Technology Ltd., are presented in Tables 10.1 and 10.2 respectively.

Table 10.1 Sampling locations January 10 2003.

REF.	LOCATION	REASON FOR SELECTION
C1	Cloyne River 15m u/s of confluence with Saleen Stream	To ascertain water quality u/s of confluence
C2	Cloyne River 1m d/s of confluence with Saleen Stream	To ascertain water quality d/s of confluence
S1	Saleen Stream 10m u/s of existing WWTP discharge	To ascertain water quality u/s of existing effluent discharge from WWTP
S2	Saleen Stream 5m d/s of existing WWTP discharge	To ascertain impact of WWTP discharge

10.3.2 Suspended solids levels in the Cloyne River were satisfactory, while both sampling sites on the Saleen Stream were found to have elevated levels. In part this may reflect the silty nature of the latter. The elevated level at station S2 may also be attributable to the discharge from the existing treatment plant. This level exceeded the 25mg/l limit specified by the Freshwater Fish Directive.

10.3.3 Concentrations of ammonia, nitrite and nitrate were elevated at all stations, with general increases noted downstream of the existing WWTP discharge. Relevant standards in the Fisheries and Surface Water Directives were breached in many instances. Orthophosphate levels were also high in both watercourses and indicative of some eutrophication.

Table 10.2 Water quality, January 10 2003.

PARAMETER	C1 (mg/l)	C2 (mg/l)	S1 (mg/l)	S2 (mg/l)
pH	6.78	6.83	6.95	6.96
Biochemical oxygen demand	<1	<1	<1	<1
Suspended solids	3	8	22	27
Ammonia (NH_3-N)	0.07	0.03	0.01	0.48
Nitrite (NO_2-N)	0.008	0.008	0.012	0.043
Nitrate (NO_3-N)	5.0	4.9	6.5	6.7
Orthophosphate (o-PO_4-P)	0.100	0.090	0.012	0.043
Total phosphorous (t-PO_4-P)	0.27	0.28	<1	<1

Analysis: Water Technology Ltd.

10.3.4 While BOD levels recorded at all sites were low, results obtained from both watercourses were generally unsatisfactory. It is not known if elevated concentrations of nutrients recorded in the Cloyne River were a result of a recent isolated pollution event or if chronic problems persist. In Saleen Stream, elevated levels of nutrients and suspended solids would appear to be linked in part to the existing WWTP discharge.

10.3.5 It must be noted that the chemical data discussed above arise from one sampling occasion. No long term data are available for these sites. Where such data do not exist, it is recommended that any WWTP developments be accompanied by an ongoing review of water quality.

10.4 BIOLOGICAL SURVEY

10.4.1 In the absence of any EPA biological quality data as noted in 8.1, a biological survey was undertaken on both watercourses in question on January 20 2002. The purpose of the survey was to assess the impacts of the existing discharge on the long term water quality of the stream; the determination of such long term impacts is not possible on the basis of chemical data. The survey will also provide a baseline against which future comparisons may be made.

10.4.2 A biological survey will provide an accurate assessment of water quality when carried out during the summer or autumn, and in this respect the timing of the survey described was not ideal. However results obtained are significant in the absence of other data.

10.4.3 Samples were taken at three locations; the locations and results obtained are presented in Table 10.3. A summary of the biological report is given in Appendix II.

Table 10.3 Q-values obtained January 20 2002.

SITE	LOCATION	Q-VALUE
B1	Cloyne River 50m u/s of confluence with Saleen Stream	Q3(3-4)
B2	Cloyne River 5m d/s of confluence with Saleen Stream	Q2-3
B3	Saleen Stream 4m d/s of discharge from WWTP	Q1

10.4.4 Sampling station B1 was a poor sampling site with a muddy substrate and limited areas of gravel. Poor quality surface runoff from an adjacent field and from cattle drinking points may be having a localised impact on water quality at this location. A Q-value of Q3(3-4) was awarded, indicating moderate quality. Suitable sampling sites are limited at this location due to heavy shading, and it is recommended that this stretch of river be re-sampled in June 2003 to more accurately assess local water quality.

10.4.5 Site B2 was situated 5m downstream of the Cloyne-Saleen confluence. The station was a good sampling location with a mixed substrate of gravel, cobbles and larger stones. The presence of polychaete worms here is indicative of some saline influence. A rating of Q2-3 was assigned to this site, indicating reduced quality, and this site is most likely being affected by the existing WWTP discharge.

10.4.6 Site B3 was situated on Saleen Stream 4m downstream of the existing discharge. The site was characterised by extensive growths of sewage fungus and strong odours. This section of the watercourse is being affected by the WWTP discharge on an ongoing basis, and was assigned a Q value of Q1 indicating very poor quality. This site is seriously polluted with consequent impacts on macro-invertebrate populations.

11. NOISE & ODOUR

11.1 Saleen village is a small settlement located on regional route R630. There are no industrial noise sources in the vicinity of the village, and the noise environment is dominated by traffic (local and through-flow). Occasional noise emissions will arise from domestic sources (eg. children), agriculture (eg. tractors) and natural noise (eg. wind, birds).

11.2 The local air environment is also rural, with no sources of industrial atmospheric emissions present in the immediate locality. An oil refinery at Whitegate and a power generating station at Aghada, both within 7km of the village, may give rise to occasional odours. In addition, the village's location at the northeastern corner of Cork Harbour may result in infrequent odours arising from the pharmaceutical industry concentrated at Ringaskiddy.

11.3 From the foregoing, the noise and odour environment at Saleen village is generally rural in character. The most intrusive feature is the noise level arising from passing traffic, particularly traffic associated with the installations noted in 11.2. It is recommended that the proposed upgrade to the WWTP does not give rise to intrusive noise or odour emissions in the village or its environs.

12. INTERPRETATION – EXISTING ENVIRONMENT

12.1 This section provides a summary of information documented in Part 1 (Sections 2 to 11) regarding the existing environment.

12.2 The Cloyne River catchment is of relatively small size and has not been included in Cork County Council or EPA river monitoring programmes in the past. Consequently there are no long term water quality data available for the Cloyne River or its tributaries. In addition, there are no water quality or river basin management plans for the catchment in existence. While ongoing and past monitoring programmes have been carried out in Cork Harbour, there are little or no data available in relation to the corner of the harbour under consideration.

12.3 Cartographic information from the Ordnance Survey (1935 ed. 1:10560 map) indicates that the 'Highest Point to which Ordinary Tides Flow' occurs 100m downstream of the Cloyne River and Saleen Stream confluence. A visual examination of the study site suggests that tides probably reach a small footbridge located 10m downstream of the confluence. Thus the WWTP site lies at the downstream tip of the Cloyne catchment and in close proximity to the estuary head.

12.4 Information obtained from the Geological Survey of Ireland indicates that the geology in the immediate vicinity of the WWTP site is classified as 'High Vulnerability'. In addition, the site lies over a 'Regionally Important Aquifer', reflecting the underlying karst limestone geology. Preliminary surveys undertaken indicate that soils at the site are heavy and may have a high clay content in certain areas. Such conditions on a low-lying site will generally preclude on-site disposal via percolation.

12.5 There are no surface water abstractions in the Cloyne catchment. All potable water is taken from a number of groundwater wells in the region, and thus Cloyne and Saleen villages are net contributors to the surface water system. There are only two discharges of significance in the catchment: the discharge under consideration and a treated wastewater discharge at Cloyne. Ongoing monitoring of the latter indicates that wastewater treatment efficiency here is satisfactory.

12.6 No direct measures of flow are available for either Saleen Stream or the Cloyne River. Flowrates were calculated on the basis of known flow data for an adjacent catchment which matches the Cloyne catchment in many respects. Using this data, the unit area dry weather flow rate in the catchment was estimated at 2.23l/s/km^2.

The daily flowrate in the Cloyne River is increased by an estimated 140m^3 (dry weather flow) downstream of the Cloyne WWTP outfall.

12.7 The study site is included in a Special Protection Area (SPA) under European Council Directive 79/409/EEC on the conservation of wild birds. Saleen Creek, immediately downstream of the WWTP site, is recognised nationally as an important little egrets viewing location. Given the link between nutrient discharges and bird feeding sites, it is likely that the proposed development will have a neutral to slightly negative impact on feeding bird populations via a reduction in nutrient availability for animal and plant growth. A beneficial impact is expected, however, on other forms of aquatic life.

12.8 Cloyne River, Saleen Stream and Saleen Creek are not known to be of particular fisheries significance. A closer inspection of fish stocks is recommended during summer 2003.

12.9 Information obtained from the Department of Communications, Marine and Natural Resources on current licensed aquaculture sites in proximity to Saleen indicates that all such sites in Cork Harbour are located to the north of Great Island. An observed pacific oyster trestle located at the mouth of Saleen Creek is not included in the Department's list of licensed sites.

12.10 Water samples taken at the study site during the preparation of this report indicate that water quality in the Cloyne River was slightly unsatisfactory at the time of sampling, with elevated nutrient levels present. It is not known if these levels were attributable to a recent isolated pollution event or if chronic problems persist. BOD and suspended solid levels, however, were satisfactory. Chemical and biological samples taken from Saleen Stream indicate the water quality is currently suffering as a result of the existing WWTP discharge.

12.11 The local environment at the study site is rural in character, with little or no noise or air nuisance present. Despite the dominance of traffic noise on regional route R630, it is imperative that the rural environmental character be maintained with no air or noise emissions from the treatment facilities proposed.

PART 2: LEGISLATION & STANDARDS

13. SURFACE WATER DIRECTIVE

13.1 Council Directive 75/440/EEC of 16 June 1975 concerning the quality of surface water intended for the abstraction of drinking water in the Member States was incorporated into Irish law by the European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989 (S.I. No. 294 of 1989). The Regulations set out quality standards for a total of 39 parameters for waters which are to be treated for distribution, with the standards varying with the degree of treatment provided.

13.2 There are no abstraction points on the Saleen River downstream of Saleen, and none are proposed. The area's proximity to Cork Harbour and its consequent susceptibility to tidal influence precludes any abstraction on this stretch of the river. It follows that the Surface Water Directive is not of significance here.

14. BATHING WATER DIRECTIVE

14.1 Council Directive 76/160/EEC of 8 December 1975 concerning the quality of bathing water, and the numerous Irish follow-up Quality of Bathing Waters Regulations (the most recent being S.I. No. 177 of 1998) lay down quality requirements for inland and coastal waters at designated bathing areas. The quality standards refer chiefly to microbiological parameters, with provision for monitoring of other parameters where it is suspected that conditions have deteriorated.

14.2 There are no designated bathing areas on the Cloyne River or in Cork Harbour. The nearest beach is located at White Bay at the harbour mouth. Some aquatic activities such as wind surfing are carried out along the coastline by Aghada, approximately 2km southwest of the Poulnabibe inlet. While due regard should be given to the amenity value of this area of the harbour, the provisions of the Bathing Water Directive do not directly apply.

15. FRESHWATER FISH DIRECTIVE

15.1 Council Directive 78/659/EEC of 18 July 1978 on the quality of fresh waters needing protection in order to support fish life was given Irish effect by the European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988). The Regulations specify a separate range of standards for salmonid and cyprinid fish in waters designated as needing protection or improvement for their support.

15.2 The Cloyne River is not designated under the Regulations, and it is not expected that the river will be designated in the immediate future. The fisheries significance of the river has been discussed in Section 5.

15.3 Notwithstanding the absence of any fisheries designation, the Freshwater Fish Directive carries some weight due to its strict limits and the consequent suitability of a watercourse for other uses should it meet these limits. The most significant wastewater parameters are presented in Table 15.1 with respect to the Directive.

Table 15.1 Freshwater Fish Directive limits.

PARAMETER	SALMONID LIMIT	CYPRINID LIMIT
BOD	3mg/l	6mg/l
Suspended solids	25mg/l	25mg/l
Ammonia – N	0.02mg/l[1] 0.82mg/l[2]	0.02mg/l[1] 0.82mg/l[2]
Nitrate – N	-	-
Orthophosphate – P	-	-
Total phosphorous – P	0.062mg/l[3]	0.124mg/l[3]

[1]Un-ionised ammonia
[2]Total ammonium
[3]Not specified as limit but rather 'may be regarded as indicative in order to reduce eutrophication'.

15.4 Limits specified in Table 15.1 will be used where applicable in the assessment of wastewater impacts on receiving freshwaters.

16. SHELLFISH DIRECTIVE

16.1 Council Directive 79/923/EEC of 30 October 1979 on the quality required by shellfish waters, and the associated Quality of Shellfish Waters Regulations, 1994 (S.I. No. 200 of 1994) specify designated coastal and brackish waters needing protection or improvement in order to support shellfish. Specified limit values apply to these areas. The are no designated shellfish areas on this stretch of the Irish coastline, and thus the Directive and Regulations do not apply.

16.2 Pursuant to Council Directive 91/492/EEC (as amended by Council Directive 97/61/EC) which lays down the health conditions for the production and the placing

on the market of live bivalve molluscs, the Minister for the Marine and Natural Resources issued the Live Bivalve Molluscs (Production Areas) (No. 2) Designation, 2002 in which a number of production areas are listed from which molluscs may be taken. The designation requires that all mussels and oysters harvested in Cork Harbour may be placed on the market for human consumption only after treatment in a purification centre or after relaying which ensures that requirements specified in Directive 91/492/EEC are met.

16.3 Directive 91/492/EEC specifies, *inter alia*, that shellfish tissue is required to contain limited numbers of faecal coliforms. It is noted that live bivalve molluscs must not exceed, in 90 per cent of samples, the limits of a five-tube, three-dilution MPN-test of 6,000 faecal coliforms per 100g of flesh, or 4,600 E.Coli per 100g of flesh. Despite the absence of a formal shellfish designation within Cork Harbour under S.I. No. 200 of 1994, it is advisable that the microbiological quality of the northeast harbour area is not affected by the proposed upgrade. It should be noted that there are no disinfection facilities within the existing treatment system at Saleen, and the proposed upgrade will result in a significant improvement at the very least.

17. URBAN WASTE WATER TREATMENT DIRECTIVE

17.1 The Environmental Protection Agency Act, 1992 (Urban Waste Water Treatment) Regulations, 1994 (S.I. No. 419 of 1994) were issued to give effect to EU Council Directive 91/271/EEC concerning urban waste water treatment. The Regulations specify that wastewater arising from populations of less than 2,000 shall, by the end of 2005, be subject to appropriate treatment prior to discharge. Appropriate treatment is defined as

> *…any process and/or disposal system which after discharge allows the receiving waters to meet the relevant quality objectives and the relevant provisions of the Directive and of other Community Directives.*

This requirement applies to freshwater and estuarine discharges.

17.2 Wastewater quality limits specified in the Second Schedule of the Regulations note that the final concentrations of BOD and suspended solids shall not exceed 25mg/l and 35mg/l respectively. These limits apply, however, only to treated discharges from populations over 2,000 (10,000 where the discharge is coastal); the relevant discharge standards to be applied are to be determined from '*…other relevant Community Directives*'. Other directives of immediate relevance are Directives 75/440/EEC and 76/160/EEC, both of which have been discussed above.

17.3 The Urban Waste Water Treatment Directive notes in Annex IIA that a water body (freshwater, estuarine or coastal) must be identified as a sensitive area if certain criteria are met and to where treated waste from agglomerations of greater than 10,000 p.e. will discharge. Neither the Cloyne River nor Saleen Creek have been designated as sensitive areas. The designation process is directed at agglomerations

significantly larger than that under consideration here. Cork Harbour has not been designated as a sensitive area at the time of writing. It is expected that the harbour will be designated in the near future pending the completion of nutrient studies.

17.4 The Directive specifies a number of obligations regarding the design of wastewater treatment plants as follows:

(a) Such plants shall be designed, constructed, operated and maintained to ensure sufficient performance under all normal local climatic conditions.

(b) When designing the plants, seasonal variations of the load shall be taken into account.

(c) Waste water treatment plants shall be designed or modified so that representative samples of the incoming waste water and of treated effluent can be obtained before discharge to receiving waters.

(d) The points of discharge of urban waste water shall be chosen, as far as possible, so as to minimize the effects on receiving waters.

It is recommended that items (a), (b) and (c) are taken into account at the design and installation stage of any extensions to the existing treatment plant. Item (d) is addressed in this report.

18. PHOSPHOROUS REGULATIONS

18.1 The Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorous) Regulations, 1998 (S.I. No. 258 of 1998) were introduced to counter eutrophication observed throughout Irish watercourses and also to comply with Council Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment. The Regulations oblige local authorities to maintain or improve the water quality at any part of a river, by 2007, by reference to the biotic index (Q-value) *or* to the concentration of molybdate-reactive phosphate (largely orthophosphate). The target values specified are set out in the third schedule of the Regulations and are reproduced in Table 18.1.

18.2 The target values specified in the Regulations were adopted on the basis of the empirical relationship between the biotic indices and orthophosphate concentrations in Irish waters as monitored extensively by the EPA. Some concern has been expressed that this simplistic approach does not apply equally throughout Irish watercourses, with consequent complications in the assessment of existing and proposed discharges. These and other difficulties may be addressed in the incorporation of the EU Water Framework Directive into Irish law.

Table 18.1 Phosphorous Regulations target values.

EXISTING Q-VALUE	EITHER TO BE APPLIED	
	TARGET Q-VALUE	TARGET MRP (µg/l)
5	5	15
4-5	4-5	20
4	4	30
3-4	4	30
3	3-4	50
2-3	3-4	50
≤2	3	70

Source: Phosphorous Regulations, 1998

18.3 The limited size of the Cloyne River and its tributaries is such that the catchment has been generally ignored in the preparation and application of water quality plans by the EPA and Cork County Council to date. Thus there are no biological data available from the EPA, and the catchment has not been included in any local authority implementation report prepared in accordance with the Phosphate Regulations.

18.4 In the absence of any specific requirements under the Regulations, it is recommended that biological data discussed in Section 10.4 be used in the application of local quality objectives. Any recommendation made below on discharge points will be accompanied by a review of existing and target Q-values specified in the Regulations.

19. NITRATES DIRECTIVE

19.1 Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources obliges member states to identify Nitrate Vulnerable Zones within which restricted agricultural practices will apply. Zone designation is undertaken by reference to a number of criteria listed in Annex I of the Directive including excessive nitrate concentrations in surface or ground waters and high trophic status. With respect to surface waters, the Directive notes that sensitive waters shall be identified where nitrate levels exceed the maximum concentration specified in the Surface Water Directive ie. 11.3mg/l N.

19.2 No surface waters have been designated as Nitrate Vulnerable Zones in Cork. In addition, nitrate levels presented in 10.3 indicate that nitrate concentrations are currently satisfactory in the Cloyne River in the context of the Directive.

20. ROYAL COMMISSION STANDARDS

20.1 The standards noted in the *Eight Report of the Royal Commission on Sewage Disposal* (1912) have played an important part in water quality management since their publication. The standards are summarised in Table 20.1.

Table 20.1 Royal Commission standards, 1912.

DILUTION	STANDARD (mg/l)		TREATMENT REQUIRED
	BOD mg/l	SS mg/l	
8-150	20	30	Primary & secondary
150-300	-	60	Chemical precipitation
300-500	-	150	Plain sedimentation
>500	-	-	No treatment

Source: Royal Commission, 1912.

20.2 The normal standard fixed was 20mg/l BOD and 30mg/l suspended solids. The Commission did not include a quality standard for receiving waters in their recommendations, but noted that river waters with a BOD of 4mg/l will be ordinarily free from signs of pollution.

20.3 In accordance with the Commission's report, most river authorities have traditionally sought a minimum dilution of 1:8 in the discharge of treated wastewater to a watercourse, regardless of treatment efficiency.

20.4 The Commission standards formed the basis of *Memorandum No. 1: Water Quality Guidelines* (1978) issued by the Irish Department of the Environment Technical Committee on Effluent and Water Quality Standards. The majority of quality standards specified in the memorandum have since been superseded by more recent legislation and standards such as those described above. *Memorandum No. 1* specifies that the maximum BOD concentration in salmonid freshwaters and estuarine waters should not exceed 4mg/l. While the river under consideration has not been designated as salmonid, it is recommended that this stricter limit be applied.

20.5 *Memorandum No. 1* makes recommendations regarding discharges to estuarine environments (Section 9). Maximum BOD loadings recommended in the document are considered lenient in the context of modern legislation and standards, and the stricter limits applicable to freshwater situations are considered more appropriate to the discharge assessed in this report.

21. NOISE & ODOUR

21.1 There are no national noise limits in place in Ireland. Most developments are usually restricted by way of noise conditions in relevant planning permissions or Environmental Protection Agency licences. In the granting of permission to developments, the authorities will often refer to the EPA document *Integrated Pollution Control Licensing – Guidance note for noise in relation to scheduled activities* (1995) which notes that the noise level at a sensitive location should be kept below an L_{Ar} value of 55dB during the hours 0800-2200, and below 45dB outside of these hours, the L_{Ar} being equal to the L_{Aeq} (the average noise level) plus a penalty applied where the noise is tonal or impulsive. The guidance note states in particular that audible tones and impulsive noise at sensitive locations should be avoided at night, irrespective of the noise level.

21.2 The EPA guidance note defines a noise sensitive location as

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

It follows that the any local residence or establishment, internally and externally, in the vicinity of the WWTP site is a noise sensitive location within the terms of the guidance note.

21.3 While the EPA document was prepared as a guidance note for activities specified only in the First Schedule to the EPA Act (1992) and subsequently in follow-up Orders, the absence of other Irish guides or standards lends the document some significance and consequently the document now carries some weight outside of the industrial sectors regulated by the EPA.

21.4 There are no odour limits specified in Irish legislation, and only the Air Pollution Act, 1987 makes any reference to odour nuisance. In the absence of any limits, the EPA in their document *Wastewater Treatment Manuals: Treatment Systems for Small Communities, Business, Leisure Centres and Hotels* (1999) have recommended minimum buffer zones to be applied around WWTPs over certain threshold p.e. values. The zones have been selected to reduce both odour and noise impacts. The document notes that for systems designed to treat greater than 161p.e., a buffer zone of 50m should allowed ie. the WWTP should not be located nearer than 50m to existing development. It is further noted that at least 30m of this distance should be in the possession of the WWTP operator.

22. INTERPRETATION – LEGISLATION & STANDARDS

22.1 There are no abstraction points on the Cloyne River or Saleen Stream downstream of Saleen, and none are proposed. It follows that the Surface water Directive is not of significance here. In addition the Nitrates Directive does not apply.

22.2 There are no designated bathing areas on the Cloyne River, Saleen Creek or in Cork Harbour. While due regard should be given to the amenity value of this area of the harbour, the provisions of the Bathing Water Directive do not directly apply.

22.3 Neither the Cloyne River nor Saleen Stream have been designated under the Salmonid Regulations, and it is not expected that either will be designated in the immediate future. The fisheries significance of the river has been discussed in Section 5. Notwithstanding the absence of any fisheries designation, the Freshwater Fish Directive and Salmonid Regulations are of some significance, and it is recommended that the potential impact of the proposed upgrade is assessed with reference to Table 15.1.

22.4 There are no designated shellfish areas in Cork Harbour and thus the Shellfish Directive and Regulations do not apply. However, a number of oyster beds are located in the northeast of Cork Harbour, and it is recommended that the suitability of the harbour for this activity should not be affected by the proposed upgrade. Relevant legislation on the harvesting of molluscs makes specific reference to faecal coliform numbers in shellfish tissue. It has been noted above that there are no disinfection facilities within the existing treatment system at Saleen, and the proposed upgrade will result in a significant improvement at the very least.

22.5 Neither the Cloyne catchment nor Cork Harbour have been designated as sensitive areas in the context of the Urban Waste Water Treatment Directive. With reference to the proposal under consideration, the Directive notes that the proposed discharge shall be subject to appropriate treatment prior to discharge, where appropriate treatment is described as that which will allow compliance with other relevant Directives. The most pertinent of these is the Freshwater Fish Directive. The Urban Wastewater Directive specifies that the point of discharge of the treated wastewater shall be chosen so as to minimize the effects on receiving waters.

22.6 The limited size of the Cloyne River and its tributaries is such that the catchment has been generally ignored in the preparation and application of water quality plans by the EPA and Cork County Council to date. Therefore, in the absence of any specific requirements under the Phosphate Regulations, it is recommended that biological data obtained during the preparation of this report be used in the application of local quality objectives.

22.7 The 1912 Royal Commission report notes that a wastewater discharge to a watercourse should comply with a 20mg/l BOD and 30mg/l suspended solids standard, and a minimum dilution of 8. This standard is generally the minimum allowed in the disposal of treated wastewater, and has been endorsed by the Irish Department of the Environment Technical Committee on Effluent and Water Quality Standards.

22.8 In the assessment of noise and odour impacts, the EPA document *Wastewater Treatment Manuals: Treatment Systems for Small Communities, Business, Leisure Centres and Hotels* (1999) specifies recommended minimum buffer zones to be applied around WWTPs over certain threshold sizes. The document notes that for systems designed to treat greater than 161p.e., a buffer zone of 50m should allowed, of which 30m should be in the possession of the WWTP operator.

22.9 In summary, the article of legislation of greatest significance with respect to the discharge is the Freshwater Fish Directive. Compliance with limits specified in this article will generally ensure compliance with provisions of other relevant legislation. While the Bathing Waters and Shellfish Directives do not directly apply, it is recommended that the suitability of the local harbour area for amenity and mollusc harvesting activities should not be affected by the microbiology of the proposed discharge.

PART 3: TREATMENT, IMPACTS & RECOMMENDATIONS

23. PROPOSED DEVELOPMENT

23.1 The septic tank system currently serving Saleen was originally designed to treat wastewater arising from twelve houses in the village. Since its installation, a number of additional connections have been made and the system is now entirely overloaded. The level of treatment being provided at present is unsatisfactory, and the impacts on the receiving watercourse have been noted in Part 1. Cork County Council proposes to install an improved wastewater treatment plant at this site. It should be noted that, given the current unsatisfactory level of treatment, the proposed upgrade can only improve the quality of the discharge.

23.2 The existing system is most likely in a state of poor repair. Any decision to retain the system and to link it to the new plant should be accompanied by a complete assessment of the structural integrity of the tank. Given the costs associated with such a survey, the difficulties in establishing the defined percolation area, if any, and the proximity of the tank to the tidal waters of Saleen Creek, it is recommended that the tank be decommissioned in its entirety .

23.3 Following discussions with Cork County Council, the wastewater loading arising at Saleen is 800p.e., inclusive of imminent planning developments. It is proposed to increase the design capacity of the upgraded system, initially to 1000p.e. and possibly ultimately to 1200-1500p.e., to allow for the future development of the Saleen area. In order to facilitate gradual expansion of the plant, and the possibility of further development in the long term, it is recommended that a WWTP of modular design be installed.

23.4 The EPA document *Wastewater Treatment Manuals: Treatment Systems for Small Communities, Business, Leisure Centres and Hotels* (1999) notes that recent research suggests that *per capita* wastewater flow averages 180l/day, and the document recommends this figure be used. Accordingly this per capita wastewater flow is now accepted as the standard flow to be used in the design of wastewater treatment systems. Using this flow rate, the average daily volume (dry weather flow – DWF) of wastewater arising from design populations of 1000, 1200 and 1500p.e. will be 180, 216 and 270m^3/day respectively.

23.5 As there are no industrial discharges to the existing sewerage network, the wastewater arising in Saleen is domestic in nature. The characteristics of such wastewater streams have been documented by the EPA (1999) and are summarised in Table 23.1. No unusual variations in the existing wastewater profile have been reported.

Table 23.1. Domestic inflow wastewater characteristics from EPA study.

PARAMETER	MEAN
SS	163mg/l
BOD	168mg/l
COD	389mg/l
o-PO_4-P	7.1mg/l
Total N	40.6mg/l
NH_3-N	31.5mg/l
NO_3-N	0.25mg/l
NO_2-N	0.04mg/l
pH	7.5
Total coliforms	$1x10^8$ CFU per 100ml
Faecal coliforms	$4x10^7$ CFU per 100ml

Note: Results suggest settlement in some cases.
Source: EPA

23.6 The quality and characteristics of the current discharge have not been taken into account in this report as it is recommended that this discharge will be eliminated.

23.7 The current surface water/stormwater disposal system is not entirely known. It is suspected that surface water arising in the village is directed to Saleen Stream which flows underneath the village. It is advisable that an assessment be carried out of all premises in the village area to ensure that grey water entry to the surface water system is limited.

23.8 If surface water is prevented from entering the WWTP facility, it is recommended that the treatment plant does not include an overflow. In such circumstances it is advisable that the packaged treatment plant tender specifications include provision for a flow balancing system to cater for flows up to 6 DWF.

23.9 A number of options are available for the treatment and disposal of wastewater as follows:

(i) on-site disposal
(ii) discharge to Saleen Stream
(iii) discharge to Cloyne River
(iv) discharge to Saleen Creek
(v) discharge to Cork Harbour

These options are examined in Sections 24 to 28 respectively.

23.10 Subject to a successful *Part Eight* planning application, in support of which this document will be submitted, it is expected that design and construction procedures will be commenced in 2003/2004, with commissioning of the WWTP in 2004/2005.

24. ON-SITE DISPOSAL

24.1 The disposal of treated wastewater in a manner which reduces or eliminates a discharge to surface waters may be effected by ground-disposal using a percolation area, infiltration area or evapo-transpiring beds. Various forms of surface disposal on land have been described such as irrigation and grass plots; such systems are not recommended at the location under consideration due to possible odour and insect nuisance.

24.2 A preliminary percolation assessment undertaken at the WWTP site is described in 10.2. It was noted that soils on the site are heavy and may have a high clay content in certain areas. Vegetation indicative of wetter conditions was also observed.

24.3 It is considered that the site is not suitable for conventional on-site disposal of waste water via percolation. While a raised percolation bed may be employed on an unsuitable soil type, it is not recommended that such a system be utilised at the WWTP site due to the poor percolation characteristics of the existing soil, the low elevation of the site and the likelihood of a high water table. Furthermore, the high vulnerability of the local geology and the location of a regionally important aquifer nearby have been noted in Section 2. Notwithstanding the foregoing, the proposed design capacity of the upgraded system is such that the land take required by any percolation proposals will be excessive and will render the project uneconomical.

25. DISCHARGE TO SALEEN STREAM

25.1 Wastewater discharged from the existing septic tank eventually outfalls to Saleen Stream which lies adjacent to the site. Although small in volume with a limited catchment, local information indicates that the stream flows continuously throughout the year, albeit at low levels during the summer months. That the bed does not completely dry up during drought periods suggests the possibility of spring inflow.

25.2 It was noted in 4.4.5 that the dry weather flow in Saleen Stream was estimated at 1.17l/s. On the basis of this flow, the discharge from the proposed minimum loading of 1000p.e. (180m^3/day) will result in a dilution of less than one. It follows that the current flowrate within the stream is significantly less than required. While the dry weather flow data obtained most likely underestimates the dilution capacity available, and the more useful 95th percentile flowrate is likely to be 2-4 times the dry weather flow, it is nonetheless apparent that the stream flowrate will limit the treatment capacity of the upgraded WWTP and will hinder any expansion plans in the future.

25.3 Notwithstanding the foregoing, biological quality data determined during the preparation of this report (Section 10.4) indicate that Saleen Stream is suffering from a degree of organic pollution, attributable in part to the existing discharge.

Unsatisfactory levels of physico-chemical water quality parameters were recorded both upstream and downstream of the discharge. It follows that the waste assimilative capacity of the stream will be minimal in its current state. In this context, the termination of the existing discharge is seen as an essential step in the restoration of stream water quality.

26. DISCHARGE TO CLOYNE RIVER

26.1 While the Cloyne catchment is relatively small in area, the underlying geology is such that the Cloyne River is fed by a number of spring sources throughout the catchment. Data presented in 4.4.5 indicate that the dry weather flow may be estimated at 23.1l/s immediately upstream of the Saleen Stream confluence. An additional dry weather volume of 140m^3/day arises from the WWTP at Cloyne.

26.2 As noted in 2.3.1, the Cloyne River meets Saleen Stream immediately downstream of the existing discharge. By locating the outfall from the proposed WWTP on the Cloyne River in proximity to this confluence, the river stretch subjected to the above dilutions will be shortened and additional dilution will be afforded by Saleen Stream. Dilution calculations below include the additional flow provided by Saleen Stream. The combined dry weather flow of the stream, the Cloyne River and Cloyne WWTP is 2240m^3/day.

26.3 It is proposed to provide treatment facilities for a 1000p.e. loading initially, with possible later increases to 1200p.e. and 1500p.e. The dilution capacities available for these loadings are summarised in Table 26.1 based on a dry weather flow of 2240m^3/day.

Table 26.1 Available dilutions in Cloyne River.

LOADING	DILUTION
1000p.e.	1 : 12.4
1200p.e.	1 : 10.4
1500p.e.	1 : 8.3

26.4 It should be noted that the dilutions presented in Table 26.1 were calculated on the basis of dry weather flow data due to the absence of preferable 95th percentile figures. Such figures will usually be 2-4 times dry weather flow levels. In order to maintain a worst-case scenario, assimilation capacities are determined below using dry weather flow dilutions.

26.5 From Table 26.1 the dilution capacities available for treated discharges arising from 1000p.e., 1200p.e. and 1500p.e. are greater than the 1:8 standard specified by the Royal Commission (1912) which is normally sought by river authorities (Section 20). The available dilutions are, however, not significantly greater than the standard.

27. DISCHARGE TO SALEEN CREEK

27.1 Saleen Creek is the local name for that stretch of the Cloyne River which is subject to tidal influence. It has been noted in 2.3.6 that cartographic information suggests that the 'Highest Point to which Ordinary Tides Flow' occurs 100m downstream of the Cloyne River and Saleen Stream confluence. During site surveys, however, visual and physico-chemical assessments suggested that high tides most likely flow to within 10m of the confluence on occasion, possibly reaching the confluence during spring tides.

27.2 In the search for greater dilution capacities on a watercourse, the relocation of a proposed outfall downstream will usually provide greater assimilative capacity due to increased flowrates associated with the larger catchment drained. This will be particularly the case where a tributary meets the watercourse in the intervening stretch. It follows that the relocation of the proposed discharge point from the existing WWTP site near the Cloyne River to Saleen Creek should theoretically provide greater dilution and assimilative capacity.

27.3 Despite the foregoing, surveys undertaken at the study site indicate that the installation of the proposed outfall at Saleen Creek will not prove advantageous and may, in fact, create localised problems. There are no tributaries of any significance discharging to the Cloyne River-Saleen Creek system downstream of Saleen Stream. While some increased flow may be provided in the Creek by surrounding land run-off, the additional land area drained is relatively small, not exceeding 1km^2 at a point 500m downstream of the WWTP site.

27.4 The discharge of treated wastewater directly to Saleen Creek will most likely result in localised difficulties associated with the mixing zone. Estuarine mudflats may become highly productive environments where sustained inputs of nutrients are provided. The discharge of poor quality effluent from septic tanks and malfunctioning WWTP units has resulted in localised problems in the past at Cork sites such as Rosscarbery, Clonakilty and Courtmacsherry, although agricultural inputs and flow restrictions were also suspected here. Problems arising from such discharges relate chiefly to excessive growth of algae and odours deriving from summertime decay of same. While the provision of modern WWTP units has significantly reduced incidences of algal blooms on estuarine mudflats, problems may be encountered in estuarine mixing zones immediately around WWTP outfalls due to limited flushing and mudflat dynamics. Such problems are less evident in running freshwater environments. Where the local ecology is of some importance such as at Saleen Creek, the provision of an estuarine outfall becomes less favourable. In addition, costs and access difficulties associated with the construction of a discharge mains render this option unfavourable.

28. DISCHARGE TO CORK HARBOUR

28.1 It has been noted in 17.1 that the Urban Waste Water Treatment Regulations, 1994 specify that coastal wastewater discharges from populations of less than 10,000 shall, by the end of 2005, be subject to appropriate treatment prior to discharge. Appropriate treatment is defined as that required to meet relevant provisions of other Community Directives such as those discussed in Part 2 of this report. Council Decision 98/249/EC on the conclusion of the convention for the protection of the marine environment of the north-east Atlantic also places an onus on authorities to ensure no marine pollution arises from land-based discharges to the marine environment; authorities who discharge treated effluent to sea-waters in accordance with the Urban Waste Water Treatment Directive will meet the requirements of the Convention.

28.2 The installation of a harbour discharge would require the provision of a mains sewer to transport treated wastewater from the WWTP site. In order to avoid localised ecological problems such as those discussed in 27.4, a mains of approximate length 2km would be preferable. The route of such a mains would most likely be through Saleen Creek (with concomitant construction and ecological difficulties) or overland through private lands at Oldtown to the southwest of Saleen. Neither option is attractive, and both are expensive.

28.3 The disposal of wastewater off-shore has proven to be an economically attractive means of discharge in coastal locations. Almost unlimited dilution, and the absence (perceived or otherwise) of strict quality objectives such as those applicable to land discharges, reduces or eliminates the need for expensive treatment facilities. Such benefits, however, would not arise with respect to any proposed discharge to Cork Harbour. As discussed in Section 8.2, the harbour has been categorised as eutrophic by the EPA, and ongoing nutrient studies will most likely conclude that a sensitive designation under the Urban Waste Water Treatment Regulations is merited. It follows that this normally attractive disposal option will be less favourable due to the requirement for full treatment, in addition to mains installation costs.

29. SUMMARY OF DISPOSAL OPTIONS

29.1 Due to the poor percolation characteristics of the soil on the WWTP site, and its potential to become waterlogged as a result of the elevated water table, on-site disposal options are restricted. The high vulnerability of the local geology and the location of a regionally important aquifer nearby further preclude this option.

29.2 A discharge to Saleen Stream is restricted due to its low flows and current poor water quality. A discharge to Saleen Creek or Cork Harbour will be rendered impractical by mains construction costs. While such costs may often be offset against reduced treatment requirements in coastal discharges, full secondary treatment will

be required as a minimum due to existing nutrient problems and ecological considerations.

29.3 A discharge to the Cloyne River remains as the only practical option and this option is examined further below. The existing WWTP site lies close to the river, thereby minimising capital construction costs. This option will also be the most favourable on ecological grounds. The available dilution capacity is sufficient to treat up to 1500p.e.

29.4 While the estimated dilution available does not significantly exceed the 1:8 Royal Commission standard, it is recommended that the design of the proposed WWTP be such that future expansion to treat populations up to and greater than 1500p.e. is not prevented. Such future expansions may be deemed possible for a number of reasons:

(a) Detailed flow data may be recorded during the intervening period. Such data may be used in the calculation of future dilution capacities in the river.

(b) The available dilution was determined using the estimated dry weather flow, and not the larger and more usually applied 95th percentile flow. The normal flow is likely to significantly exceed this level - EPA notes that the average flows in Irish rivers correspond to the 30th percentile flow (1997). Groundwater charging is also a significant contributor to this catchment. Further dilution attributable to tidal influence has not been assumed in flow calculations.

(c) The Royal Commission 1:8 dilution standard was prepared on the basis of a discharge containing 20mg/l of BOD and 30mg/l of suspended solids. No reference was made to discharges containing the lower concentrations more readily achievable today.

30. IMPACTS

30.1 Possible impacts arising from the discharge of the treated wastewater are examined below. The determination of downstream parameter concentrations has been carried out using background levels measured during the site survey of January 10 2003. Levels recorded in the sample taken upstream of the Cloyne River-Saleen Stream confluence have been used in preference to the downstream sample to avoid impacts associated with the discharge from the existing septic tank.

30.2 Of critical importance is the awareness that calculation of parameter concentrations is carried out on the basis of samples taken on January 10 2003. Such samples provide a snapshot picture of water quality at the time of sampling, and may not accurately indicate long term quality trends. In the absence of long term data no alternative exists but to use such figures. It is always advisable that wastewater discharge assessments are accompanied by extended water quality surveys where possible.

30.3 Mass balance equations may be used to determine the concentration of a parameter in a watercourse downstream of its discharge. A typical equation is as follows:

T = (FC + fc) / (F + f) *Equation i*

where T = downstream pollutant concentration
F = upstream river flow
C = background pollutant concentration
f = effluent flow
c = effluent pollutant concentration

31. WASTE ASSIMILATIVE CAPACITY & BOD

31.1 The waste assimilative capacity (WAC) of a watercourse is the mass of BOD which the watercourse can healthily absorb in one day. The WAC is a function of the existing BOD in the watercourse, the maximum permissible BOD and the minimum flow rate. The WAC may be determined as follows:

$WAC = (C_{max} - C_{back}) \times F_{95}$ *Equation ii*

where WAC = waste assimilative capacity
C_{max} = maximum permissible BOD
C_{back} = background upstream BOD

F_{95} = 95th percentile flow

31.2 Dry weather flow data are used below in the absence of 95th percentile data. Thus a worst-case scenario is maintained. The additional flow available downstream of Saleen Stream is included, given a dry weather flow of 2240m^3/day.

31.3 Department of the Environment *Memorandum No. 1: Water Quality Guidelines* (1978) specifies that the maximum BOD concentration in salmonid freshwaters and estuarine waters should not exceed 4mg/l. While the rivers under consideration have not been designated as salmonid, it is recommended that this stricter limit be applied.

31.4 The background BOD in the Cloyne River upstream of the WWTP site was noted in 10.3 to be less than 1mg/l. No long term BOD data are available with which to describe continuous quality. Applying the determined dry weather flow of 2240m^3/day at this location, the WAC was estimated to be 6.7kg BOD/day.

31.5 *Memorandum No. 1* notes that a discharge to a watercourse should not increase the BOD within the watercourse by more than 1mg/l. Using mass balance *Equation i*, the maximum concentrations of BOD in the final wastewater discharge required to

meet this stipulation were determined for design loadings of 1000, 1200 and 1500p.e. The BOD limits are presented in Table 31.1.

Table 31.1 BOD loadings to Cloyne River.

DESIGN LOADING	BOD LIMIT (mg/l)	DOWNSTREAM BOD CONCENTRATION (mg/l)	BOD LOADING (kg/day)
1000p.e.	15	2.0	2.70
1200p.e.	12	2.0	2.59
1500p.e.	10	2.0	2.7

31.6 It is recommended that treatment to 15mg/l be installed initially to cater for up to 1000p.e. Well maintained secondary treatment plants may produce a clarifier effluent of 15mg/l without modification, and it is therefore recommended that a secondary stage aerobic facility or similar be installed, with ongoing monitoring of treatment efficiency following commissioning. Improvement of treatment efficiency or expansion to greater that 1000p.e. may be facilitated at a later date by retrofitting of tertiary treatment filtration.

31.7 Daily BOD loadings from the proposed WWTP at the levels of treatment proposed in Table 31.1 are included in Column 4 of the table. Loadings in all cases are significantly less than the WAC determined in 31.4 and thus sufficient capacity is available to assimilate same.

32. SUSPENDED SOLIDS

32.1 Of the various standards and articles of legislation discussed in Part 2, the strictest suspended solids limits are specified in the Freshwater Fish Directive which notes that a guide limit of 25mg/l of suspended solids is desirable in fresh waters. A similar maximum concentration is specified by the Salmonid Waters Regulations. The application of this limit will ensure compliance with those specified in the Urban Waste Water Treatment Directive and in *Memorandum No. 1.*

32.2 Based on a suspended solids concentration of 3mg/l recorded upstream of the WWTP site (from 10.3), a discharge concentration of 30mg/l will result in downstream levels outside of the mixing zone as indicated in Table 32.1.

Table 32.1 Suspended solid levels downstream of discharge.

DESIGN LOADING	DOWNSTREAM SUSPENDED SOLIDS CONCENTRATION (mg/l)
1000p.e.	5.0
1200p.e.	5.4
1500p.e.	5.9

32.3 Downstream levels in all cases are significantly less than the 25mg/l limit specified, and it is therefore recommended that at least a 30mg/l suspended solids limit be applied.

33. NITROGEN

NOTE: ALL CONCENTRATIONS BELOW IN MG/L AS N UNLESS OTHERWISE SPECIFIED.

33.1 Elemental nitrogen may be present in a number of forms in a wastewater discharge. Ammonia and nitrates are of most significance, with the relative proportions of their take-up by plants and algae varying with their ratio, the local conditions and the species involved. The nitrite form is an intermediate stage in the conversion of these two parameters.

33.2 A reduction in nitrogen levels being discharged to Cork Harbour will be welcomed in the context of nutrient studies documented in 8.2.5. Of great importance is that the proposed discharge does not elevate nitrate levels in the receiving watercourse significantly and does not affect the status of the aquatic environment with respect to the 11.3mg/l limit specified in the Nitrates Directive (Section 19).

33.3 Nitrogen present as nitrate will rarely impact directly on fish life and thus there are no limits specified in the Freshwater Fish Directive or Salmonid Regulations. Nitrite limits specified in these instruments are rarely encountered. Of more significance are levels of ammonia, particularly the un-ionised form. The European Inland Fisheries Advisory Commission (1970) have reported that an un-ionised concentration of 0.02mg/l NH_3 will present a long term sub-lethal dose for salmonid and cyprinid fish. Due to the inter-relationship between the various forms of ammonia present, the pH and temperature, many texts specify total ammonia concentrations – at varying pH and temperature – which will contain this 0.02mg/l un-ionised NH_3. Based on this relationship, the Freshwater Fish Directive and Salmonid Regulations have specified maximum 'total ammonium' concentrations of 0.82mg/l N.

33.4 Additional concerns arise where nitrogenous effluents are discharged to saline waters as nitrate rather than phosphate tends to be the limiting nutrient in coastal and marine environments. Nitrogen levels usually show a marked seasonal variation in estuaries, with highest levels in winter/early spring and lowest in late spring/summer due to the uptake of this nutrient by growing plants. In estuarine environments the discharge of nitrogenous effluents may promote algal growth on mudflats, and consequently *Memorandum No. 1* recommends a nitrate water quality standard for estuarine and coastal waters of 1mg/l outside of the mixing zone. While it has been recommended above that the proposed WWTP will discharge to the Cloyne River, the river becomes tidal within 100m of the proposed outfall point and it follows that nitrogen levels within the discharge are of some importance. As existing nitrate levels in the Cloyne River exceed this limit, it is recommended that the proposed discharge does not appreciably increase these background nitrate concentrations.

33.5 From the foregoing, nitrogen standards may be summarised as follows:

Table 33.1 Nitrogen standards of relevance.

STANDARD	LIMIT	COMMENT
Nitrates Directive	11.3mg/l	Nitrate as N
Freshwater Fish Directive	0.82mg/l	Total ammonium as N
Salmonid Regulations	0.82mg/l	Total ammonium as N
Memorandum No. 1	1mg/l	Nitrate as N in estuaries outside of mixing zones

33.6 Most modern treatment units produce a nitrified effluent, with the major portion of nitrogen converted from ammonia to nitrates as a result of nitrification processes incorporated in the design. Due to the conversion dynamics within secondary stage treatment units, it is difficult to specify separate concentrations of ammonia and nitrates to be met in the treated effluent, and the application of a total nitrogen limit – consisting of ammonia, nitrates and intermediate stages – provides a more common sense approach.

33.7 The background nitrogen concentration recorded on January 10 2003 was 5.1mg/l, inclusive of nitrate, nitrite and ammonia. Using *Equation i*, the downstream nitrogen concentrations arising from various nitrogen loadings in the proposed wastewater discharge have been calculated, and levels are presented in Table 33.2.

Table 33.2 Nitrogen levels downstream of discharge.

DESIGN LOADING	40mg/l N	30mg/l N	20mg/l N	10mg/l N	5mg/l N
1000p.e.	7.7	6.9	6.2	5.5	5.1
1200p.e.	8.2	7.3	6.4	5.5	5.1
1500p.e.	8.8	7.8	6.7	5.6	5.1

33.8 The calculations indicate that, with respect to all three design loading scenarios, nitrogen removal down to a discharge concentration of 5mg/l will be necessary to prevent any increase over background river concentrations. At discharge concentrations of greater than 20mg/l, downstream nitrogen levels will be significantly elevated in the context of levels noted in Table 33.1.

33.9 Without the installation of specific nitrogen-removal processes such as anoxic zones, secondary stage treatment units will not significantly reduce nitrogen levels but merely convert the various forms present to oxidised nitrate, with consequent reductions in ammonia concentrations. Thus the normal influent nitrogen concentration of approximately 40mg/l may not be greatly decreased during the treatment process. It follows that some form of nitrogen removal will be required at the proposed WWTP to reduce concentrations to satisfactory levels. The modular design of modern WWTP units allows additional nitrification to be introduced following commissioning.

33.10 In the setting of maximum nitrogen limits in the treated discharge, it should be noted that levels presented in Table 33.2 were determined using grab samples taken on January 10 2003. As noted previously, such samples may not accurately reflect

long term quality trends in a watercourse. In these circumstances it will be imprudent to recommend the installation of maximum nitrogen removal facilities where ongoing monitoring of river quality may indicate that such facilities are not required. Accordingly it is recommended that provision be made initially (up to 1000p.e.) for nitrogen removal down to 20mg/l, with provision for later reduction to 10mg/l where (a) ongoing monitoring indicates that downstream nitrogen levels are elevated or grab samples originally taken were not representative, or (b) it is proposed to increase the loading being discharged to the WWTP.

33.11 In certain proprietary treatment systems available today, installation costs associated with nitrogen removal to 20mg/l and to 10mg/l are not greatly different, and if such a system is chosen it is recommended that initial provision for the latter limit is made. This is particularly the case where the cost of retrofitting of additional reduction facilities may be significantly higher than first-day installation costs.

33.12 As noted above, the majority of effluent nitrogen will be present as nitrate with little residual ammonia in the discharge. Calculations indicate that the application of a 20mg/l nitrogen limit will result in downstream ammonia concentrations significantly less than the 0.82mg/l limit noted in 33.3 above.

34. PHOSPHOROUS

34.1 While nitrogen rather than phosphorous will tend to be the limiting nutrient in saline waters, phosphorous may nonetheless play a part in the nutrient balance of Saleen Creek. It has been noted in 8.2 that there is some evidence that parts of Cork Harbour are phosphorous limited. In the Cloyne River downstream of the proposed WWTP outfall, phosphorous will most likely be limiting, and thus phosphorous loadings are of relevance.

34.2 Within the aquatic environment phosphorous will be present in a number of forms, both organic and inorganic, and within solution or bound in solids. All forms present are referred to as total phosphorous. A significant fraction of total phosphorus is available for biological metabolism and is termed orthophosphate. The analytical procedure used in the determination of orthophosphate is the molybdate-reactive method which is used to derive the concentration of molybdate-reactive phosphate (MRP) in a sample. Although the MRP may slightly overestimate the level of orthophosphate present, the two expressions have become synonymous.

34.3 It has been stated in 8.1 that there are no EPA monitoring stations in the Cloyne catchment, and consequently there are no biological Q-values to which the Phosphorous Regulations apply. In addition, there are no phosphate criteria applicable in the context of sensitive areas designated under the Urban Waste Water Treatment Directive.

34.4 The Freshwater Fish Directive does not include a limit for phosphates in freshwaters. However, the Salmonid Regulations note that a limit value of 0.124mg/l

of total phosphorous may be regarded as indicative in order to reduce eutrophication in cyprinid waters ie. waters not designated specifically as salmonid such as the river under consideration. In the absence of other relevant guidelines it is recommended that this limit be applied below. No limit is proposed for orthophosphate as this parameter has been factored in the derivation of the total phosphorous limit.

34.5 The background total phosphorous level recorded on January 10 2003 was significantly high at 0.27mg/l, with an orthophosphate concentration of 0.10mg/l. The biological Q-value obtained at the same sampling station during the survey of January 20 2003 was Q3(3-4) indicating moderate pollution. The Phosphorous Regulations note that this Q-value corresponds to an annual MRP level of 0.05-0.07mg/l (Section 18) which is less than the level recorded in the grab sample. On the basis that MRP constitutes approximately 70-95% of total phosphorous, the current annual median total phosphorous concentration may be estimated at 0.1mg/l. It follows that the phosphorous concentrations recorded may be significantly higher than the expected annual median levels, and the use of the former in determining treatment levels required may be superfluous. Thus the estimated annual median total phosphorous concentration of 0.1mg/l is used below.

34.6 Where the current Q-value is Q3(3-4), the Phosphorous Regulations specify a target Q-value of Q3-4 and MRP level of 0.05mg/l. Due to the relatively limited dilution available (based on a worst-case scenario dry weather flow), a total phosphorous concentration of 2mg/l in the treated discharge will result in significantly high phosphorous levels downstream of the outfall (greater than 0.2mg/l P). Downstream phosphorous levels will also remain high where an estimated 95th percentile flow of approximately three times the dry weather flow is applied to the calculations. It follows that phosphorous removal to at least 1mg/l will be required. Based on a current annual median total phosphorous concentration of 0.1mg/l, a treated discharge level of 1mg/l will result in a downstream concentration of 0.17mg/l outside of the mixing zone at a 1000p.e. loading.

34.7 It is therefore recommended that a phosphorous treatment limit of 1mg/l be applied in order to assist in the meeting of requirements specified in 34.4-34.6 above. It is also recommended that an ongoing phosphorous and Q-value monitoring programme be implemented following commissioning of the proposed WWTP to assess long term treatment efficiency and localised impacts.

35. PATHOGENS

35.1 There are no drinking water abstraction points in the Cloyne River or Saleen Creek downstream of the proposed WWTP site, and thus pathogens in the treated discharge are not of direct relevance to humans. The creek area is, however, a recognised bird feeding ground. Furthermore, the location of a number of oyster trestles at the mouth of the creek, 2km downstream of the existing WWTP site, is of some importance. Certain aquatic activities are also carried out in the Aghada area as noted in 14.2.

35.2 Table 23.1 indicates that domestic wastewater will contain on average 100 million and 40 million colony-forming units of total and faecal coliforms respectively per 100ml. These organisms, while not overtly pathogenic in themselves, are used as indicators of pathogenic activity. Due to growth and decay dynamics within bacterial populations, normal mass balance calculations cannot be applied in the assessment of bacteriological impacts. Significant variations in local environmental conditions and wastewater microbiological characteristics do not facilitate the generation of discharge-specific models.

35.3 All treatment processes applied to wastewater will provide some degree of coliform reduction, usually via the filtration of suspended solids in the wastewater stream. Gray (1999) reports that conventional treatment will remove up to 90% of bacterial pathogens. He also notes that dilution and the effects of natural biotic and abiotic factors in surface waters will reduce the density of pathogens further.

35.4 Given the difficulties associated with the modelling of microbiological impacts of a discharge, the varying treatment abilities of treatment plants, and the absence of coliform quality objectives applicable to treated discharges, no specific coliforms standards are recommended. Alternatively it is recommended that a monitoring programme is undertaken following the commissioning of the WWTP selected. An ongoing examination of key microbiological parameters, including total and faecal coliforms, faecal streptococci and sulphite-reducing clostridia, may be used to determine the overall treatment efficiency of the system chosen.

35.5 On the basis of (i) the level of treatment which will be applied to the discharge, (ii) the dilution available within the Clonye River-Saleen Creek system, (iii) the decay of micro-organisms in the natural environment, (iv) the distance between the proposed WWTP outfall and the creek mouth, and (v) the significant dilution available in the northeast harbour, no impacts on the trestles or on aquatic activities are expected. It is recommended that the design of the WWTP be such that the post-installation of disinfection equipment is facilitated if deemed necessary following an assessment of the results obtained from the sampling programme. It should also be noted that the existing treatment system at Saleen is unsatisfactory and any upgrade to the system can only improve the quality of the wastewater stream.

35.6 Feeding by birds in areas immediately downstream of wastewater discharges has been highlighted in the past as a potential risk. Studies have shown that gulls in particular are liable to feed in such locations. Concern arises where there are one or more open water supply reservoirs in proximity to the feeding site, with possible contamination arising from bird droppings. There are no uncovered water storage reservoirs near the study site, and drinking water at Saleen is supplied from distant groundwater sources. This problem is therefore not expected to arise. Submersion of the outfall pipe will further minimise this risk.

36. ECOLOGY & FISHERIES

36.1 It has been noted in Section 5 that the Cloyne catchment is of limited fisheries significance. The South Western Regional Fisheries Board have recommended that a fish stock assessment be undertaken in the future. The determination of maximum limits to be applied to the treated wastewater discharge has been addressed above in the context of the Freshwater Fish Directive and Salmonid Waters Regulations. Treatment in accordance with the specified limits will therefore be in keeping with the requirements of these articles of legislation, and no negative impacts on fisheries are expected. The outfall location and design should be chosen so as to avoid large plumes which may prove a barrier to fish movement or damage certain fish habitats.

36.2 The ecological importance of Saleen Creek has been noted in Section 5. It was also noted that the reduction in nutrient levels being discharged to the creek which will arise following the proposed WWTP upgrade may be expected to have a neutral to slightly negative impact on the size of local bird populations due to a decrease in mudflat productivity. Water quality downstream of the WWTP outfall is expected to improve as the existing discharge is decommissioned, with a concomitant improvement in aquatic ecology.

36.3 It is recommended than an annual biological survey is undertaken at stations B1 and B2 indicated in Table 10.4. Results recorded from the surveys may be used to assess the ecological health of the river and the treatment efficiency of the proposed WWTP.

37. RECOMMENDED TREATMENT STANDARDS

37.1 Treatment standards determined above are summarised in Table 37.1. It is recommended that the effluent discharge be monitored to ensure the pH does not fall outside the range 6-9. It should be noted that the standards are presented as a minimum; the Cloyne River and Saleen Creek will benefit from stricter standards where applied. Treatment standards have been recommended on the basis of dilution factors determined using estimated dry weather flow data, thereby maintaining a strict worst case scenario approach. It is important to reiterate that the standards are based in part on 'snapshot' samples taken during the preparation of this report, and future ongoing monitoring is recommended below.

Table 37.1 Recommended treatment standards at Saleen WWTP.

PARAMETER	STABDARD
BOD	15mg/l
SS	30mg/l
Total N	20mg/l
Total P	1mg/l

37.2 The quality standards recommended are relatively restrictive, with both nitrogen and phosphorous removal recommended. In addition, a high quality effluent will be required from the secondary clarifier (if installed) in order to meet the strict BOD limit recommended. The requirement for a high quality effluent is a product of limited available dilution, moderate background water quality and the complications associated with discharging a nitrogenous waste stream to a saline environment of some ecological importance.

37.3 It is recommended that a reliable and robust treatment unit be installed, with provision for retrofitting of certain components if required. The treatment standards noted in Table 37.1 may be provided to tendering suppliers.

37.4 The secondary effluent may be discharged directly after phosphorous removal and without further tertiary treatment. It is recommended that a sampling point be included on the discharge mains within the WWTP site. It is also recommended that a sampling programme is initiated following commissioning of the system. The programme should include monthly monitoring of the effluent during the first six months of operation, and thereafter at intervals in accordance with statutory or maintenance requirements. Samples should also be taken downstream of the outfall outside of the mixing zone. The following parameters are recommended for analysis: pH, BOD, SS, NH_3, NO_3, o-PO_4, t-PO_4, total and faecal coliforms, faecal streptococci and sulphite-reducing clostridia. Results of analyses should be used in any retrospective fine-tuning of the treatment plant installed.

37.5 Calculations made during the preparation of this report, and impacts determined on the basis of same, were carried out using a steady dry weather flow from the WWTP ie. 1DWF. At peaks times, discharge flowrates in WWTP systems may increase to 3DWF or greater. During such times, short term increases in nutrient loadings will be expected which will be matched by decreased loadings at other times. Such short term fluctuations in the discharge flowrate are not expected to negatively impact on the Cloyne River in the longer term, and there are no designated biological monitoring stations downstream of the WWTP site which may be sensitive to such fluctuations.

38. MIXING ZONE

38.1 It was noted in 2.3.6 that spring tides may reach the Saleen Stream-Cloyne River confluence, although further movement inland is unlikely. In order to minimise the inflow of tidal waters towards the proposed WWTP outfall, it is recommended that the outfall be located at least 20m upstream of the confluence. Complete mixing is expected upstream of Saleen Creek.

38.2 Due to the limited dilution available in the Cloyne River, the selection of outfall location is of some importance. It is recommended that the outfall be situated near the centre of the watercourse in order to avoid incomplete mixing along one side of the river. The invert level should be so as to ensure submersion at all times.

38.3 Site surveys indicate that there are no salmonid spawning sites in this stretch of the Cloyne River. Nonetheless it is recommended that the South Western Regional Fisheries Board be consulted on this matter prior to finalising the outfall position and means of construction.

38.4 As noted previously, the WWTP site lies upstream of normal tidal influence. It is possible that exceptional high spring tides may approach the proposed outfall location, although no such observations were made during surveys undertaken in the course of this project. In the event of such tides, flushing of discharges may be limited, particularly where such tides may coincide with times of peak discharges. Accordingly it is recommended that a detailed study of salinity profiles in the Cloyne River is undertaken at times of high spring tides prior to commissioning of the proposed WWTP. Where surveys suggest the possibility of limited flushing during such periods, it is recommended that provision be made for the installation of flow control devices on the WWTP outfall (eg. balancing tanks) or, less preferably, on the Cloyne River (eg. weirs).

39. RECOMMENDATIONS

39.1 It is recommended that the existing septic tank system be decommissioned and the existing discharge removed following commissioning of the upgraded plant.

39.2 It is recommended that all future developments in the village are accompanied by separate sewer systems, and that the existing network be separated as much as possible. It is advisable that an assessment be carried out of all premises in the village to ensure that grey water entry to the surface water system is limited.

39.3 It is recommended that a suitable grease trap/interceptor be stipulated in planning permissions granted to any developments proposed at Saleen which will include cooking facilities.

39.4 It is recommended that treated wastewater be discharged to the Cloyne River. The following treatment standards are recommended initially *as a minimum*:

PARAMETER	STABDARD
BOD	15mg/l
SS	30mg/l
Total N	20mg/l
Total P	1mg/l
pH	6-9

39.5 In the final selection of a treatment unit, it is recommended that the following criteria be applied by the supplier at the design stage:

(a) The plant should be designed, constructed, operated and maintained to ensure sufficient performance under all normal local climatic conditions.

(b) Seasonal variations of the load should be taken into account.

(c) If surface water is prevented from entering the WWTP facility (the preferred option), it is recommended that the treatment plant does not include an overflow. In this case it is recommended that the plant tender specifications include provision for a flow balancing system to cater for flows up to 6 DWF.

(d) Provision should be made for possible future retrofitting of additional nitrogen removal and disinfection processes in the WWTP selected.

(e) Sampling points should be provided on the influent and effluent lines to the selected WWTP unit.

39.6 It has been noted in 21.1 that the EPA's noise guidance note states that the noise level at a sensitive location should not exceed 55dB during daytime hours and 45dB at night-time. As the proposed WWTP will be operative during both periods, its is recommended that the 45dB limit be applied. Given the relatively isolated location of the WWTP site 300m southwest of Saleen village, the imposition of a 55dB limit at the boundary of the WWTP site will not breach 45dB at the nearest noise receptors. It is therefore recommended that a 55dB limit be applied at the WWTP site boundary. It is also recommended that the installed system does not result in impulsive or tonal noise emissions of any nature.

39.7 It is recommended that a buffer zone of at least 50m is allowed between the site of the proposed WWTP and the nearest existing development, of which 30m or more should lie within the WWTP site boundary in order to minimise odour nuisance.

39.8 It is recommended that the outfall be situated at least 20m upstream of the Saleen Stream-Cloyne River confluence, near the centre of the watercourse and so as to ensure submersion at all times. It is recommended that the South Western Regional Fisheries Board be consulted prior to finalising the outfall position and means of construction.

39.9 The construction phase of the WWTP development should be carried out in a manner which does not interfere with adjacent watercourses in any way. Untreated discharges to the river both during the construction phase and during commissioning should not be permitted.

39.10 It is advisable that a maintenance contract is agreed with the supplier of the treatment unit selected.

39.11 It is recommended that any proposed upgrade to the new WWTP or any increase in loadings to the plant is accompanied by a reassessment of waste assimilative capacities in the local catchment.

39.12 It is recommended that a monitoring programme is implemented following the commissioning of the treatment system selected. The programme should include monthly monitoring of the final effluent during the first six months of operation. Samples should also be taken downstream of the outfall outside of the mixing zone. The following parameters are recommended for analysis: pH, BOD, SS, NH_3, NO_3,

o-PO_4, t-PO_4, total and faecal coliforms, faecal streptococci and sulphite-reducing clostridia. Results of analysis should be used in any retrospective fine-tuning of the treatment plant installed, and to determine the need for disinfection of the wastewater stream or for the installation of additional nutrient removal.

39.13 It is recommended than an annual biological survey of the Cloyne River at this location is undertaken to assess the ecological health of the river.

39.14 Further salinity tests on the Cloyne River are advisable during spring tide events prior to commissioning in order to assess the likelihood of limited flushing at such times.

39.15 It is recommended that the design of the proposed WWTP be such that future expansion to treat populations up to and greater than 1500p.e. is not prevented, subject to future ongoing assessments of flow rates and water quality in the Cloyne system.

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APPENDIX I: SITE SYNOPSIS

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.

The main habitats of conservation interest are the sheltered tidal mudflats and Atlantic salt meadows, both habitats listed on Annex I of the EU Habitats Directive. These habitats, along with brackish pools and open water, support a rich invertebrate fauna. Cord-grass (*Spartina* sp.) has colonised the mudflats in places, especially around Rossleague and Belvelly.

The site is also 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. An Foras Forbartha provided the following description in 1986:
Waders and wildfowl occur in large numbers during the winter. 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 Harpers 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 (1,779) and Redshank (2,382) along with Nationally important numbers of nineteen other species. Furthermore, it contains the largest Dunlin (10,912) and Lapwing (14,713) flocks in the country. All counts are average peaks, 1984/85 - 1986/87. Much of the site forms part of Cork Harbour Special Protection Area, an important bird area designated under the 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 three 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.

APPENDIX II: BIOLOGICAL SURVEY SUMMARY

SITE B1		COMMENT
Temperature	9.1^{0}C	On Cloyne River 50m u/s of confluence with Saleen Stream. Poor sampling location with mainly muddy substrate. Small area of gravel. May be localised impacts from land run-off and cattle drinking point. Water levels high during sampling period.
Summer shade (estimated)	70%	
Current	Fast but not turbulent	
Substrate	Generally soft Small area of gravel	
Depth	40cm	
Width	1m	

SITE B2		COMMENT
Temperature	9.2^{0}C	On Cloyne River 5m d/s of confluence with Saleen Stream. Excellent sampling location with mixed gravel substrate. Polychaeate worm indicative of saline influence. Water levels high – water opaque.
Summer shade (estimated)	10%	
Current	Fast turbulent	
Substrate	Mixed gravels and larges stones	
Depth	15cm	
Width	1.5m	

SITE B3		COMMENT
Temperature	9.0^{0}C	On Saleen Stream 4m d/s of existing WWTP discharge. Good sampling location with gravel and turbulent flow. Sewage fungus noted. Water quality poor.
Summer shade (estimated)	10%	
Current	Fast turbulent	
Substrate	Mixed gravels and larges stones	
Depth	15cm	
Width	1.5m	

Results of the biological assessment at each site are presented with distribution of macroinvertebrate taxa. Sensitivities of different taxa, numbering method and method for determining Q-values are outlined in *The Biological Survey of River Quality 2000* (EPA, 2001).

	B1	B2	B3
Baetis rhodani	Small Numbers	Common	
Gammarus sp.	Common		
Asellus sp.			
Seristocomatidae	Small Numbers	Present	
Limniphilidae	Fair Numbers		
Polycentropus sp.			
Glossosomatidae		Common	
Tipulidae			
Tabanidae		Fair Numbers	
Simulidae	Common		
Chironimidae	Small Numbers	Fair Numbers	
Chironomous sp.			Common
Elminthidae			
Lymnea sp.	Present	Numerous	
Tubificidae	Present		Dominant
Oligochaete			

STATION	Q-VALUE
B1	Q3(3-4)
B2	Q2-3
B3	Q1

All three sites appear to be suffering from some degree of organic pollution with unsatisfactory water quality at each site. Water quality at site B3 is particularly poor with a Q rating of 1 assigned. A Q value of 2-3 was assigned to site B2 suggesting that it is being affected by the wastewater discharge upstream. Site B1 which is not affected by the discharge from the WWTP was found to have the best water quality although it was still unsatisfactory. The most likely cause is localised agricultural impact.

APPENDIX 6

Cork Harbour 2006-2008

Segment				
R Lee		LE010	Lee	
Lee C Estuary		LE020 - LE180		
Lough Mahon		LE310 - LE380	LM	
R Owenacurra		LE500	Ocurra	
Owenacurra Estuary		LE510 - LE550	OcurraEst	
North Channel Great Island		LE410 - LE450	Nchannel	
Outer Cork Harbour		LE610 - LE630; LE810 - LE820	Outer	05%ile /
Coastal Cork Harbour (WFD Zone)			Coastal	
Offshore Cork Harbour <12 NM			Offshore	
Oceanic Cork Harbour >12 NM			Oceanic	

Cork Harbour 2006-2008

Counter	Station No	Sample Label		Survey Date	Time Clock	Tidal Time
	Cork Hart		274	27-Jan-06	8.47	
	Cork Hart		328	27-Jan-06	11.15	
	Cork Hart		330	27-Jan-06	11.46	
5 2008 08 01 017	LE620	LE620C		28-Jan-08	11.43	
5 2008 08 01 018	LE620	LE620C		28-Jan-08		
5 2008 08 01 019	LE630	LE630S		28-Jan-08	12.05	
5 2008 08 01 020	LE630	LE630B		28-Jan-08		
5 2008 08 01 021	LE810	LE810S		28-Jan-08	12.2	
5 2008 08 01 022	LE810	LE810B		28-Jan-08		

Outer Winter

Summary Stats Outer Winter	Salinity ‰	SampleSal	Temp. (C)	pH	Secchi	S.S. (mg/l)	DO % Surface
MINIMUM	17.2	32.7	9.3	7.9	2.2	0	99.0
MEDIAN	32.5	34.2	9.5	7.9	2.2	#NUM!	100
MAXIMUM	34.7	35.7	9.7	8.0	2.2	0	101
No of samples	9	6	6	6	3	0	6
90%ile	23.1	32.7	9.3	7.9	2.2	#NUM!	99
95%ile	34.7	35.6	9.7	8.0	2.2	#NUM!	101
				0	0	0	0
number exceeding thresholds stated below				0		0	0
				0.0	0.0	#DIV/0!	0.0
% exceeding thresholds stated below				0.0		#DIV/0!	0.0
						<70	<70
Threshold Values				<6.5			
				>8.5	<1	>120	>120

Depth Bed	Sample Depth S	Salinity S ‰	Sample Sal	Temp S ℃	pH	Secchi m	SS mg/l	DO S % Sat
	3	32.54						
		34.01						
	3	17.2						
25.5	0	31.91517	32.69	9.33	7.93	2.2		99.4
	20.5	34.64905	35.55	9.68	7.93			99
25.3	0	32.02032	32.8	9.38	7.92	2.2		99.6
	20.8	34.74464	35.65	9.7	7.95			99.6
15	0	32.26885	33.06	9.4	7.94	2.2		100.3
	14.5	34.44831	35.34	9.65	7.95			100.8

<0.01=0.0(<0.01=0.009 <5=4.99

B.O.D. (mg/l)	TON Surface	NH3 Surface	Free NH3 Surface	DAIN Surface	PO4 Surface	TON/NH3 Surface	DAIN/PO4 Surface	Chlorophyll a S mg/m³
								Chla>100
								0
0.5	0.25	0.010	0.0002	0.259	14	13.5	0.0	0.25
0.8	0.49	0.010	0.0002	0.499	26	25.5	22.9	0.25
1.1	2.48	0.045	0.0008	2.478	45	49.4	52.2	0.25
2	9	6	6	9	9	6	9	6
1.0	**1.00**	**0.04**	**0.0007**	**1.024**	**32**	15.4	0.0	**0.25**
1.1	1.74	0.041	0.0008	1.751	39	49.4	51.2	0.25
0	1	0	0	1	1	0	3	0
	0	0	0	0	0	6	6	0
0.0	11.1	0.0	0.0	11.1	11.1	0.0	33.3	0.0
	0.0	0.0	0.0	0.0	0.0	100.0	66.7	0.0
								0.0
>4	>1	>0.3	>0.004	>1	>30	<1	<10	>10
	>3	>0.8	>0.020	>3	>100	>=1	>22	>30
								>100

B.O.D. mg/l O2	TON mg/l N	NH3 mg/l N	Free NH3 mg/l N	DIN mg/l N	PO4 µg/l P	TON:NH3	DIN:PO4 µMol	Chlorophyll a mg/m
	0.4732			0.4732	18.2723		0.025897	
	0.294			0.294	13.9365		0.021096	
	2.478			2.478	44.9065		0.055181	
	0.489	0.0099	0.00017819	0.4989	26	49.39394	42.43247	0.249
	0.489	0.0099	0.00018309	0.4989	26	49.39394	42.43247	0.249
1.1	0.631	0.03	0.00052991	0.661	28	21.03333	52.20373	0.249
	0.249	0.0099	0.00019187	0.2589	25	25.15152	22.90077	0.249
0.499	0.607	0.045	0.00083304	0.652	29	13.48889	49.71732	0.249
	0.255	0.0099	0.00019113	0.2649	26	25.75758	22.53029	0.249

	ATSEBI Criteria	Threshold	Value	Score			
A	DIN-	0.442	0.499	Fail	A Nutrient	Fail	Potential
	MRP-	43	26	Pass	B Chloro	Pass	Pass
B	Chloro. Median	10.8	0.25	Pass	C DO	Pass	Pass
	Chloro 90 percentile	21.7	0.25	Pass			
C	DO%sat 5 percentile	78	99	Pass			
	DO%sat 95 percentile	122	101	Pass			

Si_est µg/l Si	Lab. Number	Cond. µS/cm	Fluor Volts	Fluor Chl a	TOC mg/l C	DIC mg/l C	Total N	Tot P µg/l P	Colour
0.26283	260783								
0.19853	260797								
0.97157	260797								
737	280112								
737	280112								
579	280113								
507	280114								
814	280115								
341	280116								

15% range

0.3757	POTENTIAL
36.55	Pass
9.18	Pass
18.445	Pass
66.3	Pass
103.7	Pass

Chloride	T Coli /100ml	T Coli Index	E.coli /100ml