Cork County Council
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Cork Harbour Main Drainage Scheme

Environmental Impact Statement

Proposed Waste Water Treatment Plant at Shanbally, Co. Cork

Volume II

February 2008

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1 Introduction

1.1 Background

The Cork Harbour Main Drainage Scheme Waste Water Treatment Plant (also referred to as the Cork Lower Harbour Sewerage Scheme) is a scheme for the provision of collection systems and waste water treatment facilities in the Cork Lower Harbour area. The provision of a WWTP (which provides secondary treatment) for Cork Lower Harbour is a requirement under European and National law. The *Urban Waste Water Treatment Regulations*, 2001 (S.I. No. 254 of 2001) as amended, require sanitary authorities to provide treatment plants which offer secondary treatment or equivalent treatment by specified dates according to the population load entering the collection system. Upgrading of the sanitary services infrastructure has been set as an objective of the *Cork County Development Plan* 2003 and *Carrigaline Electoral Area Local Area Plan* 2005 (revised in 2007). The Water Services Investment Programme (WSIP) is the driving force behind water infrastructure. The Cork County 2007-2009 WSIP identifies Cork Lower Harbour Sewerage Scheme as one of the projects identified for investment during this period.

Cork County Council appointed MMP to prepare an EIS for the construction of a new secondary WWTP at Shanbally as part of the Cork Harbour Main Drainage Scheme. Included in the proposed development is an upgrade of the waste water collection system and construction of a new marine pipeline crossing. The proposed location for discharge of the treated effluent is the existing Industrial Development Authority (IDA) foul sewer at Ringaskiddy. It is anticipated that the construction of the proposed WWTP will proceed as a Design/ Build/ Operate contract.

Cork Harbour is the second largest natural harbour in the world and one of the most important industrial and recreational areas in Ireland.

Waste water from Cork Lower Harbour and its environs is currently discharged, untreated, to Cork Harbour. The upgrading of the existing sewerage scheme and the development of a secondary WWTP is required to cater for the existing loading on the system and for the future expansion of the area.

The environmental impact of the proposed discharge of treated municipal effluent from the Cork Harbour Main Drainage Scheme via an existing marine outfall and the associated collection system is considered within this EIS.

1.2 Legislative Framework

The *European Communities (Environmental Impact Assessment) Regulations, 1989 to 2006* and legislation contained in the *Planning and Development Acts 2000 and 2006* and enforcing regulations, bring the requirements of EC Directive 85/337/EEC, as amended by EC Directive 97/11/EC, generally known as the *Environmental Impact Assessment Directive*, into effect in Ireland. The EIA Regulations require that an EIS is prepared in respect of certain defined categories of developments to accompany the planning application for the proposed development.

The categories of development requiring an EIS are contained in the First Schedule of the *European Communities (Environmental Impact Assessment) Regulations, 1999 (S.I. No. 93 of 1999).* In addition, the Fifth Schedule of the *Planning and Development Regulations, 2001 (S.I. No. 600 of 2001)*, which brings the *Planning and Development Act 2000* into effect, specifies developments for the purposes of Part X of the *Planning and Development Act 2000*, that is developments proposed by a Local Authority that require the preparation of an EIS and approval for the development by An Bord Pleanála. Under both pieces of legislation WWTPs with a capacity greater than 10,000 population equivalent require an EIS.

The proposed WWTP at Shanbally has a design capacity of 80,000 population equivalent (PE). Therefore the development requires an EIS. Cork County Council has commissioned the preparation of this EIS in order to assess the environmental impact of the proposed development.

The Cork Harbour Main Drainage Scheme WWTP Environmental Impact Statement will be submitted as part of an application by Cork County Council to An Bord Pleanála (as the competent authority for development control purposes) under *Part X, Section 175* and *Part XV, Section 226* of the *Local Government Planning & Development Act 2000*, as brought into force by the *Planning and Development Regulations 2001 (S.I. 600 of 2001)*, for approval of the proposed development. The application is being made to An Bord Pleanála under *Section 175* and *Section 226* of the *Planning and Development Act, 2000* as the proposed development is being carried out by or on behalf of the Local Authority and limited elements of the development are to be located wholly or partly on the foreshore.

This EIS and such further information relating to the application to An Bord Pleanála will be available for public inspection and/or purchase at the offices of Cork County Council between 9.30am-4.30pm Monday to Friday and excluding public holidays. The address of Cork County Council is:

Cork County Council,
WSIP Project Office,
Model Business Park,
Model Farm Road,
Cork

1.3 Methodology

The primary objective of the EIS is to identify the baseline environmental and socio-economic conditions in the area of the proposed development, to predict potential beneficial and/or adverse effects of the development and to propose appropriate mitigating actions, where necessary.

In addition to a detailed assessment of the WWTP site, the EPA have recommended in their guidance documents the inclusion of secondary developments/ancillary works which directly arise because of the project. For this reason the proposed footprint of the collection system has been included in the assessment.

In preparing this EIS, MMP have taken into account the following:

The requirements of European Communities Directives and Irish Regulations regarding Environmental Impact Assessment; and

The '*Guidelines on the Information to be Contained in Environmental Impact Statements*' and the '*Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements)*' published by the EPA in March 2002 and September 2003 respectively.

Information on the project and the receiving environment was obtained through a number of means including:

- Site visits
- Field surveys
- Review of existing data for the environs of the proposed WWTP site
- Review of existing studies carried out in the Cork Harbour Area
- Meetings and discussions with Cork County Council representatives
- Consultation with interested parties

Specialist contributions to the EIS were made as follows:

- Noise & Vibration Assessment: ANV Technology Limited
- Air Quality (incl. Odour): Odour Monitoring Ireland Limited
- Terrestrial & Marine Ecology: Ecofact Environmental Consultants Limited
- Hydrodynamic Modelling: University College Cork
- Cultural Heritage: Aegis Archaeology Limited & ADCO
- Landscape and Visual Assessment: Brady Shipman Martin

1.4 Environmental Impact Statement Format

This EIS has been prepared according to the '*Grouped Format Structure*' as outlined in the EPA's *Guidelines on the Information to be Contained in Environmental Impact Statements*. The EIS is divided into four main chapters:

Volume I - Non Technical Summary

Volume II - EIS

- Chapter 1 Introduction
- Chapter 2 Description of the Development
- Chapter 3 Receiving Environment, Impacts and Mitigation Measures
- Chapter 4 Interactions of the Foregoing

Volume III - Appendices

Chapter 3 is divided into nine sub-sections addressing the topics as set out in the Second Schedule of the *European Communities (Environmental Impact Assessment) Regulations (S.I. No. 93 of 1999)* as follows;

Human Beings

- Human Beings (Section 3.1)

Flora and Fauna

- Terrestrial and Marine Ecology (Section 3.2)

Soils

- Soils, Geology and Hydrogeology (Section 3.4)

Water

- Water Quality (Section 3.3)

Air and Climatic Factors

- Air Quality, Odour and Climate (Section 3.6)
- Noise and Vibration (Section 3.7)

Landscape

- Landscape and Visual Assessment (Section 3.9)

Material Assets (incl. Architectural, Archaeological and Cultural Heritage)

- Material Assets (Section 3.5)
- Cultural Heritage (Section 3.8)

Interrelationships

- Interactions of the Foregoing (Chapter 4)

Within each sub-section individual topics are assessed with reference to the existing environment, the proposed development, the likely impacts and, where necessary, mitigation measures. Where relevant, the inter-relationship between the above factors is addressed within each section or included in *Chapter 4- Interactions of the Foregoing*.

All figures and plates referenced in the text are included at the end of each relevant chapter/section.

1.5 Consultation

Submissions regarding the development and the scope of the environmental impact assessments were invited and/or received from a number of relevant statutory and non-statutory consultees specified in Section 4 of the EPA's *Advice Notes on Current Practice* (2003) as follows:

- An Bord Pleanála
- The Arts Council (An Comhairle Ealaíon)
- An Taisce
- Fáilte Ireland (formerly Bord Fáilte)
- Department of Agriculture, Fisheries and Food (formerly Agriculture, Food and Science)
- Department of Arts, Sport and Tourism
- Department for Trade, Enterprise and Employment

- Department of the Environment, Heritage and Local Government (Head Office, Development Applications Unit, National Monuments Section, National Parks & Wildlife Service and the Local Conservation Ranger – Danny O'Keeffe)
- Department of Communications, Energy and Natural Resources
- Department of Community, Rural and the Gaeltacht Affairs
- Department of Justice, Equality and Law Reform (incl. Office of the Tánaiste and Minister for Justice, Equality and Law Reform)
- Commission for Electricity Regulation
- Dublin Airport Authority (Cork Operations)
- National Authority for Occupational Safety and Health
- National Roads Authority
- Environmental Protection Agency
- Irish Aviation Authority
- Cork County Council (County Archaeologist, Water Services, Planning Department, Heritage Section, Environment and Waste, Housing – South Rural & City Hinterland Areas, Coastal & Recreation – South Cork Divisional Services, Infrastructure & Development, Community & Enterprise, Waste Management Operations, Roads)
- Office of Public Works
- Railway Procurement Agency
- Dublin Transport Office
- Central Regional Fisheries Board
- South Western Regional Fisheries Board
- The Heritage Council
- Health Services Executive (HSE) - Southern Area
- Badger Watch Ireland
- Bat Conservation Ireland
- Bird Watch Ireland
- Bord Gáis
- Bord Iascaigh Mhara
- Botanical Society of the British Isles
- Cobh Angling Centre
- Cork City Development Board
- Cork County Bat Group
- Cork Harbour Boats
- Cork Historical & Archaeological Society
- Éircom
- Electricity Supply Board (ESB)
- Geological Survey of Ireland (GSI)

- Great Island Historical Society
- Iarnród Éireann
- Irish Federation of Sea Anglers
- Irish Underwater Council
- Irish Whale and Dolphin Group
- Irish Wildlife Trust
- Marine Institute Headquarters
- Port of Cork Company
- Radiological Protection Institute of Ireland
- South West Regional Authority

Copies of correspondence received concerning the content of the EIS are included in Volume III Appendix 1A of this statement. The reader is recommended to review all the correspondence included, however for the purposes of the introduction to this statement, please find detailed hereunder a list of some of the extensive topics raised in the correspondence received:

- An Bord Pleanála – alternative treatment processes considered, alternative locations, potential alternative procurement methods, current impacts on water quality and ecology, impacts and relationship with other effluent discharges, baseline study of nutrient levels and fish species, visual impact assessment of the WWTP on the landscape, impact of the discharge on flora and fauna of ecological value, likely effects on human beings in the vicinity in relation to odours, noise and traffic generated, information on all planned and approved developments in the vicinity of the site, odour dispersion patterns and the level of potential odour generation from the different process operations, and the likely effects on items of archaeological interest arising from the construction of the outfall and WWTP. These items are addressed in Chapter 2 - Section 2.3, 2.4 and 2.5, and Chapter 3 – Section 3.1, 3.2, 3.3, 3.6, 3.7, 3.8 and 3.9.
- South Western Regional Fisheries Board – physical impacts of waters containing fisheries, effects of sediment disturbance, and impact on commercial/amenity fisheries from the marine crossing. Impact on shellfisheries. Impacts on fish habitats & water quality (chemical & microbiological). Assessment of the potential for untreated effluent to discharge to harbour waters and Monkstown Creek. Nutrient loading effects on Cork Lower Harbour which is periodically affected by phytoplankton blooms. Measures to avoid and prevent pumping station overflow discharges during operation. These items are addressed in Chapter 2 - Section 2.11 and Chapter 3 - Section 3.1, 3.2 and 3.3.
- Department of Communications, Marine and Natural Resources – noise and vibration details should be noted and limited in accordance with relevant legislation, specify in the EIS if dredging for the marine crossing is required, details to be provided on proposed pipelines in the foreshore incl. timing/duration, refer to the designation of Shellfish Waters, and potential impacts on navigational safety and passage of migratory fish. These items are addressed in Chapter 3 - Section 3.1, 3.2, 3.3, 3.4 and 3.7.
- Irish Whale and Dolphin Group – Identified importance of minimising impacts from acoustics marine mammals such as whales, dolphins and porpoise.
- Bat Conservation Ireland – A number of bat species have been recorded in the vicinity the proposed development. A bat survey has been recommended for road schemes to determine the roosting, commuting and foraging potential for local bat populations. These items are addressed in Chapter 3 - Section 3.2.

- Birdwatch Ireland – Cork Harbour has been identified as highly important for wintering waterbirds and no deterioration in their habitat quality should occur. Site 4030 has been designated a SPA under the EU Birds Directive (79/409/EEC). These items are addressed in Chapter 3 - Section 3.2.
- National Roads Authority – Impacts of dust generated by activities on roads, the need for a traffic and transport assessments, assessment of the trips generated and their impacts, traffic exhaust emissions and road traffic noise implications. These items are addressed in Chapter 3 - Section 3.1, 3.6 and 3.7.
- Development Applications Unit – As part of an environmental review for the development, a full archaeological impact assessment was recommended. These items are addressed in Chapter 3 - Section 3.8.
- Office of Public Works – issues of potential flood risk in the area that may result from the proposed works should be addressed. These items are addressed in Chapter 2 - Section 2.4 and Chapter 3 - Section 3.4.
- Eircom – Identified extensive telecommunication services in the area; not to be interfered with.
- Geological Survey of Ireland – Identified 3 geological heritage sites in the region (not impacted on by the proposed development areas). These items are addressed in Chapter 3 - Section 3.4.

Public Consultation:

A summary report of the scheme was presented to local councillors at the Carrigaline Area Committee meeting on 18/09/2006. Following requests from the councillors an overview of the Cork Harbour Scheme was presented to the Council members on 16/10/2006. In addition, an overview of the scheme was presentation to local interested parties in Shanbally on 28/11/2006.

A Public Open Evening was widely advertised and held at Ringaskiddy Community Hall from 3pm to 11pm on 11/01/2007 where a significant portion of the local residents and businesses attended.

A second Public Open Evening was presented to the local residents and interested parties in Ringaskiddy Community Hall on 06/12/2007 from 6pm to 9pm. Details of the EIA for the proposed scheme were displayed.

During the development of the project a commitment was given to Elected Members of the Council that intake and sludge management at the WWTP would be located at the western end of the proposed site (to minimise impacts on residential dwellings). This has been incorporated in the WWTP design and the EIS as an objective of the Scheme.

1.6 Information to Assess the Project & Difficulties Encountered

MMP is satisfied that adequate information was collated, in the preparation of this EIS, to assess the likely effects of the proposed development on the environment. Where it is considered that information was limited, this has been identified in the EIS.

Any difficulties encountered during the specialist field surveys are detailed in the specialist reports included in Volume III of this statement.

At present no specific detail on construction activities is available. However, the contractor will be required to prepare and agree a detailed construction management plan with Cork County Council prior to construction work commencing on site. A Construction Environmental Management Plan (CEMP) will be a part of this and will incorporate the mitigation measures specified in this EIS. An Operation Environmental Management Plan (OEMP) will also be generated by the Contractor and submitted to Cork County Council for agreement in advance of commencing development operations.

1.7 Acknowledgments

Mott MacDonald Pettit Limited would like to acknowledge the assistance and courtesy extended by the staff of Cork County Council throughout the research and preparation of this EIS.

2 Description of the Development

2.1 Introduction

The objective of the Cork Harbour Main Drainage Scheme is to provide waste water treatment for the towns and villages in the lower Cork Harbour area. The main population centres to be served by the scheme include Cobh, Passage West/Glenbrook, Monkstown, Ringaskiddy (including Shanbally and Coolmore), Carrigaline and Crosshaven.

The proposed development includes for the construction of a WWTP, which will include for sludge treatment, and a collection system to convey the waste water to the new plant. The proposed scheme also includes for upgrading the existing drainage network to modern standards and expanding the network in order to cater for the future needs of the area. The Scheme will be designed to meet the needs of the Cork Harbour Area to the year 2030. This section describes the existing drainage system, and the characteristics of the proposed development.

The proposed WWTP will be constructed using the Design/Build/Operate (DBO) procurement system. A Contractor will be appointed to design, build and operate the WWTP for a period of 20 years to achieve the required standards within defined design constraints. As a consequence the Contractor will be required to produce a detailed design as part of the procurement process.

Nevertheless, it is possible to describe the necessary level of treatment to be provided to achieve the required effluent treatment standards. The treatment requirements and treatment options are discussed in Section 2.5. In order to assess the environmental impact of the development, indicative designs of the proposed Cork Harbour Main Drainage Scheme WWTP have also been undertaken. The indicative designs achieve the required discharge standards and are described in detail in Section 2.5.5.

2.2 Existing Public Sewerage Scheme

2.2.1 Description of the Existing Collection Scheme

Currently, waste water from the population centres within Cork Harbour Main Drainage Scheme (namely Carrigaline, Ringaskiddy (including Shanbally and Coolmore), Cobh, Monkstown, Passage West/Glenbrook and Crosshaven) is generally not treated (significant elements receiving no treatment and limited volumes receiving comminution) and is discharged directly to the Lower Harbour.

The existing drainage infrastructure within the Lower Harbour area comprises sewers, culverts, manholes, pumping stations, overflows and outfalls. Some of these structures have been in existence for more than 50 years and in some cases are no longer adequate for their intended purpose due to structural damage, excessive infiltration and lack of capacity.

The locations of the existing outfalls discharging to Cork Harbour from the towns/villages to be served by the Scheme are shown in Figure 2.1 *Location of Existing Outfalls and Proposed Outfall*. A description of the existing collection systems in each population centre is provided below.

(i) Carrigaline Collection System

The Carrigaline collection system consists of both combined and separate sewers. There are two foul interceptor sewers and three collector storm sewers within the catchment. New housing estates have separate local foul and storm water sewers in place.

The two foul interceptor sewers were constructed in the mid-eighties and run from the town centre, along either side of the Owenboy River, to the comminutor and main pumping station on Church Road. The southern interceptor sewer crosses the estuary to join the other interceptor sewer approximately 1.3km east of Carrigaline Bridge.

Effluent from the Carrigaline catchment is directed to the Church Road pumping station via the interceptor sewers. From the Church Road pumping station, the waste water is pumped via twin rising mains into the main gravity sewer serving the IDA industrial lands in Ringaskiddy which discharges through a long outfall into Cork Harbour.

There are also two smaller pumping stations in Carrigaline (Waterpark Pumping Station (PS) and the Crosshaven Road PS), which pumping the waste water from the central low-lying catchments on either side of the Owenboy River to the interceptor sewers.

(ii) Ringaskiddy, Shanbally & Coolmore Collection System

The main collection system serving the industrial section of the Ringaskiddy catchment was developed by the IDA. A foul sewer and a storm sewer run parallel to each other through the middle of the IDA owned lands. These sewers were sized in order to cater for full industrial development of the area. Discharge of the screened effluent is via marine outfall to deep water.

The IDA sewer runs through the centre of the Shanbally/Coolmore residential development areas. Shanbally is served by a combined sewer system which gravitates to the Shanbally pumping station. The pumping station lifts flow to a gravity sewer serving the southern Shanbally area and discharges to the IDA foul sewer. Two other smaller sub catchments North and West of Shanbally are served by septic tanks.

South of the IDA sewer in the Coolmore area, all developments are connected to septic tanks. The IDA storm sewer, which runs parallel to the foul up to this point, turns south to discharge into the Owenboy River.

Ringaskiddy Village has its own combined collection system which discharges the untreated effluent directly north of the village.

Untreated effluent from Carrigaline is pumped from Church Road pumping station to a foul manhole located on the IDA sewer upstream of the Shanbally connection.

(iii) Crosshaven Collection System

Effluent originating from Crosshaven is currently pumped without treatment to the collection system in Carrigaline. The design loads have been incorporated into the Carrigaline catchment.

(iv) Passage West/Monkstown Collection System

This collection system serves the population centres of Passage West, Glenbrook and Monkstown.

The collection system drains to three major outfall points in the catchment. There are five submersible pumping stations within the system, two of which are situated in Passage West, one in Glenbrook and two in Monkstown.

In Passage West, the Cork Road pumping station serves the low-lying catchments to the north west of the town. All flows from this area are directed to the Passage outfall via a comminutor chamber near the old railway line in North Passage. The Passage West Centre pumping station serves the centre of Passage West. All flows from central Passage, Glenbrook and Carrigmahon are directed to the Glenbrook comminutor and outfall adjacent to the Glenbrook ferry slipway.

All flows from Monkstown are directed to a comminutor and pumping station on the sand quay at the centre of the village Boatyard and pumped to the Monkstown outfall by the old railway tunnel north of Monkstown village.

The Coast Road pumping station takes the flow from the houses south of Monkstown village and pumps it to the pumping station on the sand quay in the centre of the village.

(v) Cobh Collection System

The waste water from Cobh Town discharges largely untreated into the tide with the exception of the waste water from Eastern Cobh, which passes through a comminutor before discharging into the harbour via an outfall in Whitepoint.

The collection system drains to five major outfall points serving different catchment areas within the town. There are also a number of smaller outfalls serving independent areas in Cobh.

Flow from East Cobh is directed to two major outfalls. Pilot Pier outfall is located opposite the Mall near the slipway and breakwater. Corbett outfall is sited opposite Fr. Corbett Terrace at the junction between Harbour Terrace and Connolly Street. In East Cobh there is also a small outfall east of Lynch's Quay serving apartments on the waterfront and two further outfalls opposite Connolly Street.

Two major outfalls serve central Cobh. The King's Quay outfall is located under the Jetty at King's Quay. The West Beach Outfall is located at the Pier opposite Cobh Square. There is also an existing outfall serving the railway station and Heritage Centre which discharges at the promenade.

The majority of flows from West Cobh are directed to a major outfall at White Point. The Whitepoint outfall is located near the slipway in southern White Point and is the largest outfall serving western Cobh. There are also a number of smaller outfalls serving low-lying areas close to the shore.

2.3 Consideration of Alternatives

Alternative treatment options, plant designs and outfall locations were evaluated on environmental, economic and engineering criteria.

2.3.1 Alternative Waste Water Treatment Scheme

Initially nineteen. potential WWTP sites were evaluated in the Lower Harbour Area to determine the optimum sites for construction and operation of a WWTP. This preliminary evaluation considered WWTP's serving a single population centre, a number of population centres or the entire catchment area. Figure 2.2 *Location of Potential WWTP Sites* shows the location of the nineteen sites evaluated. Criteria used to assess the sites included:

- Availability of sufficient site area
- Land Zoning
- Ecological Considerations
- Proximity to human beings
- Elevation (required elevation to prevent flooding and facilitate gravity discharge against high tide)
- Distance from the treated effluent outfall point
- Distance from nearest habitable dwelling
- Distance from Population centres
- Access to the site
- The Sludge Management Plan for County Cork, 2000
- Capital Costs
- Operating and Maintenance Costs

The preliminary evaluation identified ten sites as being unsuitable for the location of the WWTP. The nine ***sites*** considered further were Loughbeg (Site Nr. 2), Loughbeg West (Site Nr. 3), Coolmore (Site Nr. 8), Marino (Site Nr. 11), Shanbally (Site Nr. 18), Ringaskiddy (Site Nr. 1), Carrigaline Pumping Station (Site Nr. 7), Ardmore, Passage West (Site Nr. 16) and Carrigrennan on Little Island [Cork City WWTP] (Site Nr. 19).

Of the nine sites the following five sites were identified as having good potential to accommodate waste water treatment facilities for the entire catchment to be served and to act as a hub centre for the treatment of sludge from Region 19 (refer to section 2.5.4 (v)) and these were then subjected to a more detailed evaluation in terms of incorporation into the overall scheme:

Loughbeg (Site Nr. 2)

Loughbeg West (Site Nr. 3)

Coolmore (Site Nr. 8)

Marino (Site Nr. 11 – waste water only & not sludge treatment)

Shanbally (Site Nr. 18)

A further four sites were identified as having good potential to accommodate local WWTP facilities or pumping stations. These were than included for further evaluation on this basis only in terms of their incorporation into the overall Scheme:

Ringaskiddy (Site Nr. 1)

Carrigaline Pumping Station (Site Nr. 7)

Ardmore, Passage West (Site Nr. 16)

Carrigrennan on Little Island [Cork City WWTP] (Site Nr. 19)

Each potential WWTP site has associated with it a number of alternative conveyance systems depending on which or how many population centres it is to serve. The above nine sites were assessed for the collection and conveyance system to convey raw waste water from each population centre to the optimum treatment plant location (s).

The following Sewerage Scheme ***options*** were considered.

One WWTP serving all of the specified population centres. The five potential sites identified included:

Shanbally (Site Nr. 18)

Coolmore (Site Nr. 8)

Loughbeg (Site Nr. 2)

Loughbeg West (Site Nr. 3)

Cobh at Marino (Site Nr. 11)

Two WWTP's with each plant serving one or more population centres:

Shanbally (Site Nr. 18) & Marino (Site Nr. 11)

Marino (Site Nr. 11) & Loughbeg (Site Nr. 2)

Carrigrennan (Site Nr. 19) & Shanbally (Site Nr. 18)

Ardmore, Passage West (Site Nr. 16) & Loughbeg (Site Nr. 2)

Ardmore, Passage West (Site Nr. 16) & Shanbally (Site Nr. 18)

Shanbally (Site Nr. 18) & Loughbeg (Site Nr. 2)

Carrigaline Pumping Station (Site Nr. 7) & Loughbeg (Site Nr. 2)

Three WWTP's:

Loughbeg (Site Nr. 2) & Marino (Site Nr. 11) & Shanbally (Site Nr. 18)

Marino (Site Nr. 11) & Ardmore, Passage West (Site Nr. 16) & Shanbally (Site Nr. 18)

Loughbeg (Site Nr. 2) & Marino (Site Nr. 11) & Ardmore, Passage West (Site Nr. 16)

Loughbeg (Site Nr. 2) & Ardmore, Passage West (Site Nr. 16) & Shanbally (Site Nr. 18)

Four WWTP's, with one serving each major population centre:

Passage/Monkstown: Site at Ardmore, Passage West (Site Nr. 16)

Cobh: Site at Marino (Site Nr 11)

Carrigaline (Site Nr. 18)

Ringaskiddy: Loughbeg (Site Nr. 2)

The preliminary evaluation reduced the number of potential collection treatment and disposal scheme options for further evaluation to ten. A detailed evaluation was carried out for ten different scheme configurations comprising of the potential treatment plant sites and various conveyance system options for the Cork Harbour Main Drainage Scheme. These options are outlined briefly below.

- ***Option 1:*** A single WWTP constructed at Ringaskiddy, with the Passage West and Monkstown waste water pumped to Cobh and the combined flow pumped to Ringaskiddy via a second marine crossing. Waste water from Crosshaven and Carrigaline would be pumped directly to the site. Treated effluent would be discharged via the existing Ringaskiddy outfall.

- ***Option 2:*** A single WWTP at Shanbally. Waste water from Cobh would be pumped across to Monkstown (which would be the only new marine work required), with the combined Passage West, Cobh and Monkstown flow pumped to the site. Combined flows from Crosshaven and Carrigaline would be pumped via the existing rising mains to the site. The treated effluent would be pumped to the existing Ringaskiddy outfall.

- ***Option 3:*** Two WWTP's (at Shanbally and Marino) with the site at Marino treating waste water from Cobh, and the Shanbally site providing treatment for waste water from population centres on the western side of the harbour so that no marine crossings would be required. A new outfall is required at Marino.

- ***Option 4:*** As per Option 3 with the two WWTP's (Shanbally and Marino), but with the Passage West and Monkstown waste water pumped to Cobh (via a marine crossing) for treatment at the Marino site rather than to Shanbally. A new outfall would be required at Marino.

- ***Option 5:*** As per Option 4 with two main WWTP's but with a third smaller WWTP at Loughbeg serving only the Ringaskiddy catchment. This would require one marine crossing (Passage – Cobh) and one new outfall (from Marino site).

- ***Option 6:*** A variation of Option 2 with a major WWTP at Shanbally, and a marine crossing conveying waste water from Cobh to Monkstown. A second smaller plant would be located at Loughbeg to treat the waste water from only the Ringaskiddy catchment. Only one new marine crossing would be required.

- ***Option 7:*** A variation of Option 3 with a major WWTP at Shanbally, but with the Marino WWTP of Option 3 replaced with a marine crossing transferring the waste water from the Cobh catchment to the Cork WWTP at Carrigrennan. Only one new marine crossing would be required.

- ***Option 8:*** A variation of option 5 with a major WWTPs at Shanbally, but with Marino WWTP of Option 5 replaced with a marine crossing transferring the waste water from the Cobh, Passage West and Monkstown catchments to treatment at Carrigrennan (similar to Option 7). Two new marine crossings would be required.

- ***Option 9:*** A variation of Option 3 with two major WWTP, one at Shanbally serving Crosshaven, Carrigaline and Ringaskiddy and the second at Marino serving Cobh. An additional smaller plant would be provided to the North of Passage West to provide treatment for Passage West and Monkstown flows. This option would require two new outfalls (Passage West and Marino).

- ***Option 10:*** A variation of Option 1 with a major WWTP at Loughbeg (Ringaskiddy) treating flows from Crosshaven, Carrigaline, Cobh and Ringaskiddy. The waste water from Passage West and Monkstown would be treated in a separate plant to the north of Passage West. This option would require the provision of one marine crossing and one new outfall.

2.3.2 Alternative WWTP Locations

An evaluation of the various WWTP sites favoured the following two sites.

Option 2: A single WWTP at Shanbally. Sewage from Cobh would be pumped across the Harbour to Monkstown, from where the combined Passage West, Cobh and Monkstown flows would be pumped to the WWTP. Waste water from Crosshaven and Carrigaline would be pumped via the existing rising mains to the WWTP. The treated effluent would be pumped to the existing Ringaskiddy outfall. The only marine work required would be at Cobh to Monkstown marine crossing.

Option 3: Two WWTP's (Shanbally and Marino) would be provided, with no marine crossings required. However, a new outfall would be required at Marino.

A detailed environmental assessment of the two sites was undertaken. Flora and fauna, noise and archaeological surveys were carried out and reported for both of these short-listed sites ("Shanbally" and "Marino") in order to identify the more favourable site in terms of environmental impact. A summary report of the environmental assessment and a letter, by the ecologist, recommending the proposed site is provided in *Volume III Appendix 1B.*

In comparison to "Shanbally", the "Marino" site was considered to have a greater diversity of habitats such as treelines, scrub, stone walls and disused stone building. Due to the layout, avoiding the removal of substantial portions of the existing habitats would be difficult. An IFI industrial complex is located directly across the road, approximately 22m from the boundary. Levelled remains of 'Marino Farm' are located at the northern end of the site.

On the basis of these surveys and assessments the "Shanbally" site was identified as the preferred location for the proposed WWTP. Option 2 was therefore selected as the preferred configuration, which involves a single WWTP at Shanbally, a marine crossing between Cobh and Monkstown with the treated effluent discharged via the existing IDA marine outfall from Ringaskiddy.

In summary, Option 2 is considered the most advantageous location. The main advantages with this option are summarised below:

- Least environmental impact in terms of the two favoured sites
- One single WWTP is preferable from a management perspective
- Utilises the existing IDA outfall
- Discharge is to the outer harbour (less sensitive waters)
- Site is zoned for utilities and infrastructure use
- Site is distanced from existing residential dwellings
- Site has sufficient scope to provide for future expansion and the incorporation of a sludge hub centre
- Most cost effective
- Adequate access can easily be provided to the site
- Services readily accessible (power, water, gas)
- Site is central to the population centres being considered

A detailed description of the proposed site and alternative treatment options are discussed in Section 2.5 *Characteristics of the Development.*

2.4 Procurement Options and Alternatives

2.4.1 Comparison of Procurement Options

It is proposed to advance part or all of the works in a Public Private Partnership (PPP) arrangement.

A number of different procurement routes are available for the Cork Harbour Main Drainage Scheme under a PPP arrangement. These include:

- Design / Build (DB)
- Design / Build / Operate (DBO)
- Design / Build / Finance / Operate (DBFO)

The advantages/disadvantages of the PPP process compared to the conventional procurement route have been described below in general terms.

Conventional Method:

In "Conventional Procurement" the Client appoints a Consulting Engineer to carry out the detailed design of the works. Where the layout of the works is particularly dependent on the size and type of plant and equipment to be incorporated into the works, as is the case with a WWTP, it is necessary for the Consultant to select the process and specific items of plant before the design of the civil elements can be carried out.

In the case of pumping stations and WWTPs, the normal route is to tender for any Process Plant and Mechanical/Electrical (M&E) work separately, and design the Civil Works around the plant layout in a separate Civil Engineering Contract. Hence there will be two separate contracts running together which require considerable liaison in order to match the interfaces.

The main advantages of the conventional procurement route are:

- It uses forms of Contract which are well understood and tested in law
- It allows the Client more control over the final product, including type of plant and equipment
- Operational preferences can be built into the design

The main disadvantages of the conventional procurement route are:-

- The overall programme for implementation is generally longer with more potential for design decision delays
- Less certainty in construction and operational cost estimation – potential for delay and cost increase is greater
- There can be interface problems between the M & E and Civil Contracts
- Complicates the guarantee, as there are split responsibilities
- Less effective allocation of risk for performance, in particular with regard to responsibility for process design, performance guarantees and liability

Design / Build (DB):

Under the Design and Build procurement route, a Consultant is appointed to prepare tender documents for a Design and Build Contract, and act as Client's Representative to administer the Contract. To ensure a competitive and comprehensive bid, the following information needs to be included:-

- Definition of Client's essential performance requirements
- Plant Flow/ Load
- Discharged Water Quality Requirements
- Geotechnical survey – site investigation data
- Planning constraints – conditions of the certified EIS if applicable
- Definition of performance requirements e.g. treated water quality, final sludge quality etc.
- Operational and Maintenance needs

The main advantages of the Design/Build procurement route are:

- Faster implementation of the project
- Contract interfaces are reduced – one Contractor is responsible for both the Process Plant and the Civil Works Design
- Advantage can be taken of innovative solutions to design issues put forward by the Tenderers within the constraints of the conditions contained within the specification
- Much, but not all, of the risks that lead to significant cost increases can be passed to the Contractor
- The bids can be evaluated taking due account of both Capital and Operating costs to establish the best value for money, using guaranteed figures
- Lends itself to the inclusion of an Operations element

The main disadvantages of the Design/Build procurement route are:

- It is difficult and expensive to make client led changes once the Contract is signed
- It is more difficult to allow for expansion of the plant
- It allows the Client less control over the type of plant

Design, Build and Operate (DBO):

There is little difference between this option and the Design and Build option, other than the addition of operation of the WWTP. Operational Contracts have an important role to play ensuring that the works procured are built and maintained to a high standard.

The Operation and Maintenance (O&M) Period should be of a reasonable duration of greater than 15 years. The accumulation of changes in catchment characteristics and the potential for technological advance would suggest that it would be unwise to opt for a very long period, with 40 years representing an absolute upper limit. The possibility of re-tendering for a follow-on O&M Contract can always be considered in the event that "out-sourcing" is still considered appropriate.

In considering the influence of O&M costs, one aspect that can be assessed is the effect of the duration of the O&M period on the overall Contract price. In order to encourage a tenderer to give a valid tender, with efforts made to minimise operational costs, as well as capital costs, it is desirable that both components of cost contribute to the tender amounts used for assessment. With a discount rate of 5% in accordance with normal Department of Finance Guidelines for the Evaluation of Public Projects, a balance is achieved with an operational period of greater than 15 years. Any lesser period involves the tenderer to adopt a solution based on lower capital cost and accepting higher running costs. This is not in the long-term interest of the Local Authority.

Therefore, from the point of view of encouraging tenderers to seek technical solutions biased towards low running costs, it would appear that an Operational Period of 15 years should be considered as a minimum duration, with longer periods providing even greater encouragement. However, for periods of more than 30 years, the significance of a further extension of the Operating Period begins to diminish.

The life expectancy of the major items of mechanical and electrical plant is typically 20 years. The maintenance of the works will require many activities to be carried out much more frequently, ranging from monthly maintenance schedules to pump impeller replacement (perhaps at 5 year intervals). The significance of the duration of the O&M Period, from the point of view of the life expectancy of the plant, is considered in Table 2.1 *O&M Period and Plant Life Expectancy.*

Table 2.1: O&M Period and Plant Life Expectancy

O&M Period (years)	Plant Condition	Contractor's Incentive
5	Plant still relatively new, any residual commission problems resolved, but medium and long-term reliability not demonstrated.	Little incentive for good design or good maintenance.
10	Medium term reliability will have been demonstrated but specified plant life expectancy not yet demonstrated.	Greater incentive for good design, but not necessarily to full specification. Short and medium term maintenance practices should have been optimised.
15	Efficient plant operation dependent on good maintenance practices.	Incentive for good design, but reduced incentive to maintain ageing plant through to the end of its design life.
20	Plant at the end of normally specified life expectancy. Need to undertake major refurbishment.	Incentives for good design and efficient maintenance are maximised. Contractor could be asked to undertake refurbishment, or competitive tenders could be sought.
25	Plant will be in good condition following refurbishment, but it may have been upgraded because of new technology, and/or increased throughput, and/or change in raw water quality and/or change in legislation.	Contractor in strong position to negotiate conditions and payment for refurbishment. Difficult for Employer to engage another Contractor to undertake refurbishment whilst original Contractor is operating the works. Original tendered rates for O&M becoming increasingly out-dated.
30	Plant likely to be different from the original supplied.	Contractor committed to uncertain obligations, may be including significant sums for unknown risks.
35	Difficult to predict.	Difficult to predict.

The factors presented in Table 2.1 *O&M Period and Plant Life Expectancy* suggest a 20 year O&M Period, which tie in with the normally specified life expectancy of the major items of plant. The Local Authority would then be in a position to commission a major refurbishment, for which the Contractor could be invited to bid, but under the pressure of a competitive tendering process.

Design, Build, Finance and Operate (DBFO):

This form of PPP partnership is similar to the DBO form, but with the private sector Contractor responsible for financing the construction of the facility. The private sector Contractor would recover its costs solely from Cork County Council.

In accordance with circular L10/01, DBFO should only be examined as a potential PPP option at the specific request of the Department of the Environment, Heritage and Local Government.

Internationally, DBFO is more common than DBO, largely driven by the need for private sector finance to implement necessary infrastructure, where public sector funding is not sufficiently available. It is considered that the estimated cost of the scheme is not high enough to attract sufficient interest from financial bodies and, as such, the DBFO option would not provide adequate value for money. Therefore the elements of the scheme are only assessed between DB, DBO, and Traditional methods of procurement.

The Cork Harbour Main Drainage Scheme can be split into three main elements for the purpose of this assessment:

1. Gravity Sewers & Rising Mains
2. Pumping Stations
3. WWTP

Gravity Sewers & Rising Mains

It is recommended that the procurement of gravity sewers and rising mains follow the conventional route with detailed design by a Consultant Engineer, followed by open tendering.

The main reasons for opting for the traditional type arrangement and individual contracts for each of the schemes are as follows:

- If difficulties arise with progressing the scheme in one of the collection systems, (e.g. due to difficulties with land acquisition, foreshore applications, planning permission etc.), this scheme will not interfere with progress on the others if each is procured using a separate contract
- None of the advantages of following the DB / DBO route would apply, e.g. as there is little or no scope for innovative solutions, new technology, maintenance, etc.
- Operation and maintenance deliverables in the case of gravity sewers and rising mains are qualitative and would be difficult to determine and enforce contractually

- The Local Authority can maintain a level of control over items that possess risks from the public acceptance point of view. These would be difficult to assess and agree contractually prior to the beginning of the works
- The potential for the phasing of some elements of the collection system would be more suited to the traditional type contract agreement

Pumping Stations

It is recommended that the procurement of pumping stations within the collection system follow the conventional route of detailed design by the Consultant Engineer, followed by open tendering. Pumping stations pumping directly to the WWTP will form part of the WWTP contract. The reasons for this assessment are as follows:

- All work on the collection system can be carried out by the same contractor (i.e., gravity sewers, rising mains and local pumping stations), thereby reducing level of interface required between contractors and contracts
- The local authority can maintain responsibility over the civil works of the schemes, excluding the WWTPs, and therefore will have additional control over works that may come under scrutiny from a public acceptance perspective
- Pumping stations within the WWTPs and feeding to them can be considered integral parts of the treatment processes

WWTP

It is recommended that the procurement for the WWTP should follow the DBO route. The main reasons for use of the DBO procurement route are as follows:

- The proposed discharge of treated effluents will have special requirements in relation to environmental impact and effluent discharge standards and it would be important to take advantage of innovative solutions
- Contract interfaces are reduced – one Contractor is responsible for both the Process Plant and the Civil Works Design
- The project can be implemented faster than through the conventional route due to a single contractor and contractor design for each site
- Risks that lead to significant cost increases can, for the most part, be passed to the Contractor
- The bids can be evaluated taking due account of both capital and operating costs to establish the best value for money
- The operational responsibility within of the Contract will ensure that the works are constructed and maintained to a high standard and efficiency

2.5 Characteristics of the Development

2.5.1 General

The proposed development consists principally of the construction of a large sized urban WWTP including a sludge treatment plant to serve the population centres of Cork Lower Harbour and its' environs. The proposed WWTP is an essential element of the Cork Harbour Main Drainage Scheme. Associated works, which will be carried out as part of the proposed development, include:

- The widening and upgrading of the site access road;
- Marine crossing;
- New waste water pumping stations;
- The laying of rising mains, surface water sewers and gravity waste water sewers to direct the waste water to the new treatment plant; and
- New waste water treatment plant.

The proposed collection system associated with the Cork Harbour Main Drainage Scheme including Pumping stations, sewers, rising mains and the marine pipeline crossing is described further in Section 2.11 *Ancillary Developments*.

2.5.2 Proposed Waste Water and Sludge Treatment Plant Site

The proposed site is a greenfield site located approximately 11km south of Cork City and 2.24km west of Ringaskiddy in the townland of Shanbally (refer to Figure 2.3 *Site Location - Regional* and Figure 2.4 *Site Location - Local*). The village of Shanbally is located 625m to the north east of the site and the town of Carrigaline is located circa 1.06km to the south-west.

The N28 is a National Primary Road which links Cork City to Ringaskiddy and is less than approximately 490m from the northern boundary of the site. There are proposals to improve the existing N28 by constructing a new section of roadway which will by-pass the villages of Shanbally and Ringaskiddy on lands immediately north of the proposed WWTP site.

The proposed site consists of portions of two large agricultural fields located on sloping ground and is currently used for pasture. A view of the site from the south western boundary is given in Plate 2.1 while Plate 2.2 represents an aerial view of the site. The site has an area of approximately 7.36ha and is situated on a south facing slope at approx. 30m OD Malin Head. The site is located between two overhead high voltage power lines to the north and south of the site. The level and height of the proposed development in relation to existing features is addressed in detail in Section 3.9 *Landscape and Visual Assessment*.

With the exception of a small Bord Gáis substation, which adjoins the south-west corner of the site, the site is bordered on all sides by adjoining agricultural fields (see Plate 2.2). The boundaries of the two fields consist primarily of managed, immature to semi-mature hedgerow. A large ESB substation is situated circa 160m west of the site and a sports field is located circa 80m to the northeast of the site.

The site is zoned for Utility and Infrastructure development by the *Carrigaline Electoral Area Local Area Plan*, 2005 and adopted amendments (January 2007). A significant portion of land in the general vicinity of the site has been either zoned for industrial development according to the *County Cork Development Plan*, 2003 and the *Carrigaline Electoral Area Local Area Plan.* An area of approximately 5.23ha is located 134m from the site boundary is zoned residential. Planning for residential development has been granted at this site. Land use zoning and development policy maps for the area are shown in *Volume III, Appendix 1C*.

There are no existing site services. Access to the site will be provided via an existing access road to the Bord Gáis substation currently bordering the site. The proposed site is located approximately 405 metres east of the minor road LS427 (locally known as Cogan's Road) which links to the N28 National Primary Route just east of Raffeen Bridge.

2.5.3 Proposed Design

The proposed WWTP will be designed to meet the needs of the Lower Cork Harbour area to the year 2030. A layout plan, showing the scope of the Cork Harbour Main Drainage Scheme WWTP is shown in *Volume III, Appendix 1C*. The loading rates to the proposed WWTP from the various population centres over the design horizon of the plant are provided in Table 2.2 *Cork Harbour Main Drainage Scheme – Base Year (B.Y.) and Design Year (D.Y.) Loadings*.

The WWTP design and the quality of the treated waste water must meet the waste water standard as required by the EU Urban Waste water Treatment Directive 91/271/EEC and subsequent amendments. In Ireland S.I. No. 254 of 2001, *Urban Waste Water Treatment Regulations*, 2001 and amendment S.I. No. 440 of 2004 *Urban Waste Water Treatment (Amendment) Regulations 2004* give further effect to the EU Directive 91/271/EEC and the *Water Framework Directive* 2000/60/EC. The discharge standards, which shall apply to the proposed WWTP are:

Biochemical Oxygen Demand (BOD)	25 mg/litre
Total Suspended Solids	35 mg/litre
Chemical Oxygen Demand (COD)	125 mg/litre

The treated waste water will be discharged to Cork Lower Harbour (see Figure 2.1 *Location of Existing Outfalls and Proposed Outfall*) which has not been designated as a "sensitive" or "less sensitive" area by the Department of the Environment in accordance with the terms of the *EU Council Directive on Urban Waste Water Treatment (91/271/EEC).* Therefore, nutrient removal (i.e. nitrogen and phosphorus) will not be required at present. However, this situation may change in the future as the designation of sensitive areas will be periodically reviewed, as required by the Directive. The proposed WWTP will be designed to allow easy retrofitting of nutrient removal facilities at a later stage should it be required.

The overall area of the two fields on which this proposed WWTP will be constructed is approximately 17.5ha. However, the fields are traversed by overhead high voltage electrical cables. By providing sufficient clearance from these power lines a suitable area of approx. 7.36ha is available between the power lines. This area is considered adequate for the construction of the proposed WWTP, including facilities for organic-material removal, nutrient removal, sludge treatment and appropriate landscaping measures.

The current *Sludge Management Plan for County Cork* (March 2000) recommends that all municipal sludge produced in Region 19 be treated in a hub centre to be located in the Ringaskiddy area. The principle population centres of Region 19 consist primarily of the Lower Harbour towns and include Cobh, Passage West, Monkstown, Ringaskiddy, Carrigaline and Crosshaven, Shanbally, Coolmore, Minane Bridge, Whitegate and Aghada.

It is proposed that in addition to treating the sludge arising from the population centres from the Cork Harbour Main Drainage Scheme that sludges will also be imported from Minane Bridge septic tank (100PE).

Whitegate and Aghada are located at the opposite side of Cork Harbour. Domestic sludge produced at these locations will be transported past the Midleton hub centre for Region 21. It is therefore recommended that the municipal sludge produced in Whitegate and Aghada be transported to Midleton for treatment, since the Midleton treatment plant is less than half the distance from Whitegate and Aghada to the site of the Cork Harbour WWTP.

The *Sludge Management Plan for County Cork* recognises the potential for the co-treatment of municipal waste water and biological industrial sludge at a hub centre located in the Ringaskiddy area. No provision will be made in the design of the sludge treatment system at the Cork Harbour WWTP for the treatment of industrial sludges produced in the region. The treatment and disposal of sludge is discussed further in Section 2.5.4.

Table 2.2: Cork Harbour Main Drainage Scheme – Base Year (B.Y.) and Design Year (D.Y.) Loadings

LOADING[Note 1]		Cobh		Carrigaline		Passage West & Monkstown		Ringaskiddy, Shanbally & Coolmore		Crosshaven		Total	
Category	**Parameter**	**B.Y.**	**D.Y.**	**B.Y.**	**D.Y.**	**B.Y.**	**D.Y.**	**B.Y.**	**D.Y.**	**B.Y.**	**D.Y.**	**B.Y.**	**D.Y.**
Domestic	Flow (m^3/d)	1,608	3,076	1,917	3,496	760	1,437	179	202	300	485	4,764	8,696
	BOD (kg/day)	643	1,230	767	1,398	304	575	71	81	120	194	1,905	3,478
	SS (kg/day)	750	1,435	895	1,631	355	671	83	94	140	226	2,223	4,057
Infiltration Flow	Flow (m^3/d)	>697	1,025	3,130	1,165	>1,000	479	60	67	100	162	1,588	2,898
Commercial	Flow (m^3/d)	293	492	342	559	122	230	30	32	48	78	833	1,391
	BOD (kg/day)	117	197	139	224	49	92	11	13	19	31	335	557
	SS (kg/day)	136	230	162	261	57	107	13	15	22	36	391	649
Institutional	Flow (m^3/d)	178	146	114	120	37	43	5	28	Note 2	36	334	374
	BOD (kg/day)	72	56	57	60	19	22	3	14	Note 2	18	150	170
	SS (kg/day)	84	65	66	70	23	25	3	16	Note 2	21	175	197
Industrial	Flow (m^3/d)	0	344	607	1,238	0	0	0	0	0	0	602	1,482
	BOD (kg/day)	0	138	16	456	0	0	0	0	0	0	16	594
	SS (kg/day)	0	2,300	22	531	0	0	0	0	0	0	21	2,831
Total	Flow (m^3/d)	>2,776	5,083	6,105	6,478	>1,919	2,189	272	329	448	761	8,121	14,841
	BOD (kg/day)	832	1,621	978	2,138	371	689	86	108	139	243	2,406	4,799
	SS (kg/day)	971	4,030	1,145	2,493	433	803	100	125	162	283	2,810	7,734
	Peak Flow (l/s)	181.6	N/A	251	N/A	81	N/A	19	N/A	31	N/A	564	N/A
	PE (60 gBOD/h/d)	13,865	27,020	16,305	35,636	6,189	11,478	1,426	1,798	2,317	4,050	40,102	79,982

Note 1: Loadings are based on figures calculated in Cork Harbour Main Drainage Preliminary Report (Mott MacDonald Pettit, 2007). Base Year= Year 2001, Design Year= Year 2030.
Note 2: The effluent loadings relating to Institutional sources was not quantified separately from that of the other categories of sources of effluent loadings in Crosshaven.
Note 3: Design treatment capacity is taken as 80,000 p.e.

2.5.4 Alternative Treatment Options

The Cork Harbour WWTP will be constructed using the Design/Build/Operate procurement method, with the type of treatment process and associated technology to be selected by the successful Contractor. A Contractor will be appointed to design, build and operate the WWTP for a period of 20 years to achieve the required discharge standards within defined design constraints. Therefore the exact details regarding the design of the development and the waste water and sludge treatment processes to be used are not available at this stage. Nevertheless an indicative design has been undertaken in order to assess the environmental impact of the development.

A number of different process options suitable for large WWTPs are available. Any of these options must meet certain criteria with regard to the design and operation.

These criteria should include:-

- Capability to consistently treat the waste water to the required standard
- Optimum capital and running (operating and maintenance) costs
- Modular type design to cater for both present and future design loads and seasonal load fluctuations
- Design flexibility to allow for future extension or retrofitting for nutrient removal and/or further treatment
- Minimisation of environmental impacts, including odour, noise and height and appearance of plant/buildings
- Land area requirements

The principal elements of a treatment plant of the type and scale proposed include preliminary, primary and secondary treatment of the waste water stream with further provision for treatment of sludge arising from the primary and biological stages of the treatment process. The various unit processes likely to be incorporated in any design are as follows:

- Preliminary Treatment including
  - Pre-Treatment (if required)
  - Screening
  - Grit/Grease Removal
- Storm Water Handling and Disposal
- Primary Treatment
- Secondary Treatment
- Sludge Treatment
- Sludge Storage
- Sludge Reuse

The treatment options are described in more detail below with particular reference to the Cork Harbour WWTP.

An indicative design (*Indicative Design Nr. 1*) and layout for the proposed WWTP is provided in Section 2.5.5. This represents a conservative type of system with a large footprint, within which adequate scope is available for the successful Contractor to incorporate innovative technologies with smaller footprints without difficulty. Indicative Design Nr. 1 is considered the worst case scenario and has been used as the specimen design for assessment of environmental impacts. An alternative indicative design (*Indicative Design Nr. 2*) is also provided in this section.

(i) Preliminary Treatment

The objective of preliminary treatment is to remove objects or material which could damage mechanical equipment or interfere with the subsequent treatment processes. Preliminary treatment in similar sized urban WWTPs normally consists of screening and grit removal. The preliminary treatment at the Cork Lower Harbour WWTP must also include for septicity control in addition to screening and grit removal. Preliminary treatment facilities will be incorporated within a building with air extraction to an odour control system. The inlet works including channels and chambers, the screening and grit removal systems and the septicity control system will be covered with headspaces vented to an odour control system.

Pre Treatment - Septicity Control

There is a strong potential for septic conditions to arise in the collection and conveyance systems en route from the waste water sources in the different towns to the WWTP due to the length of the conveyance system and the distance from the population centres to the treatment plant.

Parts of the town of Cobh are approximately 12km in sewer length from the proposed WWTP, with Passage West and Crosshaven being up to 11km in terms of sewer length from the proposed plant. The resultant residence time in the sewer network and conveyance system would be expected to give rise to septic conditions in the waste water.

To overcome this, it is intended to provide septicity control in the form of chemical addition at critical pumping stations and locations in the collection/conveyance system. Septicity control at the WWTP is also required to address the risk of residual septicity in the waste water.

The two principal methods used for septicity control are the addition of chemicals or the aeration of the waste water. The chemicals most widely used are nitrate compounds or ferric sulphate. Nitrate compounds are generally dosed into the waste water at the pumping stations feeding the WWTP to reduce the formation of hydrogen sulphide in the delivery pipework.

Ferric sulphate is generally dosed upstream of the primary settlement stage at the WWTP, and has the effect of precipitating the dissolved hydrogen sulphide from the raw waste water into the sludge.

Aeration for septicity control usually takes the form of injection of high pressure air into the rising mains or sewers feeding the WWTP, or else the addition of air into the raw waste water at a lower pressure in a designated chamber.

Due to the odour nuisance associated with septicity and the long residence times of raw waste water in the conveyance systems it is essential that the inlet channels and chambers be covered, vented and connected to an odour control system.

Screening

Screening of the raw waste water is essential:

- to prevent blockage or malfunction of downstream equipment due to build up or deposition of gross solid material (rags, plastics etc.), to protect downstream equipment from damage,
- to ensure good quality treated effluent with no visible waste water derived debris floating near the outfall and,
- to maintain a good quality sludge product.

Screening to 6mm will be provided for all of the waste water flows arriving at the Cork Harbour WWTP.

There are numerous types of screen available on the market for this application. In general the advantages and disadvantages of the different types of screens are more dependent on the bar spacing or aperture size of the screen than on the specific make. A basic requirement of the screen is that the screen be automatically cleaned using a mechanised rake or brush. A bypass channel, fitted with a manually raked screen, should be provided to facilitate maintenance or isolation of the mechanical screen.

It is inevitable that some organic and faecal matter will be removed in the screened material. It is therefore essential to provide screenings treatment in the form of washing to improve the aesthetics of the screenings, to reduce the odour potential and to render it less objectionable for disposal. The wash-water containing the organic matter gravitates back into the main flow for treatment with the waste water. The screenings are de-watered and compacted to minimise the volume of screenings for disposal.

Due to the odour potential of the raw waste water, the screening system will be enclosed and connected to an air extraction system. The vented air will be passed through an odour control unit.

Grit Removal

Removal of grit from the raw waste water prevents its deposition and build up in downstream stages of treatment, reduces the corrosive wear on pump and other mechanical equipment, and also improves the quality of sludge produced. Generally grit particles of less than 0.2mm in size are acceptable and cause few problems.

The optimum grit/grease removal system for a particular situation generally depends on the size of the sewerage scheme and the quantity of waste water to be treated. The two principal types of system used for WWTPs of this scale are the aerated grit channels and the vortex type grit separator. Both systems are equally effective at removing grit particles down to 0.2mm in size. The aerated grit channel does have the advantage of facilitating the removal of fats, oils and greases from the waste water. However, it does have a greater plant footprint. The vortex type of grit trap has a smaller footprint and is more widely used.

It is inevitable that some faecal matter will be removed from the waste water in the grit. It is therefore necessary to provide grit treatment and washing, with the resultant washwater returning the organic matter to the main flow for treatment. This reduces the odour potential and makes the grit less objectionable for storage and disposal.

Screenings and grit removed from the waste water will be stored in either covered skips or else automatically bagged prior to disposal off site to a licensed landfill.

Due to the odour potential of the raw waste water, the grit removal systems will be enclosed and connected to an air extraction system. The vented air will be passed through an odour control unit.

(ii) Storm Water Handling and Disposal

Waste water is diluted with storm water during rainfall events due to surface runoff and infiltration entering the collection system. While the collection systems in newer residential areas and from industries will not contain a storm water contribution, it is not feasible to completely eliminate storm water from older combined sections of the collection system.

Future developments in the catchment area will be provided with separate foul and storm water collection systems and no storm contribution will be conveyed to the treatment plant from these areas.

The peak flow reaching the WWTP will correspond approximately to 6 times the Dry Weather Flow (6 DWF) at the design year 2030 loadings, and will be experienced when all of the duty pumps at Carrigaline, Raffeen, Ringaskiddy, Coolmore and Shanbally are operating simultaneously at full capacity (refer to Section 2.11 *Ancillary Developments* for collection system details). There will be periods when not all of the pumps are operating simultaneously and much lower flows can be expected for periods each day.

The variation in flows reaching the WWTP can be dealt with in one of two ways. The simplest option is to design the entire WWTP to accommodate flows of 6 DWF. However, this results in operational difficulties and much larger tankage.

Alternatively, the main treatment stages could be designed to accommodate only flows up to 3DWF, with flows in excess of this being overflowed upstream to a storage tank where it would be allowed to settle. As the incoming flow rate decreases the contents of the storage tank would be returned to the main waste water stream for treatment. This will result in smaller settlement tanks and downstream pipework and channels.

The storm water settlement tanks typically used are either circular radial flow tanks and fitted with rotating scraper mechanisms or else rectangular tanks, without sludge scrapers. In both cases the settled storm water will overflow a weir and gravitate to the treated effluent discharge line. Both options are comparable and either could be used at the Cork Harbour WWTP.

(iii) Primary Treatment

The aim of primary treatment is to remove the maximum amount of polluting matter (in the form of readily settleable solids) from the waste water. The units used in primary treatment are commonly known as primary sedimentation tanks, primary settlement tanks or primary clarifiers.

The principle advantage of primary settlement is that it provides for a simple means of removing approximately 30% of the BOD and 60% of the suspended solids from the waste water with a very low energy requirement. This reduces the loading on the secondary treatment stage, resulting in a reduction in tank volumes and energy requirements. While the primary sludge produced can be odorous it is ideally suited to treatment by anaerobic digestion with consequent energy recovery.

Primary Settlement for WWTPs of this scale is generally provided in rectangular horizontal flow tanks or in circular radial flow tanks. The radial or horizontal flow tanks reduce the velocity of the waste water flow such that a proportion of the suspended matter settles out. Solids in the waste water sink to the bottom (primary sludge) whilst the liquid fraction overflows at the surface of the tank. Both types of system would incorporate overflow weirs and continuous sludge scraper mechanisms. A hopper, located at the centre or edge of the tank, is used to collect the settled sludge. The sludge scraper mechanism is usually employed to move the settled sludge into the hopper. The collected sludge is then removed to a sludge treatment area.

Circular radial flow tanks are more suitable to this application because the continuous rotating scraper mechanism keeps the settled sludge moving toward the collection hopper and minimises the residence time of the sludge in the tank. Regular withdrawal (by pumping) of the primary sludge from this hopper is essential. The circular tanks also provide the maximum weir length for a more even flow of the settled waste water.

Because of the potential for septic conditions in the sludge, and the odour potential associated with these tanks (primarily at the overflow weirs) the design of these primary tanks should incorporate adequate odour control measures.

There are some secondary treatment processes which can provide the necessary standard of treatment without primary settlement, and therefore do not produce a primary sludge.

(iv) Secondary (Biological) Treatment

The main objective of the secondary or biological treatment stage is the removal of carbon measured as BOD or COD effluent to comply with the required discharge standards. It is not necessary at this stage to provide for nutrient removal at the Cork Harbour WWTP but the plant will be designed to allow easy retrofitting of nutrient removal facilities at a later stage should it be required.

The secondary treatment stage will involve the biological degradation of the organic content of the waste water by encouraging the growth of suitable micro-organisms within a particular process. The micro-organisms consume the organic content of the waste water and biomass or sludge is produced. The growth of micro-organisms in the structure can be encouraged on fixed media or as a suspended biomass within the waste water body.

A wide range of biological treatment systems are available. These include:

- Activated Sludge (AS) Processes such as
  - Completely mixed conventional aeration system
  - Extended Aeration Activated Sludge
  - High Rate Activated Sludge Systems
  - Plug Flow Systems
  - Sequencing Batch Reactors (SBR)
- Bio filtration processes such as
  - Conventional Trickling Systems
  - Biotower
  - Rotating Biological Contactor (RBC)

- Hybrid Systems such as
  - Biological Aerated Filters (BAF)
  - Membrane Bioreactors
  - Integrated Fixed-Film Activated Sludge Process (IFAS) system
  - Moving Bed Bioreactor (MBBR)
- Various configurations of the above

This WWTP will be constructed using the Design/Build/Operate method with the type of treatment technology and process to be proposed by the successful Contractor and agreed with Cork County Council. The processes that are most commonly and effectively used for medium to large sized municipal WWTPs are suspended growth (such as activated sludge), and fixed film (such as biofiltration) systems. In recent years, a number of hybrid systems have also been developed which incorporate elements of both suspended growth and fixed film systems.

The treatment of domestic type waste water is well understood and all of the available systems can be designed to treat the waste water to the required standards. The essential elements common to most of the systems noted above include process structures/tanks, aeration devices, pumps, mixers, monitoring equipment, pipelines and access facilities. In any case the size and height of the structures will depend on the type of process. Regardless of the process all tanks/process structures will be restricted to a maximum height of 12m above the current ground level.

Secondary treatment systems may require separate final settlement tanks (such as with the conventional Activated Sludge System) or settlement can be achieved within the main process tanks (such as with the SBR System). Where separate final settlement tanks are required these are likely to be constructed at a lower level than the main process tanks and are typically circular concrete tanks.

The main element of the mechanical equipment associated with the secondary treatment process is the aeration equipment. It is recommended that aeration equipment be installed completely within the process tanks or alternatively in a building adjacent to the process tanks. Noise levels associated with air blowers can be significant and as such, it is recommended that the blowers be located in acoustic enclosures or housed.

(v) Sludge Treatment

The main objective of sludge treatment is to produce a product with optimum reusable potential. The *Sludge Management Plan for County Cork* divides the County into five regions, namely regions 18 to 22, for the purposes of municipal waste water sludge treatment. The Ringaskiddy area is proposed as the most suitable location for the treatment hub-centre for Region 19 (*Sludge Management Plan for County Cork*, 2000). Region 19 consists primarily of the towns/villages included within the Cork Harbour Main Drainage Scheme i.e. Cobh, Passage West, Monkstown, Ringaskiddy, Crosshaven and Carrigaline but the region also includes Whitegate, Aghada and Minane Bridge. The towns to be served by the proposed new WWTP will not generate sludges locally.

The *Sludge Management Plan for County Cork* identifies 6,082 tonnes of dry solids generated annually for Local Authority non hazardous waste water sludges in the county. The volume of this sludge generated in Cork County is expected to more than double between 1998 to 2020. The volumes of sludge for the proposed WWTP are detailed in Section 2.5.5 (Indicative Design Nr.1 and Indicative Design Nr.2).

It is proposed that the sludge from the septic tank serving Minane Bridge which has a design population equivalent of 100PE be transported to the proposed to the Cork Harbour WWTP.

Although it is recommended that sludges from Whitegate and Aghada be diverted to Midleton hub centre for treatment, they may also be transported to the proposed WWTP site and as such sludge reception facilities to cater for all three locations will be incorporated in the design of the proposed plant. Sludge delivered to the site will be unloaded at the sludge reception facility. The mechanism by which the sludge is handled and discharged will be designed so as not to cause an odour nuisance.

The *Sludge Management Plan for County Cork* recognises the potential for co-treatment of municipal waste water sludge and biological industrial sludge at a hub centre located in the Ringaskiddy area. No provision will be made in the design of the sludge treatment system at the Cork Harbour WWTP for the treatment of Industrial sludges. The proposed development will include for the handling, treatment and disposal of sludges produced on site and the imported domestic sludges imported from Region 19.

Initially all sludges produced on site will first be thickened to reduce their volume, and the size of the main sludge treatment processes. The sludge thickening processes are optimised by providing separate systems for the primary and secondary sludges. The type of sludge treatment system to be employed at the Cork Harbour WWTP depends on the ultimate end use of the biosolids product, and also on the type of waste water treatment process producing the sludge. As the WWTP will be constructed using the Design/Build/Operate procurement method the type of sludge treatment process will be selected by the successful contractor.

The *Sludge Management Plan for County Cork* recommends Advanced Fluidised Composting, which is a sludge destruction technology, as the sludge treatment technology to be used at the Ringaskiddy sludge treatment centre. This is on the basis of co-treatment of municipal waste water and industrial biological sludges to produce a biosolids product which may not be suitable for beneficial reuse in agriculture due to industrial constituents in the sludge. However, as stated above provision is not being made for the co-treatment of municipal waste water and industrial biological sludges at the proposed Cork Harbour WWTP at this stage.

In the absence of industrial sludge contribution to the sludge being treated, the ultimate end use of the biosolids product is not restricted to disposal to landfill, and could include beneficial reuse in agriculture. Similarly, the type of sludge treatment technology to be employed will not be restricted to the solids destruction technologies such as Advanced Fluidised Composting.

As indicated in the *Sludge Management Plan for County Cork*, agricultural land in the Cork Harbour tidal area is unsuitable for landspreading of the biosolids product as this area displays a nutrient surplus in terms of phosphorus. In addition, 40% of agricultural lands in the Cork Harbour tidal area lie on an extremely vulnerable, regionally important aquifer. However, based on phosphorus balances undertaken for the *Sludge Management Plan for County Cork*, there is sufficient spare capacity in County Cork as a whole to facilitate the landspreading on agricultural land of all of the municipal waste water sludge produced in the County. The contractor responsible for operating the waste water and sludge treatment plant may therefore transport the biosolids further afield from Region 19 for landspreading on suitable agricultural land.

The most attractive option would be to produce a biosolids product for use in agriculture. If the treated sludge is to be reused as biosolids in agriculture, it will be necessary for the biosolids product to comply with the *Waste Management (Use of Sewage Sludge in Agriculture) Regulations*, 1998 to 2001 and the *Codes of Good Practice for the Use of Biosolids in Agriculture*.

The list of acceptable sludge technologies which could produce a biosolids product suitable for use in agriculture are as follows:

- Mesophilic anaerobic digestion with pre- or post- pasteurisation
- Thermophilic anaerobic digestion
- Thermophilic aerobic digestion
- Composting (windrows or aerated piles)
- Alkaline Stabilisation
- Thermal Drying

The type of technology to be used is not limited to this list, as other innovative technologies may be developed which would also produce a biosolids product of acceptable quality. However, not all of the above technologies may be suitable for use at the Cork Harbour WWTP.

Alternatively, the appointed Contractor may determine that it would be more economical to employ a solids destruction form of sludge treatment (such as Advanced Fluidised Composting) on site, and dispose of the end product to landfill. Either option would be compatible with the general recommendations of the *Sludge Management Plan for County Cork* (March 2000).

However, Article 14 of the *Urban Waste Water Treatment Directive* (91/271/EEC) states that "sludge arising from waste water treatment shall be re-used whenever appropriate." Since some income can be obtained from the "beneficial reuse" option it is most likely that this will be the option preferred by the Contractor. To facilitate the ultimate end use of the biosolids (e.g., seasonal nature of landspreading) it will be necessary to provide adequate storage at the WWTP for the biosolids product. It will also be necessary to provide for storage on site for untreated sludge to facilitate repairs and routine maintenance of the sludge treatment equipment.

The Cork Harbour WWTP will be constructed using the Design/Build/Operate procurement system. The treatment processes and types of technology which will be employed will therefore be selected by the successful contractor. The treatment process most likely to be adopted is thermal drying (either with or without anaerobic digestion of the sludge prior to drying). However, the appointed Contractor may have innovative developments to offer, and these should be considered at that stage if commercially and environmentally viable.

Sludge process tanks and structures such as pasturisation tanks and digesters will depend on the sludge treatment process chosen but regardless of the process all tanks will be restricted to a maximum height of 12m above the current ground level. All buildings will be restricted to a maximum height of 10m above the current ground level.

Thickening and dewatering facilities are likely to be provided for sludges as part of the proposed development. If primary settlement tanks are installed it will be necessary to install a primary thickening tank. This tank will be roofed and the headspace will be extracted to an odour treatment process. Dewatering facilities may be installed to reduce the volumes of sludge for disposal or to produce a product suitable for drying. The dewatering facilities are usually mechanical devices such as belt presses or centrifuges and should be installed in a Sludge Treatment Building. The dewatering areas within the building must include air extraction systems, which shall be directed to an odour control system.

In order to increase flexibility for reuse of the sludge, sludge drying may be included as a possible process to be included as part of the development. A sludge dryer will be housed within a Sludge Treatment Building. The Sludge Treatment Building/Buildings shall be restricted to a maximum height of 10m above existing ground level. The dryer will incorporate an exhaust stack, which will extend approximately 2.0m above the height of the building.

(vi) Sludge Storage

Sludge storage facilities will be provided on site. The number of tanks and the location of the tanks within the site will depend on the proposed treatment processes. All sludge holding tanks will be covered and the headspaces of same will be vented to an odour treatment facility. The capacity of the sludge storage facilities will allow for a buffer period to cater for short-term delays in the removal of the sludge off-site.

(vii) Sludge Reuse/Disposal

The proposed development includes for the transportation of sludge off-site and the reuse at sites yet to be identified. The sludge is likely to be recycled to agricultural lands (nutrient recovery). However, it is possible that the sludge may be used in energy recovery systems or other applications. The use of sludge in agriculture will be carried out in accordance with established codes of practice and will adhere to statutory regulations concerning this practice. Any off-site storage facilities that may be required for the management of sludge during the winter months will be subject to separate planning permissions.

The volume of sludge transported off-site will depend upon the dry solids content of the final product. For example at maximum design loading if the sludge is dewatered to approximately 20% dry solids (DS), this will require approximately two to three truck loads leaving the site each day. If the sludge is dried the truck loads leaving the site will reduce to approximately two per week.

(viii) Energy Recovery System

Methane gas is produced as a by-product of sludge digestion processes. The gas is a valuable energy source and can be burned to produce heat for the digestion and drying processes, or electricity to power plant equipment or to export to the public grid. All energy recovery systems will be installed in the Sludge Treatment Building.

(ix) Gas Storage Tank / Gas Flare

Gas storage tanks may be provided for sufficient storage of gas to operate sludge drying facilities and/or energy recovery systems. The tanks are typically spherical or cylindrical in shape. A gas flare will be installed to burn off surplus gas.

(x) Odour Control

Odour control facilities will be installed as part of the development. These will comprise a combination of systems designed to cater for the various off-gases generated from treatment processes and generated during the handling of liquids or sludges.

Typical systems which may be utilised include the following:

- Biofilters and bioscrubbers
- Wet chemical scrubbing
- Catalytic oxidation
- Dry scrubbing and adsorption

A number of these units may be installed external to buildings. These will typically be biofilters, which will comprise steel enclosures on concrete plinths.

(xi) Buildings

The WWTP will include buildings to house a number of elements, which may include the following:

- Administration Offices
- Canteen and Sanitation Facilities
- Laboratory
- Workshop
- Electrical Control Panels
- Inlet Works
- Sludge Thickening and Dewatering Facilities
- Sludge Treatment System
- Aeration Equipment (if applicable)
- Odour Control Equipment

The number of buildings and the facilities accommodated in each will depend upon the final process design selection. However the Contractor will be restricted in terms of building heights. All buildings within the site will be restricted to a building height of at least 10m above the current ground level (all tanks will be restricted to a maximum height of 12m above the current ground level). In addition the overall plan area occupied by buildings will not exceed 3,100m^2.

(xii) Instrumentation Control & Automation

The proposed WWTP will incorporate process control and monitoring equipment. The equipment will be capable of monitoring the individual process parameters and the status of various plant items and utilities.

Information from the plant instrumentation will be automatically tracked and logged together with any relevant faults, actions and alarms. In the event of alarms occurring when the system is unmanned, an automatic call-out facility to relevant personnel will be activated.

(xiii) Treated Effluent Discharge

The treated effluent from the WWTP will be discharged directly into the nearby IDA sewer, which gravitates to the Ringaskiddy outfall. The elevation of the site discharge is higher than the IDA sewer, eliminating the need for treated effluent pumping.

(xiv) Outfall Location

The existing outfalls and proposed outfall are identified in Figure 2.1 *Location of Existing Outfalls and Proposed Outfall*. It is intended to utilise an existing IDA outfall for the proposed development. This currently discharges untreated municipal waste water from Carrigaline and Crosshaven and also discharges treated industrial effluent from the Ringaskiddy area into Cork Lower Harbour. The existing marine outfall extends eastwards terminating at the Dognose Bank on the eastern side of the mouth of Cork Harbour.

(xv) Site Drainage

Any hard standing area with the potential for contamination should drain to the WWTP for treatment. Surface water from other areas on the site e.g. rainwater from roof tops etc. will be diverted to the IDA storm sewer.

2.5.5 Proposed WWTP Options

As stated previously the Cork Harbour WWTP will be constructed using the Design/Build/Operate procurement method, with the type of treatment process and associated technology to be selected by the appointed Contractor. For the purpose of providing an indication of the type of plant and site layout, an indication is provided below of the treatment processes considered most likely to be employed. This is based on experience of other plants of this scale and on current developments in technology.

The principle differences between Indicative Design Nr. 2 compared to Indicative Design Nr. 1 are the omission of the primary settlement stage and associated sludge treatment system, replacement of aeration and secondary settlement tanks with sequencing batch reactors, and the exclusion of anaerobic sludge digestion. In addition rectangular storm water settlement tanks fitted with mixers are included instead of the radial flow tanks.

Indicative Design Nr. 1 is used for the assessment of impacts throughout the EIS. This is considered the 'worst case scenario' for potential impacts (based on the extent of the WWTP footprint, the treatment process and the type of plant proposed).

(i) Indicative Design Nr. 1 - Considered the 'Worst Case Scenario'

The treatment process is shown schematically on Figure 2.5 *Proposed WWTP Schematic Flow Profile for Conventional Activated Sludge System (Indicative Design Nr. 1).*

Waste Water Treatment Process

The indicative treatment process described below is based on a conventional activated sludge process preceded by primary settlement, with the resultant sludge produced being treated by anaerobic digestion and thermal drying. This represents a conservative type of system with a large footprint, within which adequate scope is available for the successful contractor to incorporate innovative technologies with smaller footprints without difficulty. An indicative layout of the proposed WWTP is provided in Figure 2.6 *Indicative Site Layout Nr. 1.*

It is acknowledged that not all of these unit processes are essential to produce a treated effluent and sludge of the required standards, but their exclusion will impact on the sizes and treatment capacity requirements of the remaining process units. The unit sizes below are therefore based on the inclusion of each of these treatment stages.

Preliminary Treatment System

A complete preliminary treatment system with the following elements would be located within the Preliminary Treatment Building:

- 2 Nr. (duty/duty) mechanically cleaned fine screens (with 6 mm spacing), in parallel channels each approximately 2m wide. These will be capable of passing the maximum flow of 979l/s.
- 1 Nr. manually raked bypass screen to facilitate maintenance on the fine screens.
- 2 Nr. (duty/assist) screenings washing, de-watering and bagging facilities
- 2 Nr. (duty/duty) vortex type grit traps complete with air lift grit removal system with a diameter of approximately 3.65m and each capable of passing 490l/s
- 2 Nr. (duty/assist) grit classifiers.

The preliminary system will also include 1 Nr. covered pre-aeration tank with an operational capacity of 590m^3 and 2 Nr. (duty/standby) air blowers rated at 1,057 Nm^3/hr to aerate the contents of the pre-aeration tank.

The quantity of screenings removed on site for disposal (note that screening systems employed at Cobh retain the screenings in the flow) is estimated at 1.7m^3/day based on 85m^3 per 10^6 m^3 of waste water at average flow. This will be taken off site for disposal at the Cork County Council landfill site.

The quantity of grit produced on site for disposal off site is estimated at 0.39m^3/day (with 0.21m^3/day grit already removed in Cobh) based on a typical grit removal rate of 30m^3 per 10^{6}m^3 of waste water.

All of the waste water channels and chambers within the preliminary treatment building will be covered, with the air in the enclosed headspaces extracted and vented through an odour control unit. This unit is likely to be outside of the building, and will discharge the treated air to the atmosphere.

Because of the risk of the presence of flammable gases such as methane in this building, it will be zoned as a hazardous area, with all electrical equipment including motors and instruments suitable for such an environment. The associated control panels should be installed in a separate non-hazardous room within the building. Also the presence of hydrogen sulphide and other gases in the raw waste water require that the building itself is also vented, with the extracted air passed through an odour control system.

Preliminary Treatment Building:

Housing inlet screens, grit removal plant and pre-aeration tanks. Maximum plan area of approximately 550m^2 with a maximum above ground building height of 6.5m.

Storm Water Treatment

The storm water management and treatment system on site is likely to restrict the flows to primary settlement and secondary treatment to 3 DWF, and to allow flows in excess of this to overflow to a storm water treatment system. This system may comprise of:

- 1 Nr. storm water overflow weir in a designated chamber
- 2 Nr. radial flow settlement tanks constructed in reinforced concrete, and fitted with a rotating sludge scraper mechanism and a peripheral overflow weir system. These are sized to provide the equivalent residence time of 2 hours for the excess 3DWF, i.e. with a combined operational capacity of 3,710m^3. When full, these tanks will overflow to the treated effluent discharge pipeline. Based on a typical average water depth of 3.5m in these tanks, these would each have a diameter of 26.0m.
- 1 Nr. storm water return sump common to both tanks, and fitted with 2 Nr. submersible pumps to operate on a duty/assist basis to return the contents of the tank to the main waste water flow upstream of the primary settlement tanks. This flow will be returned when the main flow for treatment reduces to 2DWF or less.

Primary Settlement

The provision of primary settlement tanks operated at an upward flow rate of 1.2m^3/m^2.hr will remove at least 50% of the suspended solids from the raw waste water, and provide a reduction in BOD reduction of at least 30%. With careful operation and management of these tanks higher removal efficiencies are possible, but the figures quoted here are conservative and allow for flexibility in the systems offered.

- 2 Nr. radial flow settlement tanks each with an internal diameter of 31.4m and a sidewall height of 2.5m, of which only the top 1.0m will be above ground level. Each tank will be constructed in reinforced concrete and will be fitted with a rotating scraper sludge system and an access bridge. The depth of the overflow weirs will be kept to a minimum to reduce turbulence at the weirs and to reduce odour. It is also most likely that each of the primary settlement tanks will be covered with their head space vented through an odour control system.

- 1 Nr. primary sludge sump fitted with 2 Nr. sludge pumps will be provided to serve both primary settlement tanks. This chamber will also be covered with the headspace vented through an odour control system. These will be pumping the primary sludge at a sludge thickness of 2% dry solids to the primary sludge thickener.
- The maximum height above ground including covers will not exceed 5.0m.

Secondary Treatment

To achieve the treated effluent standard required a completely mixed activated sludge system is likely to be provided. This would comprise the following:

- 3 Nr. selector tanks constructed in reinforced concrete and each with an operational capacity of 417m^3 would be provided upstream of the aeration tanks. These would be aerated and fitted with a fine bubble diffused air aeration system
- 3 Nr. aeration tanks constructed in reinforced concrete, and each with an operational capacity of 1,866m^3. These would be operated at a top water level of 4.5m and would be fitted with a fine bubble diffused air aeration system, and flow directional mixing system.
- 3 Nr. positive displacement air blowers to operate on a duty/assist/standby basis would be installed within acoustic enclosures in a designated blower building near the aeration tanks. These would each be rated at 3,112 Nm^3/hr, and would supply the entire air requirements of the selector and aeration tanks.
- 1 Nr. dissolved oxygen control system, which would control the output of the aeration blowers to match the demand of the loading and mixed liquors.

Secondary Treatment Building:

Housing sludge thickening equipment, blowers, control panels, stores and workshops. Maximum plan area 1,200m^2 with a maximum height above ground of 10.0m.

Secondary Settlement

Each of the above aeration tanks would have a designated secondary settlement tank (with interchange possible) which would be constructed in reinforced concrete.

- 3 Nr. radial flow secondary settlement tanks each fitted with a rotating bridge and scraper system and a peripheral overflow weir. Each of these will have a plan area for settlement of 619m^2 and a corresponding internal diameter of 28.1m.
- 3 Nr. pairs of duty/standby sludge return pumps will be provided, with each returning the activated sludge to its designated selector/aeration tank.
- 2 Nr. sludge wastage pumps to pump the surplus activated sludge to the activated sludge thickening system.

Sludge Thickening

Because of the different thickening characteristics of primary and surplus activated sludge, separate thickening systems will be provided.

- 1 Nr. gravity sludge thickener installed in a glass reinforced steel tank and fitted with a rotating picket fence assembly will be provided to increase the thickness of the primary sludge from 2% to 6% dry solids. This tank will have an operational capacity of 206m^3 and an internal diameter of 8.1m. Due to the odorous nature of primary sludge this tank will be roofed, with the air extracted from the headspace and vented through an odour control system.

- 1 Nr. gravity belt thickener with an odour enclosure fitted will be installed in the Sludge Treatment Building to increase the thickness of the surplus activated sludge from 0.5% to 6% dry solids. To achieve this sludge thickness the sludge will be dosed with a polyelectrolyte solution. This unit will be required to thicken approximately 95kg dry solids per hour. This thickener will also be connected to an air extract system and odour treatment unit.

- 2 Nr. thickened sludge pumps (duty/standby) will be provided for each of these thickeners to pump the sludges to a common sludge buffer tank.

Sludge Treatment

To provide maximum flexibility in the use of the biosolids produced, the sludge treatment system to be installed here may include an anaerobic digestion process, preceded by a pasteurisation stage and followed by dewatering and subsequent sludge drying. This system will produce 4.97 tonnes of biosolids per day (1,814 tonnes per annum) for which a market and end use must be sought.

- 1 Nr. sludge buffer tank constructed in glass enamelled steel and into which the thickened primary and secondary sludges would be pumped. This tank would be fitted with a mixer, and would have an operational capacity of 320m^3 corresponding to three days sludge production.

- 1 Nr. sludge pasteurisation tank constructed in steel and thermally insulated would be provided with an operational capacity of 6m^3. This would be maintained at a temperature of 57 °C.

- 2 Nr. anaerobic digesters constructed in glass enamelled steel and thermally insulated to maintain the temperature of the contents at 37 °C. Each tank will be fitted with an internal gas mixing system. The operating volume of each of these will be 798m^3, with a tank diameter of 10.5m and a sidewall height of 10m.

- 1 Nr. digester heating system comprising of a combined heat and power (CHP) system and standby boiler capable of operating with either natural gas or biogas. These will be used to heat the digester contents by the use of heat exchangers. This heating system will be installed within the Sludge treatment Building.

- 1 Nr. biogas holder constructed in glass enamelled steel will be erected near the digesters. This will have an operating capacity of 431m^3, and will have a diameter of 12m and a maximum height of 10 m based on a bell-over-water type with the bell at its maximum lift.

- 1 Nr. flare stack

- 1 Nr. digested sludge storage tank constructed in glass enamelled steel will be provided adjacent to the digesters. This will be identical in size to the digesters and will be roofed. This will have an operational capacity of 798m^3, corresponding to 7 days sludge processing capacity. The contents of this tank will be mixed continuously.

- 1 Nr. high pressure sludge dewatering belt press capable of dewatering up to 200 kg dry solids/hour. This press will be enclosed and housed in the sludge Treatment Building. A polymer dosing system will be provided to enhance the dewatering process.

- 1 Nr. dewatered sludge silo constructed in either glass reinforced plastic (GRP) or steel will be provided with a capacity equivalent to one day's production of dewatered sludge, i.e. 22.5m^3.
- 1 Nr. sludge dryer capable of drying 4,469kg dry solids/day. This will be operated with an evaporation rate of approximately 0.70m^3/hr of water taking into account the necessary 125% peaking factor. The dryer will incorporate all necessary feed and discharge screws, heat generation system, heat exchangers, condenser and air scrubbing system. The dryer will be installed within the Sludge Treatment Building.
- 1 Nr. sludge silo constructed in either GRP or steel will be provided with a capacity equivalent to 4 day's production of dried sludge, i.e. 20m^3.
- 1 Nr. bagging system will be provided for the dried sludge.

Sludge Treatment Building:

Housing sludge dewatering equipment, sludge drying equipment, energy recovery systems, control panels, odour control facilities, stores and workshop. Maximum plan area 1,100m^2 with a maximum height of 10.0m.

Odour Control System

All of those unit processes with odour potential must be connected to a negative air extraction and odour treatment system. Less offensive sources (the aeration tankage, secondary settlement tankage and storm water tankage) are considered low risk in terms of odour and do not require odour control units (OCU).

Based on the preliminary site layout prepared, (Figure 2.6 *Indicative Site Layout Nr. 1*) this may comprise three separate odour treatment units with one in each of the locations shown. The units are likely to be installed at the Preliminary Treatment Building, at the Activated Sludge Building and adjacent to the Sludge Treatment Building.

OCU 1	inlet works, preliminary treatment (screening, grit removal and pre aeration) and primary settlement tanks (Figure 2.6 *Indicative Site Layout Nr. 1*, Note 15).
OCU 2	primary sludge thickener tank and activated sludge building (Figure 2.6 *Indicative Site Layout Nr. 1*, Note 16).
OCU 3	anaerobic sludge digesters, digested sludge storage tank, sludge treatment building (containing the digested sludge dewatering system and sludge drying plant) and the dried sludge storage silo (Figure 2.6 *Indicative Site Layout Nr. 1*, Note 17).

The types of odour control unit most commonly used for this application are biofilter units with a shell based media. The number of odour control units and number of stages in the odour control system will be selected by the contractor; however the contractor will be required to meet the overall maximum allowable emission rates specified in Section 3.6 *Air Quality, Odour and Climate*. An odour limit of less than 1.5 Ou_E m^{-3} for the 98th percentile and 3.0 Ou_E m^{-3} for the 99.5th percentile is recommended for the nearest sensitive locations and areas of amenity. These limits are considered sufficiently conservative to provide protection to the community at large taking into account the latest suggested odour impact criteria by environmental agencies in Ireland, the UK and the Netherlands.

Noise Attenuation

The treatment of the waste water requires the use of several elements of rotating machinery, such as pumps, air blowers, compressors, centrifuges, aerators, etc. The noise levels associated with these items can be quite significant, and attenuation is required if nuisance levels are to be avoided. Section 3.7 *Noise and Vibration* addresses the potential noise impacts and the required mitigation measures.

A design noise criterion of 45 dB(A) at 20m from the boundary of the WWTP, and a design criterion of 45 dB(A) at 5m from the pumping stations is specified. This represents the noise emissions from continuous plant and processes.

In addition, for the WWTP site, a daytime design noise criterion of less than 55 dB(A) at 20m from the boundary is proposed to ensure negligible noise impact due to daytime work activities and vehicles operating within the site.

Plant Control

Provision of sophisticated modern process monitoring and control equipment allows for efficient operation of the treatment process by increasing information levels and staff efficiency.

To optimise the operation and performance of this plant a Supervisory Control and Data Acquisition (SCADA) system will be necessary. This will significantly reduce the level of manual intervention required for plant operation, and will also enable continuous plant operation without continuous manning of the site. It will incorporate an automatic dial-out system to alert personnel to any critical plant failures when the plant is not manned. Critical information will be made available and transmitted to the relevant Cork County Council office.

Provision of continuous monitoring and sampling of waste water flow entering and leaving the site will be provided. This will also include monitoring and measuring of the storm water content. This waste water monitoring is critical not only in terms of controlling plant operation but also in terms of complying with the *Urban Waste Water Regulations* 2001 & 2004 amendments. To comply with the *Waste Water Discharge (Authorisation) Regulations* of 2007, a Waste Water Discharge licence will be required from the EPA for the Cork Harbour WWTP. The purpose of the licence is to make provision for the protection of human, animal and plant life from harm and nuisance caused by the discharge of dangerous substances to the aquatic environment as well as to ensure compliance with National law.

Incoming and Outgoing Control - There will be deliveries by road tanker of imported influents and sludge, collections and transport off site of grit, screenings and bio-solids product on a daily basis. Facilities are required to monitor the volume and quality of the different loads being received and dispatched.

(ii) Indicative Design Nr. 2 - Alternative Treatment System

A schematic flow profile of an alternative waste water treatment system which may be employed on site is shown in Figure 2.7 *Proposed WWTP Schematic Flow Profile for SBR System (Indicative Design Nr.2),* with an indicative layout provided in Figure 2.8 *Indicative Site Layout Nr. 2*.

Preliminary Treatment System

- As per system described above (Indicative Design Nr.1).

Storm Water Treatment System

- 2 Nr. rectangular settlement tanks fitted with submersible mixers, tipping bucket flushing systems and an overflow weir along the outlet end of each tank. The tipping bucket is normally at rest above top water level, while the mixer is normally switched off. When it is intended to return the settled water to the main waste water stream for treatment the mixer is activated to ensure that the return flow is of a consistent nature. When all of the tank contents have been emptied and returned for treatment, the tipping bucket is lowered to empty its contents and flush the floor and side walls of the tank. The operational capacity of these tanks will be exactly the same as for the radial flow circular tanks.
- 1 Nr. storm water sump complete with 2 Nr. pumps as per main treatment option.

Primary Settlement

By the nature of this alternative treatment system the provision of primary settlement tanks is not a requirement for this option.

Secondary Treatment

To achieve the treated effluent standard required a Sequencing Batch Reactor (SBR) activated sludge system is likely to be provided as an alternative treatment option. This would comprise of the following:

- 4 Nr. SBR reactor tanks constructed in reinforced concrete, and each with an operational capacity of 2,000m^3 (larger capacity than required for conventional system). These would be operated with a top water level of 5.5m and a bottom water level of 3.85m. Each tank would be fitted with an automated feed system, desludging system and decanting weir. Aeration would be provided by a fine bubble diffused air aeration system. Each of the SBR tanks would incorporate a Selector compartment with an operational capacity of 313m^3 at the SBR inlet. These compartments would also be aerated and fitted with a fine bubble diffused air aeration system.
- 3 Nr. positive displacement air blowers to operate on a duty/assist/standby basis would be installed within acoustic enclosures in a designated blower building near the aeration tanks. These would each be rated at 4,000 Nm^3/hr, (larger than requirement for conventional system) and would supply the entire air requirements of the selector and aeration tanks.
- 4 Nr. pairs of duty/standby sludge recycle pumps will be provided, with each returning the sludge from the SBR to its selector zone.
- 1 Nr. dissolved oxygen control system, which would control the output of the aeration blowers to match the demand of the loading and mixed liquors.

Secondary Settlement

Separate secondary settlement tanks are not required for the SBR.

- 2 Nr. sludge wastage pumps to pump the surplus sludge to the sludge thickening system.

Sludge Thickening

Because there will be no primary sludge produced on site by this treatment option only surplus activated sludge thickening system will be provided.

- 2 Nr. gravity belt thickeners with an odour enclosure fitted will be installed in the Sludge Treatment Building to increase the thickness of the surplus activated sludge from 0.5 % to 6 % dry solids. To achieve this sludge thickness the sludge will be dosed with a polymer solution. These units will each be required to thicken approximately 95kg dry solids per hour. These thickeners will also be connected to an air extract system and odour treatment unit.
- 2 Nr. thickened sludge pumps (duty/standby) will be provided for each of these thickeners to pump the sludges to a common sludge buffer tank.

Sludge Treatment

The sludge treatment system to be installed here might not include an anaerobic digestion stage and therefore only a dewatering stage followed by sludge drying will be required. This system will result in the production of approximately 7 tonnes per day (2,555 tonnes per annum) of biosolids product for which a market an end use must be sought. This is approximately 41% more than that produced by the other treatment option.

- 1 Nr. sludge buffer tank constructed in glass enamelled steel and into which the thickened primary and secondary sludges would be pumped. This tank would be fitted with a mixer, and would have an operational capacity of 320 m^3 corresponding to three days sludge production.
- 1 Nr. high pressure sludge dewatering belt press capable of dewatering up to 280 kg dry solids/hour. This press will be enclosed and housed in the sludge Treatment Building. A polymer dosing system will be provided to enhance the dewatering process.
- 1 Nr. dewatered sludge silo constructed in either GRP or steel will be provided with a capacity equivalent to one day's production of dewatered sludge, i.e. 32m^3.
- 1 Nr. sludge dryer capable of drying 6,300 kg dry solids/day. This will be operated with an evaporation rate of approximately 1.0m^3/hr of water taking into account the necessary 125% peaking factor. This is approximately 40% higher than the capacity of the drying system required for the conventional activated sludge system with primary settlement and anaerobic digestion. The dryer will incorporate all necessary feed and discharge screws, heat generation system, heat exchangers, condenser and air scrubbing system. The dryer will be installed within the Sludge Treatment Building. The dryer will use natural gas from the national grid as the fuel source for the heating system.
- 1 Nr. sludge silo constructed in either GRP or steel will be provided with a capacity equivalent to 4 day's production of dried sludge, i.e. 28.2m^3.
- 1 Nr. bagging system will be provided for the dried sludge.

2.5.6 Proposed Site Layout

An indicative site layout for the proposed WWTP based on the conventional activated sludge process is described above and shown in Figure 2.6 *Indicative Site Layout Nr. 1*. To optimise the use of the sloping nature of the site, the preliminary treatment and primary settlement stages would be located at the higher elevations on site. Since these would be constructed for the most part below ground level only the tops of the chamber walls would be visible. These would be screened from view by local vegetative screening.

Similarly, the storm water settlement tanks, aeration tanks and secondary settlement tanks would be constructed in part below ground level, with only the top one metre of the side walls emerging above the finished ground levels.

2.5.7 Plant Flexibility and Future Expansion

Assuming the WWTP is operational in 2010, the waste water loads will be approximately 65% of the loads predicted for the year 2030. As such the proposed WWTP will be capable of effective operation while the loading is gradually increasing to the design loading. The modular nature of the activated sludge system described above would facilitate this requirement by operating at lower loading rates or at increasing loading rates with one of the three aeration tanks and its secondary settlement tank out of service in the initial stages of operation.

Sufficient space is also provided at the treatment plant site to facilitate further future expansion to accommodate further development in the scheme's catchment area beyond 2030.

2.6 Construction of WWTP

It is expected that the construction phase for the WWTP will extend over a two-year period. However, the timing for the commissioning of the WWTP will depend upon the completion of other associated works, such as construction of the pumping stations, drainage network, etc.

The construction works associated with this development will involve normal construction activities such as excavation, filling, lifting, pumping, pipe laying, concrete works, mechanical installation, etc. Other more specialised techniques may include piling and marine works. Blasting is not envisaged for this development.

Excavated material generated during the construction of the plant, where possible will be reused on site. For example, it may be possible to reuse excavated material for landscaping purposes in the context of the landscaping plan. However, any surplus spoil not suitable for re-use on site will be disposed of to a licensed landfill site. It will be the responsibility of the Contractor to ensure all disposal of waste is undertaken in a responsible manner. Where waste has to be transported off site for disposal, appropriate permits will be held by operators transporting the waste and an appropriate waste licence will be held at the waste disposal facility as per the requirements of the *Waste Management Act, 1996 - 2005* and associated regulations as amended. The quantity of surplus excavated materials will depend upon the final process design. However, taking a worst case situation where the secondary treatment process tanks are constructed substantially below ground, the maximum estimated volume of surplus material is in the order of 10,000m^3. It is anticipated that tanks will not be excavated to depths greater than 5m below current ground level. A large proportion of this material will be subsoil (refer to Section 3.4 *Soils, Geology and Hydrogeology* for sub-surface stratification), which can be reused for landscaping works on site or for example as landfill capping material.

Site accommodations including offices, stores, workshops, canteens, etc. will be located within the boundary of the site. Likewise, parking facilities for construction vehicles and private transportation will be located within the development site. Temporary site fencing will be erected and maintained to secure the site during the construction phase.

A detailed Construction Environmental Management Plan (CEMP) will be drawn up for all construction activities to be carried out on site. This management plan will address activities likely to affect all aspects of the environment e.g. noise, dust, traffic, run-off, spillages, effluents etc. and will include environmental protection measures such as monitoring, protection barriers, operational procedures and contingency measures.

Provisions to reduce the environmental impact of the construction activities will include the following:

- Requiring contractors to ensure that no pollution or obstruction of existing streams, ponds, ground water or watercourses is caused by their operations.
- Requiring contractors to comply at a minimum with the provisions of *BS 5228 (Noise Control on Construction and Open Sites), 1997 and the Safety, Health and Welfare at Work (General Application) Regulations* 2007, S.I. No. 299 of 2007 for noise exposure within worksites.
- Requiring Contractors to take reasonable precautions to ensure that all discharged waste water (arising due to construction activities) shall not be harmful to, or cause obstruction, or deposit in, the drains or sewers and to prevent oil, grease or other objectionable matter being discharged into drains or sewers.
- Requiring contractors, during the execution of the works, to keep all plant and materials and all things connected with the construction of the works in good order and clean and tidy.
- Requiring the Contractor to ensure waste materials from the site are disposed of to a licensed waste facility.
- Requiring contractors to ensure that the public roads in the vicinity of the site are maintained free from all mud, dirt and rubbish which may arise from or by a reason of the execution of the works. To facilitate this, the Contractor could be required to provide a wheel washing facility to an approved standard within the construction site.

- Prohibiting the disposal of excess concrete on any part of the construction site. Requiring the Contractor to provide a designated bin for washing down the chutes of concrete trucks on site.
- Requiring the Contractor to keep the construction compounds free and clear of excess dirt, rubbish piles and scrap wood, etc. at all times.
- Requiring the Contractor to keep the designated parking area and other common areas clear and free of rubbish and debris.
- Requiring the Contractor to be responsible for the disposal of all wood, food, food packaging and paper and requiring them to furnish containers. Dumping these items within the construction site will be prohibited.
- Requiring scrap materials, rubbish, etc. to be hauled out of the work areas and disposed of by the Contractor on a regular basis. All hauling/disposing will be to a licensed waste disposal facility and the collectors will hold an appropriate waste collection permit.
- Requiring the Contractor to obtain any necessary permits from the Local Authority or EPA for the disposal of waste.
- At the completion of the work, require the Contractor to leave the Construction Area in neat, clean and orderly condition.
- Requiring the Contractor to provide sanitary facilities adequate for construction personnel. Sanitary facilities will include proper wash down WCs with sewer connections, or if this is impracticable, chemical closets.
- Requiring that all temporary buildings associated with construction of the development comply with the up to date *Safety, Health and Welfare Regulations*. On completion of the works, contractors will remove them entirely with all slab, drains and water mains and restore the surface of the land to its original condition or other reasonable condition. Typically with the exception of the marine crossing (where there may be a need to carry out essential night time works) construction restrictions will apply (07.00 to 19.00 for weekdays and 08.00 to 13.00 on Saturdays).

2.7 Commissioning of WWTP

Programmes for the phasing of the Works for the Cork Harbour Main Drainage Scheme are not available at this preliminary stage and will be undertaken at detailed design stage.

There may be an interim period between the completion of the collection system and the commissioning of the WWTP where temporary mitigation measures may be required to minimise environmental impact. These measures will be set out in the CEMP and agreed with Cork County Council. At no stage will the impact be worse than prior to the construction phase.

It is expected that the WWTP will be put into operation immediately on completion of construction of the plant and other waste water conveyance systems. It is also expected that mechanical, electrical and process commissioning will extend for approximately 12 weeks after the start-up of the plant. However, the full capacity of the plant may not be utilised for some years as the design capacity is to the year 2030.

2.8 Licensing Requirements

WWTPs are exempt from requiring a waste licence under Section 3 of the *Waste Management Act* 1996. Sludge produced as a by-product of the waste water treatment process is not considered to be a waste under the *Waste Management Act* 1996 when it is reused in agriculture. Ultimately, the treatment of sludge and the final reuse of the sludge will determine whether a waste licence is required.

A waste licence from the EPA is necessary where storage (for over 6 months) is provided at the proposed WWTP prior to disposal to landfill or reuse on land. It is not proposed to provide a storage capacity of 6 months or greater at the proposed plant and therefore a waste licence is not required.

Under the new *Waste Water Discharge (Authorisation) Regulations, 2007 (S.I. No. 684 of 2007)*, there will be a requirement for all waste water discharges occurring from agglomerations of over 500 PE to apply for a license. Thus, it will be necessary to attain a discharge license under the above mentioned regulations for the Cork Harbour Main Drainage Scheme. Pre-application consultation with the EPA is recommended.

2.9 Operation of WWTP

The WWTP and pumping stations will be operational 24 hours per day, 365 days per year. It is not anticipated that the plant will be staffed 24 hours per day. Normal working hours will typically be within 8.00am – 6.00pm Monday to Friday, with visits to the plant on Saturday and Sunday, as required. Automatic control of the plant will be undertaken by a computerised control system, with key information and alarms relayed to the relevant Cork County Council office. When the site is unmanned, any critical alarms of the plant will activate an automatic call-out system. Sufficient, suitably qualified staff will be employed to operate the WWTP including supervisors, laboratory technicians, general operatives, electricians, fitters, etc.

Activities associated with the WWTP will include arrivals and departures of employees on a daily basis. Maintenance personnel such as electricians will arrive at the plant as required and there will be regular maintenance necessary. Parking will be included for employees and visitors.

An Operation Environmental Management Plan (OEMP) and Maintenance Manual will be produced for the site.

Locally directed on-site lighting will be provided for access and maintenance purposes. Lighting will be provided on the access roads and other locations only as required for safety and security reasons.

Access to the site by unauthorised persons will be prevented. Safety features for minimising risk to all plant personnel/visitors/intruders will include, but not limited to the following:

- Handrails to uncovered tanks, where appropriate
- Handrails and toe-boards to access platforms, walkways, etc.
- Controlled access to all stairs and platforms
- Safety chains/cages to units/ladders, where appropriate
- Safety grid flooring to all ducts and channels
- Local emergency stop buttons on all machinery

- Life buoys at strategic locations around all tanks
- Hand rails and harnesses for maintenance personnel
- Perimeter security fence with an intruder alarm system linked to the central control station
- Portable gas monitor and breathing apparatus for use by site personnel

The appointed Contractor will be required to comply with the appropriate health and safety legislation including:

- European Council Directive 94/09/EC – ATEX Directive
- Safety Health and Welfare at Work Act, 1989 and 2005
- Safety Health and Welfare at Work (Construction) Regulations, 2006
- Safety Health and Welfare at Work (General Application), Regulations, 1993 as amended in 2001 and 2003
- Safety Health and Welfare at Work (Biological Agents) Regulations, 1994 as amended 1998
- Safety Health and Welfare at Work (Control of Noise at Work) Regulations, 2006
- Safety Health and Welfare at Work (Work at Height) Regulations, 2006
- Safety Health and Welfare at Work (Control of Vibration at Work) Regulations, 2006
- European Communities (Waste Water Treatment)(Prevention of Odours and Noise) Regulations, 2005

Facilities for diverting flows from the various treatment units will be provided to effect ease of maintenance and to facilitate isolation of any integral unit should breakdown occur, without significantly impairing the overall treatment efficiency.

All critical items of plant equipment such as pumps, blowers, will be provided with stand-by facilities, which would be automatically brought into operation upon failure of "duty" unit.

2.10 Waste Water Monitoring

The Fifth Schedule of the *Urban Waste Water Treatment Regulations, 2001 (S.I. Nr. 254 of 2001)* stipulates the following monitoring requirements for urban WWTPs with population equivalents of 50,000 PE or over:

- A minimum of 24 samples should be taken annually at regular intervals during the year
- Flow proportional or time based 24-hour samples are to be taken.
- If 24 samples are taken annually, the waste water BOD during 'normal operating conditions' may must not deviate from the standard by more than 100% for four of the samples and 150% deviation is acceptable for suspended solids standards.
- Extreme waste water quality values are not to be considered, when resulting from unusual situations such as those due to heavy rain.

These requirements will be implemented as part of the operational control of the WWTP. However it is likely that additional monitoring will be conducted by the appointed Contractor to ensure effective process control.

In advance of the WWTP becoming operational the Council will arrange pre application discussions with the Environmental Protection Agency (EPA) for a Waste Water Discharge Licence under the *Waste Water Discharge (Authorisation) Regulations* 2007 *(S.I. No. 684 of 2007)*. These regulations apply specifically to the discharge itself and storm water overflows.

2.11 Ancillary Developments

A number of ancillary structures will be required as part of the proposed development and are described below.

2.11.1 Collection and Conveyance Systems

The proposed WWTP is one element of the Cork Harbour Main Drainage Scheme. The collection system is another element of the scheme and will convey the effluent from population centres of Cobh, Passage West (including Glenbrook), Monkstown, Ringaskiddy (including Shanbally and Coolmore), Carrigaline (including Crosshaven) to the proposed WWTP. The main elements of the proposed conveyance system include rising mains, pumping stations, gravity sewers and a marine pipeline crossing. Construction or erection of pumping stations, holding tanks or outfall facilities for waste water or storm water will require separate planning approval (Part 8, *Planning and Development Regulations*, 2001, *S.I. No. 600 of 2001*).

The Cork Harbour Main Drainage Scheme also includes for upgrading the existing collection system within each population centre to cater for future development in the areas in line with the *Cork Area Strategic Plan 2001-2020*, the *Cork County Development Plan 2003* and relevant Local Area Development Plans.

The scheme also includes for upgrading the existing sewer network because of structural damage, excessive infiltration and lack of capacity for future flows. Under the proposed scheme it is expected that waste water and storm water collection will be separated as far as reasonably possible.

Overview

The proposed scheme provides for waste water from Cobh to be pumped across the Passage West Channel in Cork Harbour from Carrigaloe to Glenbrook via a marine pipeline crossing. The combined Passage West/Glenbrook, Cobh, Monkstown and Raffeen flow is to be pumped to the proposed WWTP site. It is proposed to pump the combined flow from Crosshaven, Coolmore and Carrigaline via existing rising mains to the WWTP site. Waste water from Ringaskiddy will be pumped to Shanbally where it will be pumped to the WWTP. The treated effluent would flow by gravity to the existing Ringaskiddy outfall.

The main elements of the proposed collection system and the locations of the pumping stations and the marine crossing are shown in Figure 2.9 – *Associated Development Works*.

The Cork Harbour Main Drainage Scheme includes for the construction of the following main elements:

- Major Pumping stations
- Minor Pumping stations
- Marine Pipeline Crossing
- Rising Mains and Gravity Sewers

Major Pumping Stations

The following four major pumping stations will be constructed as part of the proposed Scheme:

- West Beach Cobh
- Carrigaloe
- Monkstown
- Raffeen

The proposed location of each of the above pumping station is shown on Figure 2.10 *Site Location Plan – Proposed West Beach Pumping Station*, Figure 2.11 *Site Location Plan – Proposed Carrigaloe Pumping Station*, Figure 2.12 *Site Location Plan – Proposed Monkstown Pumping Station* and Figure 2.13 *Site Location Plan – Proposed Raffeen Pumping Station*. The existing Church Road pumping station in Carrigaline is also considered a major station and will be upgraded as part of the Scheme.

It is noted that the potential impact on the receiving waters from emergency overflows from the Carrigaloe, Monkstown and Raffeen pumping stations is likely to be more negative than the current situation. Overflow discharges at these pumping stations will include the waste water from Cobh, and from Passage West in the case of the pumping stations at Monkstown and Raffeen. Therefore, at a minimum an automated control operating system should be put in place to ensure that if a downstream pumping station fails to operate, the upstream pumping station will cease pumping.

These pumping stations are likely to be Dry Well/Wet Well type pumping stations and therefore will be housed within an above ground building. The emergency operation of these stations is essential to minimise the environmental risk. It is essential that the pumping stations include for standby power arrangements to prevent the overflow discharge of raw effluent to the harbour. These arrangements are discussed in further detail below.

Noise and Odour abatement measures will also be included at the pumping stations and this is discussed further in Section 3.6 *Air Quality, Odour and Climate* and Section 3.7 *Noise and Vibration*.

Minor Pumping Stations

The minor pumping stations will be submersible type structures with typically only a kiosk and a vent stack visible above ground. These stations will pump much smaller flows in comparison the major pumping stations. The proposed location of minor pumping stations are shown on Figure 2.9 *Associated Development Works*.

Storm Water Overflows & Emergency Overflows

The peak flow reaching the WWTP will correspond approximately to 6 times the Dry Weather Flow (DWF) at the design year 2030 loadings, and will be experienced when all of the duty pumps at Carrigaline, Raffeen, Ringaskiddy, Coolmore and Shanbally are operating simultaneously at full capacity. Pumping stations have been designed (preliminary design) to pump forward flows up to 6 DWF. This is in accordance with industry practice. In the situation where the pumping stations receives a combination of both foul and surface waters, industry practice dictates that 'Formula A' should be adopted. Typically, pump forward flows will be in the range 6-7DWF, as a consequence. This approach has been recognised by the Department of the Environment, Heritage and Local Government as a core design principle on many sewerage schemes throughout the country.

Currently all waste water from the population centres within the Cork Harbour Main Drainage Scheme is not treated and is discharged directly to the Lower Harbour. Consequently, the quality of the discharge from any future overflows will be a significant improvement on current practice. Where overflows occur, their design will be refined at detailed design to the extent that they meet all accepted industry design parameters. All pumping stations and associated overflows will be designed in accordance with the Department of the Environment, Heritage and Local Government guidelines including the guideline document issued entitled *Procedures and Criteria in relation to Storm Water Overflows*. In addition, it should be noted that the construction of outfall facilities for waste water or storm water will require separate planning approval (Part 8, *Planning and Development Regulations, 2001*).

Emergency overflows will be located on the collection system at individual pumping stations to prevent localised flooding in the event of a pump failure or power outage. The provision of duty/standby pumping arrangements in each pumping station will minimise the potential for the discharge of raw sewage except in the event of a power outage. In this event the pumping stations will, at a minimum, incorporate facilities to allow the connection of standby generators. All overflow arrangements will be designed to minimise nuisance and associated health hazards.

Marine Pipeline Crossing

Twin rising mains will cross the West Passage Channel of Cork Harbour from Carrigaloe on Cobh Island to Glenbrook. The proposed route is downstream of the ferry crossing.

A screening and grit removal system is required upstream of the marine crossing to prevent gross solids settling out in the submerged pipelines or causing blockages, during periods of low flow or no flow.

The proposed crossing location is at a narrow stretch of the shipping channel and may interfere with shipping therefore liaising with the Port Authority is essential particularly during the construction phase. The Glenbrook/Monkstown area has steep approaches on the banks of the estuary, and these may cause problems during construction.

The precise locations of the proposed pumping stations and the routes of the gravity sewers and rising mains have yet to be finalised. There is flexibility to relocate some of these facilities without affecting the proposals for the proposed WWTP. In the event of a relocation of any element of the collection system, an environmental assessment will be required to determine that the environmental impacts are the same or less than those anticipated in the EIS.

Rising Mains and Gravity Sewers

The proposed scheme will include for rising mains and gravity sewers to convey flows from the population centres of Cobh, Passage West (including Glenbrook), Monkstown, Ringaskiddy (including Shanbally and Coolmore), Carrigaline and Crosshaven to the proposed WWTP. During the construction phase this will involve the construction of new pipelines as well as modifications to and upgrading of existing pipelines. All new and upgraded sewers and rising mains will be tested following construction to ensure the integrity of the works.

2.11.2 Access

Access to the WWTP site will be from the existing access road to the Bord Gáis substation bordering the south western perimeter of the proposed site. This access road is connected to a minor road (locally known as Cogan's Road) to the west, which currently connects to the National Primary Route to Ringaskiddy (N28). Upgrading of the existing site access road will be required in order to cater effectively with vehicles/traffic associated with the proposed development. Currently the access road for the site at the junction with LS472 is approximately 13m in width and narrows to approximately 7m at the approach to the proposed site. A 10m right of way will be required as part of the works and hence only a section of this road will be widened.

There are proposals to upgrade the N28 from Cork to Ringaskiddy. The Cork to Ringaskiddy Realignment Scheme currently has two proposed interchanges at Shannonpark and Shanbally. The proposed N28 route passes immediately north of the WWTP site and runs approximately parallel to and south of the existing N28 National Primary route.

However, the plans for the road scheme show that once constructed it will no longer be possible to access the N28 from the LS427 (Cogan's Road). Communications with the relevant road authorities (the NRA), indicate that it is not envisaged to provide direct access from the WWTP to the N28.

In the event that the road is constructed prior to the completion of the WWTP, access to the WWTP site will be from the N28 to the L2490 (Fernhill Road) and along the LS427 (Cogan's Road) for both the construction and operation phases of the project. Upgrades along this route will be carried out by the NRA as part of the proposed upgrade to the N28 Cork to Ringaskiddy Realignment.

2.12 Power, Water and Chemical inputs

Water

Water will be required during the construction phase and for the operation of the WWTP. This will be supplied by a connection to the existing water mains supply.

Water is required at various stages during the treatment process for equipment operation. Requirements for water, in addition to the normal maintenance requirements, would include water for the screening, dewatering, odour control and chemical processes.

Certain functions, such as chemical preparation, require the use of potable water. However final effluent should be suitable for many of the other duties. The use of treated effluent for miscellaneous grey water activities such as screen washing, cooling, and irrigation of the odour control systems is to be encouraged and implemented where feasible. This is recommended since it will reduce the quantity of potable water utilised on site (thereby reducing cost and limiting use of a valuable resource) and also reduce the quantity of dirty wash water for treatment.

Recycled treated effluent should be used where possible e.g. cleaning the screens etc. A connection to the public water supply is available from the existing water main within the minor road adjacent to the site.

Power

Electricity is required as a power source for the electrical and electronic equipment and machinery used on site. In terms of power supply, there is sufficient capacity available from the existing network to service the proposed WWTP.

A standby generator is recommended to ensure the plant will continue operating in the case of electrical power failure. It is normal practice to locate the generator indoors to attenuate noise levels. It is likely that diesel will be transported to the site to operate the standby generator.

Gas may be required as a fuel source for particular advanced sludge treatment systems, e.g. if a drying process is adopted. A natural gas supply is also available adjacent to the site.

Chemical Inputs

The most common method employed for the removal of phosphorus from municipal waste water utilises chemical addition and subsequent precipitation of the insoluble phosphates with the biological sludge produced. The chemical addition is usually downstream of the biological stage. Chemicals most commonly used are ferric sulphate and aluminium sulphate, both of which are available in liquid form and do not require dilution prior to addition to the waste water. It is currently not a requirement to remove nutrients such as phosphorus and nitrogen from the Cork Harbour WWTP however should nutrient removal be required such chemicals are likely to be stored on site. Associated with this it will be necessary to provide bulk storage facilities for the chemical to be added.

Chemical conditioning of the sludge is typically associated with sludge dewatering machinery such as centrifuges and belt presses. Polyelectrolyte is added to sludge, prior to dewatering, as an aid to thickening and dewatering. The particular type of polyelectrolyte used is dependent on the sludge. Polyelectrolytes are available commercially in either solid or liquid form. Liquid polyelectrolytes are more commonly used on plants of this scale and type.

The most suitable polyelectrolyte for any particular sludge is determined by on-site testing, during the commissioning and initial operation of the plant. In addition, new products are introduced onto the market on an ongoing basis. These may offer improvements in performance. The polyelectrolyte preparation and dosing systems are housed and generally comprise storage and mixing tanks complete with mixers and dosing pumps. Additional in-line dilution is usually provided in the dosing lines.

Some waste waters require pH correction, where for example lime dosing may be required. As the waste water from the harbour area is predominantly municipal it is unlikely that this will be a requirement.

Appropriate measures such as adequate bunding of chemical storage and delivery areas must be provided on site. Chemicals storage tanks should be all contained within a bund, and have emergency shower and eyewash unit located along side. The chemical dosing pumps should be installed within the bunded area.

2.13 Climate Change

The proposed WWTP is located at an elevated site (approximately 28-40m OD), away from the foreshore and therefore will not be affected by rising sea levels and flooding. Due to the topography of the catchment, the collection system is located predominantly close to the coast.

The preliminary design of the collection system used a maximum tide level of 2.5m OD which is above the Mean High Water Spring level of 1.98m OD. The collection system has been designed to eliminate direct connections between the tidal water body and the main collection system. The foul flows are conveyed to the proposed WWTP via pumping stations. Overflows from the pumping stations are necessary to eliminate excessive storm flows from the main system. These overflows will be protected by means of valves which will negate the possibility of tidal water intrusion. Detailed design will include for the sealing of all manholes which may be impacted on through pressure differentials imposed by tide levels external to the collection system. It is therefore concluded that the collection system is sufficiently protected from impacts of climate change and excessive tidal events.

Detailed design, which will be carried out following approval of the EIS, will utilise best practice in order to factor in the impacts of climate change on the collection system. Climate change predictions have varied in their estimations for sea level rise and increased rainfall intensity over the past few years. It is a recommendation of this EIS that climate change issues will be specifically refined and predictions validated with the most up to date information during detailed design.

Where possible, the Contractor is recommended to utilise a number of measures to reduce his Carbon Footprint for both the construction and operational phases of the development. These may include locally sourced products, reduced distances for the transportation of sludge, energy efficient designs, concept of reduction and reuse, a structured approach to energy management (electricity etc.), preparation of an Energy Management Action Plan (MAP).

2.14 Sustainability

The WWTP is designed to cater for the future development in the Lower Harbour area until the year 2030. Currently waste water from the towns/villages in the Lower Harbour area is discharging untreated to the Harbour.

The proposed development supports environmental, and the economic needs in the Cork Harbour Area. In order to facilitate sustainable development and an increasing population, the provision of services including WWTP's is a vital infrastructural requirement for the Cork Harbour Area.

In addition to the proposed development, the Water Services Investment Programme 2007-2009 for Cork County includes for the following to cater for future demands and improve water quality in the harbour area:

- Midleton Sewerage Scheme (Infiltration Reduction)
- Midleton WWTP Extension
- Little Island Sewerage Scheme
- Carrigtwohill Sewerage Scheme (Treatment & Storm Drain)

2.15 Decommissioning

Waste water treatment for population centres in the Lower Harbour area will be required indefinitely. Therefore it is unlikely that the plant will be decommissioned in the future and more likely that the proposed plant will require upgrading once the design capacity or lifetime of the plant has been reached. Nevertheless should the plant require decommissioning all tanks, structures and building etc. shall be dismantled and removed. Any contaminated material shall be removed off site. All material removed off site will be re-used/disposed in accordance with the relevant legislation at the time.