

**Baseline study and impact assessment of the aquatic ecology,
sediment and water quality in relation to the proposed wastewater
treatment plant and landfill leachate discharges at Newport, Co.
Mayo.**

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1. INTRODUCTION

Mott MacDonald Pettit Limited is preparing an EIS on behalf of Mayo County Council for a proposal to expand and upgrade Newport Waste Water Collection and Treatment System. Ecological Consultancy Services Ltd (EcoServe) have been commissioned by Mott MacDonald Pettit Limited to prepare an assessment of the aquatic ecology and sediment and water quality in the vicinity of the proposed development and to provide recommendations and mitigation measures to minimise the impact of the proposed development.

1.1 DEVELOPMENT BACKGROUND

Mayo County Council proposes the expansion and upgrading of Newport Waste Water Collection and Treatment System. A secondary development proposed by Mayo County Council is the piping of treated leachate from Derrinnumera landfill and its subsequent discharge through a common outfall with treated municipal wastewater to the marine environment.

Key elements of the proposed development have been summarised as follows:

- Provision of new pipelines to expand the existing Newport wastewater collection system
- Upgrading of existing pumping stations on the Newport wastewater collection system
- Replacement of existing septic tanks in Newport waste water treatment plant with new pumping stations to transport the wastewater to the proposed new treatment plant. Storm water overflows will be provided for these stations
- Provision of a pipeline to transport treated leachate from Derrinnumera landfill to the proposed Newport waste water treatment plant
- Provision of a new municipal wastewater treatment plant for Newport town

The current study relates directly to the following key elements of the proposed development:

- Provision of a marine outfall to discharge storm water overflows from Newport waste water treatment plant
- Provision of a marine outfall to discharge treated municipal wastewater and treated leachate from Derrinnumera Landfill into Newport Bay (the wastewater treatment facilities proposed for Newport are designed with a capacity of 2,500 Population Equivalent (PE))

In addition to the statutory requirements outlined by An Bord Pleanala regarding the environmental impact assessment for this development, various concerns have been expressed by groups such as the Clew Bay CLAMS Group (Bord Iascaigh Mhara and the Marine Institute), Clew Bay Marine Forum and the Clew Bay Oyster Co-Operative Society Ltd. Concerns focus on the composition of the final effluent that will be discharged from the proposed outfalls and the potential impact these will have on the surrounding environment. Primary concerns are the potential contamination of the local marine environment (and local biota including substantial numbers of both native and commercially cultivated shellfish populations) by toxins such as heavy metals, dioxins, endocrine disruptors, PCB's and phenols. The North Western Regional Fisheries Board, the Department of the Environment, Heritage and Local Government and the Environmental Protection Agency have requested that Mayo County Council follow specific guidelines in relation to the development. In the current baseline survey, consideration of both the requirements outlined by An Bord Pleanala

with regard to environmental impact assessment and the specific concerns expressed by other regulatory authorities and interest groups regarding this proposed development was exercised.

1.2 AIMS AND OBJECTIVES

The aims of the baseline survey and impact assessment were as follows:

To provide a baseline dataset of the aquatic ecology and water and sediment quality for the potentially receiving environment in Newport Channel, Newport Bay in general and to the north east of the proposed development in the Burrishoole/Lough Furnace system. It should be noted that the current study was undertaken during the period September to November 2004 and entailed 'once off' surveys of flora, fauna, water and sediment quality. The resulting data can be considered a 'snapshot' of the existing ecological characteristics of the area at the time of survey. A review of existing literature was also undertaken in order to include elements that could be absent during a 'once off' survey. Pre-construction baseline data (biotic and abiotic) have been collected from the area of the discharge and the bay and associated aquatic systems in general (marine, brackish and freshwater). Areas of conservation importance were identified. Potential impacts (likely and significant effects) of the development on the system have been assessed and recommendations and mitigation measures have been formulated where appropriate. The identification of good baseline data across a range of sites, both close to the proposed outfall and at a distance unlikely to be affected by the outfall, will allow for comparison between the current situation and that which may develop over time if a discharge licence is granted.

The survey aims to address baseline data collection for use in environmental impact assessment under two main headings:

1. *The physical disturbance and ecological impacts resulting from the actual construction of the proposed development structures (pipelines - as this is the only part of the development below HWM) - this involved detailed ecological descriptions of the areas that may be impacted by development (habitat mapping, species distributions and highlighting nature conservation importance)*
2. *The potential ecological impacts of development operation and the current contamination status of the area under investigation - this involved a baseline assessment of the contamination status of the area under investigation (through water, sediment and tissue analysis) in addition to ecological descriptions of the areas that may be impacted by the development (habitat mapping, species distributions and highlighting nature conservation importance).*

1.3 BACKGROUND – SITE NATURE CONSERVATION INFORMATION

Newport River (cSAC 002144)

The Newport River is designated as a cSAC on the basis of native Atlantic salmon (*Salmo salar*) populations (amongst other species). Water quality in the Newport River system is good (Class A or unpolluted for the main channel and all tributaries). The EPA sampled the river at six locations over the period 1995 to 2000 (Doris *et al.*, 2001). Water quality was rated between Q-value 5, and Q-value 4, both of which represent unpolluted conditions. The cSAC site includes the Glenisland, Crumpaun, Skerdagh and Glendorrugh Rivers and Lough Beltra. The Newport River is a relatively short river, flowing from Lough Beltra to the sea at Newport, Co. Mayo. The existing cSAC comprises a 7 km section of this river from

Derrynafreva Lough to the railway bridge in Newport town. The two main tributaries are the Crumpaun, which rises approximately 6 miles north of Lough Beltra and the Skerdagh River, which joins the Newport system approximately one mile downstream of the lake (Appendix 1, Figure 1.12).

Other than the Atlantic salmon, species of conservation interest present in the Newport system include a significant population of the freshwater pearl mussel (*Margaritifera margaritifera*), a species listed on Annex II of the EU Habitats Directive and also protected under the 1976 Wildlife Act and the Bern Convention. A survey in 1995 estimated the population of the pearl mussels within the Newport River cSAC site at approximately 5,000 individuals. The water quality of the river being very good, the mussels were found throughout the river system in both gravel and rocky bed areas.

The otter (*Lutra lutra*) is another species listed on Annex II of the EU Habitats Directive also present at this site. The otter is a semi-aquatic mammal, which occurs in a wide range of ecological conditions, including inland freshwater and coastal areas. Populations in coastal areas utilise shallow, inshore marine areas for feeding but also require freshwater for bathing and terrestrial areas for resting and breeding holts. Coastal otter habitat ranges from sheltered wooded inlets to more open, low-lying coasts. Inland populations utilise a range of running and standing freshwaters. These must have an abundant supply of food (normally associated with high water quality), together with suitable habitat, such as vegetated river banks, islands, reed beds and woodland, which are used for foraging, breeding and resting.

Badger, Irish hare and common frog, three Red Data Book species that are also protected under the 1976 Wildlife Act, are present in the Newport river system. The common lizard is also believed to be present another species protected under the 1976 Wildlife Act.

Clew Bay (cSAC 001482) (extract from National Parks and Wildlife cSAC site description)

Clew Bay is a wide, west facing bay on the west coast of Co. Mayo. The geomorphology of the bay has resulted in a complex series of interlocking bays creating a wide variety of marine and terrestrial habitats, including several listed on Annex I of the EU Habitats Directive: large shallow bay, lagoon, Atlantic salt-meadows, drift lines, perennial vegetation of stony banks, embryonic shifting dunes, marram dunes and dune slacks.

Within the shallow bay, subtidal sediments are characterised by typical bivalve communities in fine sand (*Chamelea striatula* and *Ensis* sp.), and by the polychaete worm *Euclymene* sp. and the bivalve *Thyasira flexuosa* in muddy sand. The intertidal sediment communities are characterised by polychaetes and bivalves in the mid-shore and by the sand mason worm *Lanice conchilega* in the low shore. In areas where there is maerl debris with small amounts of live maerl the infaunal community has a mixture of species characteristic of coarse sand (e.g. the bivalves *Timoclea ovata*, *Spisula* sp., and the polychaetes *Nephtys cirrosa* and *Glycera lapidum*) and medium sand (e.g., the bivalve *Ensis* sp. and the polychaetes *Lanice conchilega*, *Scoloplos armiger* and *Sthenelais boa*). The bivalves *Timoclea ovata*, *Tapes rhomboides* and the polychaetes *Branchiomma bombyx* and *Glycera lapidum* are typical of gravels and medium sands, whereas the bivalves *Abra alba*, *Corbula gibba*, *Thyasira flexuosa* and *Mysella bidentata* and the polychaete *Euclymene* are characteristic of muddy sands. Beds of live maerl of *Lithothamnion corallioides* are also present in a number of areas.

Around the edges of the inner part of the bay are shores of mixed boulders, cobbles, gravel with some sand and mud. They have a typical zonation of intertidal communities found on sheltered shores of mixed substratum. The shore at Murisk is unusual as a distinct zone characterised by archannelids occurs above the sandhopper zone in the upper shore under the boulders and cobbles. This is an unusual habitat. In sheltered areas of shallow water with little sand scour a well developed community of hydroids, sponges and solitary sea squirts are present. Where the sediments include gravel and mud the species richness in the area can be exceptionally high (180 species). A number of marine species that are rarely recorded are found in Clew Bay: the stalked jellyfish *Lucernariopsis cruxmelitensis*; the polychaetes *Anitides rosea*, *Clymenura clypeata*, *Pterosyllis formosa* and *Pionosyllis* sp. and the snail *Clypterea chinensis*.

Important examples of vegetated stony banks occur in a number of locations around Clew Bay. Several of the islands have fringes of shingle deposits and in places these support diverse vegetation. Characteristic species found in this habitat include: Thrift (*Armeria maritima*), Common Scurvygrass (*Cochlearia officinalis*), Sea Mayweed (*Matricaria maritima*) and Sea Campion (*Silene vulgaris* subsp. *maritima*).

Lough Furnace is located at the north-eastern corner of Clew Bay. The lough may be described as a natural saline lake or lagoon. Salinity levels can vary considerably here depending on rainfall and tides. The lake is one of the very few permanently stratified lakes known in Ireland and Britain. The lake is fringed by Common Reed (*Phragmites australis*) and Common Club-rush (*Scirpus lacustris*), with small patches of Great Fen-sedge (*Cladium mariscus*) and Bottle Sedge (*Carex rostrata*). Lough Furnace supports a relatively high faunal diversity including a number of important invertebrate species. The relict mysid species *Neomysis integer*, the isopods *Jaera albifrons*, *J. ischiosetosa* and *J. nordmanni*, and two rare amphipods (*Lembos longipes* and *Leptocheirus pilosus*) have all been recorded from the lake. Eel, Flounder and Mullet also occur in the lake waters. Mallard nest around the lough, while Saint's Island contains nesting Black-headed Gull.

Important populations of Otter and Common Seal are found in Clew Bay. Both of these species are listed on Annex II of the EU Habitats Directive. Common seals (*Phoca vitulina*) are the characteristic seal of sandflats and estuaries, but are also found on rocky shores in some areas. As pups swim almost immediately after birth, these seals can breed on sheltered tidal areas where banks allow access to deep water. Seals may range widely in search of prey, but individuals often return to favoured haul-out sites.

The juxtaposition within Clew Bay of a wide variety of habitats, including eight listed on Annex I of the EU Habitats Directive, and the combination of important flora and fauna, including one Red Data Book plant and two mammals listed on Annex II of the EU Habitats Directive, make this a site of considerable national and international importance.

Inner Clew Bay was originally designated as an Area of Scientific Interest in the early 1990's. In 1996/7, Inner Clew Bay was designated by NPWS as a proposed Natural Heritage Area (NHA); this is an area which is important to the conservation of wildlife and nature. In addition the inner Bay has been nominated by Dúchas, under the Habitats Directive 92/43/EEC, for inclusion in a list of proposed Special Areas of Conservation (SAC) (Appendix 1, Figure 1.12); for certain natural habitat sites and listed species of flora and fauna. SACs that contain habitats and species that are in danger of disappearance are given 'priority' status and are subject to a higher level of protection. Clew Bay is under an oyster fishery order that was granted to the Clew Bay Oyster Co-operative in 1979. Clew Bay (East of Old Head) is a designated shellfish water under Schedule 3 of the European Communities (Quality of Shellfish Waters) Regulations 2006 (S.I. No. 268 of 2006) and as such is monitored (both shellfish tissue and water quality) to ensure that the quality of edible species is maintained or enhanced. Data from this programme and from previous monitoring under the now revoked Quality of Shellfish Waters Regulations 1994 (S.I. No 200 of 1994) as amended, provides valuable background information on past contamination levels in the area.

Local authorities have a number of obligations under the European Communities (Quality of Shellfish Waters) Regulations 2006. Under Schedule 1 of the regulations, local authorities are 'prescribed public authorities' along with other public bodies such as the fisheries boards, the EPA and a number of government departments. The quality of shellfish waters regulations state that:

'The Minister shall, in consultation with the prescribed public authorities establish a programme of action in respect of each area of shellfish waters with a view to providing that, as far as reasonably practical, those waters comply with the Shellfish Regulations and these regulations. In particular, the objective of such a programme must be to take reasonably

practicable steps to reduce pollution in those waters with a view to meeting the standards specified in Schedule 4¹.

Also, the regulations state that ‘every public authority that has functions the performance of which may affect shellfish waters shall perform those functions in a manner that will, as far as practicable, promote compliance with the Shellfish Waters Directive and these regulations’.

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¹ Schedule 4 is the Shellfish Water Guide Values

2. METHODS

2.1 BACKGROUND AND RATIONALE

The literature review and field sampling programme was designed primarily as a descriptive study to provide baseline information on the existing ecological status of the area under investigation. This study will also accommodate the possible future development of studies that measure change or studies that improve system understanding (i.e. cause and effect). The exact spatial boundaries of the field study were selected in consultation with the client, broadly delineating an array of sampling points within the Newport Bay cSAC and pNHA areas (extending north to Lough Furnace) in addition to a control point (ST14/IT9, Appendix 1, Figure 1.1 and 1.2) located at a distance from any proposed discharge points where it is unlikely to be influenced by the development. Measurement parameters were chosen in consultation with the client to provide a baseline programme in line with relevant-legislative guidelines (including S.I. No. 268 of 2006: Quality of Shellfish Waters Regulations, SI 12/2001: Water Quality (Dangerous Substances) Regulations, 2001, 76/464/EEC Dangerous Substances Directive, 78/659/EEC Freshwater Fish Directive, SI 254/2001: Urban Waste Water Treatment Regulations, Water Framework Directive (2000/60/EC)) while addressing the requirements of An Bord Pleanála in addition to regarding specific concerns and issues expressed by the North Western Regional Fisheries Board, the Department of the Environment, Heritage and Local Government, the Environmental Protection Agency, the Clew Bay CLAMS Group (Bord Iascaigh Mhara, Marine Institute), Clew Bay Marine Forum and the Clew Bay Oyster Co-Operative Society Ltd.

An integrated assessment approach was employed. This approach merges biological (effects) and chemical (causes) using a combination of field evaluations. While the order of importance of biological versus chemical and physical monitoring can be debated, all provide important information as part of the integrated assessment of ecosystem health. A two-pronged study using chemistry and biology was implemented. Chemical measurements provided concentrations of specific contaminants that might be the cause of specific effects or modifiers of them. Biological assessment involved field measurements of aquatic ecology.

The following ecological elements and parameters were examined:

- Marine littoral flora and fauna
- Marine sublittoral flora and fauna
- Fish species
- Otters and harbour seals
- Freshwater flora and fauna
- Sediment quality
- Water quality
- Tissue contaminant analysis

The field sampling programme gives a once off ‘snapshot’ of the parameters under study. This ‘snapshot’ was, where possible, supplemented by literature reviews to give a wider view of the state of the receiving environment.

2.2 MARINE INVERTEBRATE FAUNA AND FLORA SAMPLING STRATEGY

In general, all methods for intertidal and subtidal marine monitoring followed standard methods as outlined by the JNCC (Davies *et al.*, 2001). Species nomenclature for marine organisms followed Howson and Picton (1997). The marine invertebrate flora and fauna in the area under investigation were surveyed in order to identify the distribution of any species or habitats of conservation importance and to provide baseline data that could be used to detect any spatial or temporal change in the biota, in addition to that due to natural variability, over time as a result of the proposed development. A voucher collection of marine specimens was retained for future reference.

Marine littoral floral and fauna

Littoral sampling was conducted on the 15th – 17th September 2004 and 9 November 2004. The littoral habitats, fauna and flora (biotopes) at the proposed WWTP storm water outfall, the final effluent point and the alternative outfall location were examined in order to establish the habitats, communities and species present (Appendix 1, Figure 1.1). The biotopes along the shore were mapped in accordance with the procedures detailed by Davies *et al.* (2001) and Emblow *et al.* (1998). Surveyors walked along the shore in order to identify and map the extent and distribution of biotopes. Biotope identification was carried out in the field and species lists for each biotope were compiled. Biotopes and species lists were then compared to existing data and interpreted using the biotope classification (Connor *et al.* 1997a). A voucher collection of representative specimens was made. Different survey methods were applied to the rocky and sediment biotopes as outlined below due to the different substrata.

Rock and mixed biotopes

The hard substrata within the survey area were examined following procedures detailed by Davies *et al.* (2001) and Emblow *et al.* (1998). Surveyors walked along the rocky areas in order to identify the habitat, flora and fauna (biotopes) present on the rocks. Biotope identification was carried out in the field and species lists for each biotope were compiled (Appendix 2, Tables 2.1 – 2.7). Relative abundance of species was also recorded following the six point abundance scale in Hiscock (1996). Biotopes and species lists were then compared to existing data and interpreted using the biotope classification (Connor *et al.* 1997a). Fauna that could not be identified in the field were preserved in 70% Industrial Methylated Spirits (IMS) and transported back to the laboratory for identification. Algae that could not be identified in the field was pressed while fresh and returned to the laboratory for identification.

Sediment biotopes

Sediment biotopes were surveyed by taking cores down transects on the shore to identify any infauna living within the sediment (Appendix 1, Figures 1.3 - 1.9; Appendix 2, Tables 2.1 - 2.7, Appendix 11, Plates 11.23). Where possible three samples were taken along each transect, coinciding with upper, mid and lower shore. Four replicate samples were taken at each site, using a 10.5 cm diameter core to a depth of 20 cm. The samples were combined and passed through a 1 mm mesh sieve. Species were preserved in 70% IMS and returned to the laboratory for identification and counting. Species lists were compiled for each site (Appendix 2, Tables 2.1 – 2.7). Species were identified to the lowest taxonomic level possible. Biotopes were then assigned to each site using the biotope classification (Connor *et al.*, 1997) (Appendix 10). A voucher collection of all specimens was retained. Epifauna within a 1 m² area at each station were recorded if present.

Photographs were taken to illustrate the sites and biotopes present (Appendix 11, Plates 11.1 to 11.24).

Mapping

The intertidal biotope mapping was based on aerial photographs and Ordnance Survey maps to map the distribution and extent of Marine Nature Conservation Review (MNCR) biotopes (Connor *et al.*, 1997). The surveyors mapped the biotopes directly onto the maps in the field. Additional information of interest was recorded and site details were recorded in order to place biotope and life form information in the context of larger scale physiographic features. Mapped data was entered on to a MapInfo GIS (Appendix 1, Figures 1.3 to 1.9).

Marine sublittoral flora and fauna

Fourteen subtidal sites (Appendix 1, Figure 1.2) were surveyed between the 18th and 20th October 2004 in the Clew Bay area. Key sites located around the proposed discharge locations (wastewater and storm water) and control sites free from any influences of the proposed development were selected for baseline survey to evaluate natural diversity and variability pre-development. Replicate samples were taken at each site in order to quantitatively survey the area. The JNCC Marine Monitoring Handbook (2001) recommends that at each site, a minimum of 5 replicate samples should be collected when employing a van Veen grab. However, due to the relatively ubiquitous substratum recorded in the area, it was decided that 4 replicates at each site would be sufficient, amounting to a total of 56 samples. These samples were worked up individually and not pooled.

Sublittoral invertebrate fauna were surveyed by boat using a 0.1 m² van Veen grab fitted with weights (Appendix 12, Plate 12.1). Samples from the van Veen grab were approved or rejected appropriately. Each sample was rejected if it did not contain the upper layer of sediment and an appropriate volume or bite depth. Samples where the grab did not close properly and the draining water had damaged the sediment surface were also discarded. Grab samples were passed through a 1 mm mesh sieve using a seawater hose to wash through the samples but pressure was kept low and out of direct contact with the sample material to minimise damage to the animals. Fragile animals were carefully washed or picked out of the sample during sieving to prevent damage. Large objects such as stones and shells were washed and discarded if no flora and fauna were present. Digital photographs were taken of all pre-sieved samples (Appendix 12, Plates 12.2 – 12.15).

The material collected was preserved in 70% Industrial Methylated Spirits (IMS) and returned to the laboratory for identification and counting. The sample material was sorted and all fauna extracted from the residue. Fauna were sorted into the main taxonomic groups and placed in separate sample vials with identification labels. Large specimens were kept in separate vials/jars. Notes on the substratum type were recorded where possible. Species were identified to the lowest taxonomic level possible. Specimens were identified using the following literature, Tebble (1976) for bivalves, Makings (1977) for mysid crustaceans, Crothers and Crothers (1988) for crabs, Smaldon (1993) for shrimps and prawns, Graham (1988) and Picton and Morrow (1994) for marine molluscs, Picton (1993) for echinoderms and Hayward and Ryland (1995) for other fauna. All specimens were retained.

Sites were approximately located along transects away from the proposed outfall locations to provide a baseline assessment available for use in ecological impact gradient studies of the proposed discharges in the future. The survey provides an assessment of the sublittoral marine fauna, flora and habitats present paying particular attention to species of commercial and nature conservation value. The results were compared to existing data and interpreted using the biotope classification (Connor, *et al.* 1997b).

Biotopes

A biotope is a term that describes the physical 'habitat' of an area with its biological 'community'. Using the list of species recorded from each site and information on the habitat type (from the field survey results and Admiralty charts) each site was allocated a biotope type following Connor *et al.* (1997b) (Appendix 10). Allocations were made by careful examination of the biotope descriptions from Connor *et al.* (1997b) and applying the principal of best fit to each site. In some cases it was not possible to allocate a biotope to a particular site due to the lack of species.

2.3 FRESHWATER INVERTEBRATE FAUNA AND FLORA SAMPLING STRATEGY

One freshwater site (upstream of tidal influence) was sampled in order to provide reference riverine biological water quality conditions. Due to the high levels of rain fall in October 2004, it was not suitable to sample during that period. As such, sampling was conducted on November 8th 2004 using multihabitat 'kick' sampling techniques for approximately 3 minutes in the faster flowing (riffle and rapid) areas of the watercourse where possible, using a standard hand net (250 mm width, mesh size 1 mm). Macroinvertebrates collected from the sample were preserved in 70% IMS and returned to the laboratory for identification and counting. A variety of physical data were recorded at each sampling site including, substratum type, channel width and channel depth (Appendix 5, Table 5.2). Specimens were identified using the following literature, Elliott *et al.* (1988) for Ephemeroptera, Macan (1977) for Gastropoda, Wallace *et al.* (1990) for cased caddis, Edington and Hildrew (1981) for caseless caddis larvae, Friday, (1986) for adult water beetles, and for general reference to other assorted fauna, Fitter and Manuel (1986), Croft (1986), and Nilsson (1996). Kick sampling was implemented to provide a list of freshwater macroinvertebrate species (highlighting the presence of species of conservation importance), and calculation of a Q-index of biological water quality in accordance with standard EPA methods (McGarrigle *et al.*, 2002).

Q-indices

The Environmental Protection Agency (EPA) has developed a biological quality ratings index (Q-values) that rates river quality on the relative abundance of macroinvertebrates that have different sensitivities to organic pollutants (McGarrigle *et al.*, 2002). The indicator groups of sensitivity to pollution are A (sensitive), B (less sensitive), C (tolerant), D (very tolerant) and E (most tolerant). The Q-values derived from this method give an indication of water quality status, with a value of Q5 representing pristine, unpolluted conditions whereas Q1 represents grossly polluted conditions (Appendix 5, Table 5.3). A Q-value was assigned to each site where possible based on the EPA methods (McGarrigle *et al.*, 2002). The Q-index scheme should be based on fauna and other observations from riffles and areas of eroding substrata ideally during late summer months when environmental stressors exert maximum pressure on river systems.

Aquatic macrophytes

The river channel and riparian zone was visually surveyed for aquatic macrophytes at the freshwater survey sites.

Physico-chemical characteristics of water

Parameters of water quality measured in the field at both sites were as follows:

- Temperature (°C)

- Conductivity ($\mu\text{S}/\text{cm}$)
- Oxygen (mg/l) (%sat)
- pH (pH units)

Freshwater pearl mussel (Margaritifera margaritifera) survey

A pearl mussel (*Margaritifera margaritifera*) survey was conducted at the freshwater site involving examination of the riverbed using a bathyscope (glass bottomed bucket). An area of approximately 50m^2 was surveyed in all. Presence of dead shells, river bed substratum type, proximity to river bank, adjacent land use, other species present, presence of macrophytes or filamentous algae and possible pollution sources was noted. It was not possible to survey using a pair of snorkellers because of the shallow depth of water in this river reach. Two surveyors examined the river bottom for mussels using a bathyscope. A third worker on the bank drew sketch maps of the river and surrounding areas and was in a position to mark in the location of live mussels, their numbers and positions if encountered. Survey work was carried out as much as possible during periods of clear sunshine which enhanced underwater visibility. A specially designed recording form was used to standardise the recording of data in the field. A variety of data was recorded during each survey including section name, national grid references, surveyor's names, date of survey, live mussel numbers, duration of survey and water and air temperature. Other factors such as river level, visibility, cloud cover, sunshine and rainfall were recorded. Visibility was determined as an estimate of the maximum depth at which the river bed could be viewed clearly at. Photographs were taken at the site.

2.4 VERTEBRATE SAMPLING STRATEGY

Fish species survey

A literature review was undertaken to identify fish species that utilise the estuarine habitats in the vicinity of the proposed development and that may be impacted by the current proposal. Staff from the Marine Institute facility in Furnace were particularly helpful in relation to our literature review on fisheries and more generally in relation to the aquatic ecology of the area under investigation. A covering letter and selection of relevant publications were submitted to EcoServe by Dr. Russell Poole and are included in the correspondence section – Appendix 16. A profile of estuarine fish populations as recorded by the Marine Institute during 2004 surveys in the Newport Bay area is presented in Appendix 16, Document 31. The sensitive nature of fish populations in the area (in particular the potential presence of the Atlantic salmon, a species listed on Annex II of the EU Habitats Directive), the inherently destructive nature of fish sampling, and the existence of a well established baseline dataset for fish populations both in the estuary and upstream in freshwater habitats deemed an extensive baseline survey of fish populations in the area unnecessary in this instance.

A limited fish survey was implemented at low water slack tide at the shoreline adjacent to the proposed preferred discharge point to provide a snapshot of fish populations in the area. Juvenile fish and other mobile species were sampled by sweeping through the water column, covering an area from surface to bottom using a beach seine net. Seining commenced as soon as the flow permitted, just before slack water. As many sweeps as possible were then conducted in the general vicinity of the site centre. The range sampled was approximately 50m linear distance along the shoreline. There was sufficient time to conduct two sweeps in all. Fish caught in the area were identified, counted, measured and released.

The European otter (Lutra lutra) survey

The current study aimed to record presence of otter species in the vicinity of proposed development by searching for evidence of otter activity (spraints, footprints and dens) in the area. Otters frequently deposit spraint under or near bridges, where footprints are also frequently found. Preliminary survey planning involved the identification of potential sprainting sites from Ordnance Survey 1:50,000 maps of the Newport area. It was decided to implement a walkover survey of the site in general with particular focus in the vicinity of the proposed primary discharge point, the proposed alternative discharge point, the proposed storm water outfall location and in the vicinity of bridges and other structures identified from the preliminary survey planning stage. Survey format followed protocols described in Conserving Natura 2000 Rivers – Monitoring series No. 10.

At each potential sprainting site (as identified from preliminary survey planning) and at shore areas in the survey zones, the immediate vicinity of the shore, bridge or structure was searched for potential spraint sites (dry bridge arches, rocks, ledges, tree roots and stumps, etc.) and places where otter footprints might be recorded (mud and sand banks - which are also sometimes used as spraint sites).

Harbour seal (Phoca vitulina)

Harbour (also known as common) seal populations go through a generalised annual cycle which includes a summer breeding season followed by an annual moult. The moult season is a protracted period when a large proportion of seals can be found ashore for several weeks, generally from late July through August. Consultation between organisations participating in the 'Harbour Seal population assessment in the Republic of Ireland, 2003', determined this period as the most appropriate for counting animals across a range of habitats however project timeline constraints meant that the current study was implemented during September, October and November, 2004. The pattern of harbour seal haul out is known to be influenced by several variables including state of tide, time of low tide, wind speeds and direction etc. In general the number of harbour seals ashore at a haul out appears to reach a maximum within two hours of low tides occurring in the afternoon (Thompson *et al.*, 1997) and as such surveys were planned to coincide with low tidal conditions.

A small boat survey was undertaken within the study area on September 15th, 16th and October 19th, 2004 with additional observations in early November 2004. Shoreline areas and intertidal rocky outcrops were investigated once within two hours of low tide on each day when haul outs were most likely to be in use. Seals were observed and counted on each occasion using high powered binoculars. Seal number and GPS locations were recorded on a survey sheet and results are presented in Appendix 6, Table 6.2 and Appendix 1, Figure 1.11). The field study was supplemented by a literature review of seal populations in Clew Bay.

2.5 CHEMICAL AND BIOACCUMULATION SAMPLING STRATEGY AND ANALYSIS

A baseline survey was implemented to investigate levels of chemical contaminants and the current pollutant status of the seawater, sediment and living tissue of marine algae and shellfish. Particular attention was paid to toxicants mentioned in the 'European Communities (Quality of Shellfish Water Regulations) 2006' (SI 200/1994), Water Quality (Dangerous Substances) Regulations 2001 (SI 12/2001 and EU Directive 79/923/EEC), the Water Framework Directive (2000/60/EC) and in Irish water quality legislation in general. A large list of potential toxicants are described under the broad headings: metals and metalloids; non-metallic inorganics; organic alcohols; chlorinated alkanes; chlorinated alkenes; anilines; aromatic hydrocarbons (e.g. polychlorinated biphenols and dioxins); phenols and xylenols;

organic sulphur compounds; phthalates; miscellaneous industrial chemicals; organochlorine pesticides (e.g. DDT); organophosphorous pesticides; Carbamate and other miscellaneous pesticides; pyrethroids; and herbicides and fungicides.

Many metals and metalloids are essential to life (e.g. copper, zinc and chromium etc). However they become toxicants when they are present at higher concentrations. Some toxicants are synthetic compounds that do not exist naturally in the environment. Many of these substances have been banned (e.g. DDT, chlordane and dieldrin). Others continue to be produced, or are generated unintentionally as by-products of common industry or urban treatments. In the immediate areas of high concentration, toxic contaminants in water or sediment can kill marine life (e.g. fish and invertebrates). Other acute effects may include changes in the abundance, composition and diversity of biological communities and habitats. Some toxicants persist in the environment and may progressively accumulate in sediments or in biological tissues (bioaccumulation) to levels that are much higher than water column concentrations. Chronic effects of bioaccumulated toxicants in organisms include alterations of growth, reproductive success, competitive abilities and deformities such as imposex and intersex. Elevated toxicant concentrations in organisms (e.g. fish and shellfish) may also pose health risks to consumers of those organisms (including humans).

Sampling programme

Fourteen samples of estuarine or marine sediment and water were taken at the subtidal macrofauna sampling sites (Appendix 1, Figure 1.2). Water samples were collected at a standard mid water depth at all sites while temperature (°C), salinity (psu), oxygen (mg/l) and (% saturation) were recorded *in situ* at the surface, mid-water and one metre above the bottom at all sites. Sample sites formed a baseline grid or matrix which provided reference data for conditions throughout the system on one occasion at pre-development. It should be stressed that seawater monitoring provides a 'snap-shot' of environmental quality that depends on tidal movements, inputs and rate of removal. Increasing the number of sample sites and replicates provides a better picture of environmental quality but is not always practicable.

Sediment samples were taken by boat using a 0.1 m² van Veen grab. Incomplete samples where sediment surface integrity was compromised were rejected at all sites in an effort to standardise the source and integrity of sediment for analysis. Samples were removed for analysis from the top 2-3cm of sediment using a stainless steel spoon. Sediment samples were stored in a cool environment (4-6 °C) until analysis was undertaken.

Water samples were collected using a Fieldmaster™ perspex water sampler (9 cm in diameter and 41 cm in length). The sampler enabled water to be collected at specific depths and brought to the surface without contamination from the surrounding shallower water. Temperature and salinity were recorded immediately before equilibrium with the surrounding air temperature was reached using a WTW (Wissenschaftlich-Technische Workstätten) LF 330/SET meter.

Analyses

At four locations (Appendix 1, Figure 1.2 - sites ST2, ST5, ST12, and ST14) water and sediment was analysed for an extensive suite of parameters (listed in Appendix 17, Table 17.1) to provide an extended dataset from these key locations in the sample area. The remaining 10 sites (Appendix 1, Figure 1.2) were subjected to a reduced suite of analyses. The samples were analysed by City Analysts in Dublin who are an accredited laboratory (ILAB) by the National Accreditation Board (NAB). Analyses methods and limits of

detection (LOD) for individual analyses are presented in Appendix 17, Table 17.1. *In situ* measurements of temperature, salinity and dissolved oxygen were again made.

Biological contamination study

Biota ingest and absorb contaminants from their surroundings. Contaminants that cannot be excreted remain in the body and are accumulated. Body burdens of contaminants, which are accumulated over time, integrate fluctuations in contaminant concentrations in overlying waters. Sampling of common intertidal mussels *Mytilus edulis* (plus native flat oysters, *O. edulis* from the beds at Rosgibbileen and Ardagh, Appendix 1, Figure 1.1) and the seaweed *Fucus vesiculosus* were undertaken and live tissues were analysed for possible contaminants. Metal uptake is influenced by mussel age, size, sex and shore position, water temperature, pH, salinity, and ability to absorb or excrete the contaminant (Miller, 1986). The sampling protocol was designed to limit variation in these parameters. It is important to note that contaminant levels can change on a seasonal basis in living tissues, for example spawning can influence contaminant concentrations, and thus the current study provides a reflection of contaminant levels in biota at a certain seasonal stage which can be replicated during future monitoring. The organisms used here are routinely used as indicators of heavy metal contamination in national and international monitoring programmes. They are also widespread, easy to identify and collect, and standard procedures for analysis are readily available.

Site selection

Ten sites were selected to provide an overview of the environmental status of the Newport Channel and Bay area (Appendix 1, Figure 1.1). The use of a reference site away from any likely impact of the pipeline discharge allows for natural fluctuations to be determined. Samples were collected from four shore sites around the proposed discharges (one upstream and one downstream in the immediate vicinity of the proposed storm water discharge, one towards the end of the Rosmore peninsula to assess existing contamination from local development in that area, three sites in the vicinity of the proposed primary effluent discharge point to provide adequate baseline data for this area, in accordance with best practice and to NW Regional Fisheries Board requirements, one in the vicinity of the proposed alternative discharge point and one in the Burrishoole/Lough Furnace system. One control site (ST14) was located to the south west of Newport on the open coast to act as baseline reference (outside the possible influence of the proposed discharges). Sample site locations are shown in Appendix 1, Figure 1.1. Again four of these sites corresponding to sites adjacent to ST2, ST5, ST12, and ST14 (Appendix 1, Figure 1.2) discussed previously were subjected to the extended suite of analyses to provide extended reference data. The remaining six were subject to a reduced suite of analyses.

For practical sampling reasons (sample availability, tidal access logistics), mussels (*Mytilus edulis*) were the primary species used for the shellfish toxicant baseline study. However, in order to provide baseline data for the commercially exploited native flat oyster populations in the area and in light of comments from the North Western Regional Fisheries Board the collection of baseline toxicant data from two oyster growing locations (oyster beds at Ardagh, Rosgibbileen) was also carried out.

Chemical analyses were undertaken City Analysts, Dublin, who are ILAB (International Laboratory Accreditation Board) accredited.

2.6 INDICATORS OF CHEMICAL QUALITY

Three main chemical quality indicators are available in determining the status of waters, sediment and tissue to contamination.

Concentrations of hazardous substances compared to Environmental Quality Standard

Environmental Quality Standards (EQS) are concentrations below which a substance is not believed to be detrimental to aquatic life. These were originally developed for the EC Dangerous Substances Directive (76/464/EEC). The concept is now well established and is incorporated into the Water Framework Directive (2000/60/EC). EQS are derived using acute toxicity tests on organisms at different trophic levels. To provide a safety factor, the EQS is set substantially below the concentration observed to have a toxic effect on the test organisms. EQS vary for each substance and can be different for fresh, estuarine or coastal waters. EQS for the most toxic substances (List I EC Dangerous Substances Directive or Annex I substances in the EC Water Framework Directive) are set at a European level. The EQS for less toxic substances are set nationally.

EQS for water have been used in this report, however it should be noted that these are currently under review, for 33 substances, under the Water Framework Directive. EQS have not yet been developed for sediments and biota where the 'EQS' is simply a standstill clause (i.e. no upward trends in concentrations).

Concentrations of hazardous substances compared to Background Reference Concentrations
Background Reference Concentrations (BRC) were adopted by OSPAR in 1997 for contaminants in seawater, sediment and biota as assessment tools for use in Quality Status Reports (OSPAR 2004). BRC were developed by examining typical concentrations of both naturally occurring and man-made contaminants in remote parts of the OSPAR maritime area. In general, man-made substances are expected to have a background concentration of zero. However, due to their persistence and long-range transport, many substances are detected in remote areas. For naturally occurring substances, the BRC is the range of concentrations that would be anticipated in the absence of any human activity.

Concentrations of hazardous substances compared to Ecotoxicological Assessment Criteria
Ecotoxicological Assessment Criteria (EAC) were also adopted by OSPAR in 1997. EAC are the concentrations of substances above which there may be impacts on biota. They are used to identify potential areas of concern and to prioritise substances for attention. The concepts behind EAC and EQS are similar, however EAC exist for a number of substances in sediments and biota. As with BRC, assessments made against current EAC should be treated with extreme caution. Concentrations of a contaminant below the EAC for that contaminant do not guarantee a safe situation. On the other hand it is not compelling that biological effects occur where an EAC is exceeded. This can only be established through biological investigations in the field. Current EAC are being reviewed along with BRC. It seems likely that existing EAC will no longer be endorsed, being replaced by new criteria developed using the improved methodologies now available for effects assessment.

In 2004, OSPAR held a workshop on BRC and EAC and are now in the process of developing new values for both datasets. The definition of EAC is changed from Ecotoxicological Assessment Criteria to Environmental Assessment Criteria. This change reflects the primary role of EAC as tools for the assessment of environmental data and the need for integrated assessment of chemical and biological effects data. The derivation of EAC has also been thoroughly reviewed and brought more into line with the approach taken for the

derivation of Quality Standards (QS) for the Water Framework Directive. Although EAC are not equal to QS in the Water Framework Directive, EAC are redefined to relate to them. The old range of EAC is no longer endorsed, but replaced by Lower-EAC and Upper-EAC values that have defined ecotoxicological meaning. Although two new EAC values are proposed at a lower and an upper level, it is important to recognise that these are in most cases independently derived and more robust than the previous values.

- The lower EAC value is a concentration derived for protection of all marine species from chronic effects, including the most sensitive species.
- The upper EAC is defined as the highest (transient) concentration that is expected not to cause acute toxic effects.

Interpretation of environmental assessment data will be made easier using the new values once developed, through the derivation of a “traffic light” system to allow contaminant concentrations to be used to assess the state of the environment:

- Below the lower-EAC value, measured contaminant concentration should not give rise to any biological effects. No immediate management action would be required; monitoring frequency could be stopped or reduced.
- Between the lower and the upper EAC value, biological effects are possible (e.g. as indicated by biomarker response, impaired growth, reproduction). Management actions could identify reason for elevated level(s), use expert judgement to assess significance, check trends and variability or introduce additional monitoring. This could eventually lead to resource or emission management.
- Above the upper-EAC, long-term biological effects are likely (e.g. impaired growth, reproduction and survival), and acute biological effects (survival) are possible. Appropriate management actions could verify findings (additional analysis), identify reason(s) for elevated level(s), consider the re-designing of the monitoring strategy for specific elevated contaminants and consider resource or emission management issues.

In the absence of new values, OSPAR values quoted in this report are those available at the time of writing (primarily those quoted in Mon, 1998 quoted in OSPAR, 2004).

OSPAR states clearly that although a useful guide, the EAC system is subject to several limitations. Caution should be exercised in using generic, particularly provisional, assessment criteria in specific situations. The use of EACs does not preclude the use of common sense and expert judgement with regard to the natural concentrations of e.g. trace metals in assessing the (potential for) environmental effects. Furthermore, the ecotoxicological assessment criteria do not take into account specific long term biological effects such as carcinogenicity, genotoxicity and reproductive disruption due to hormone balance disturbances and do not include combination toxicity. The effects of environmental contamination will ultimately have to be assessed in biological terms.

It should be noted that in general discussions of chemical analysis the ‘limit of detection’ of a certain analysis, i.e. the lowest level to which the analysis can confidently determine a result is referred to as the ‘LOD’.