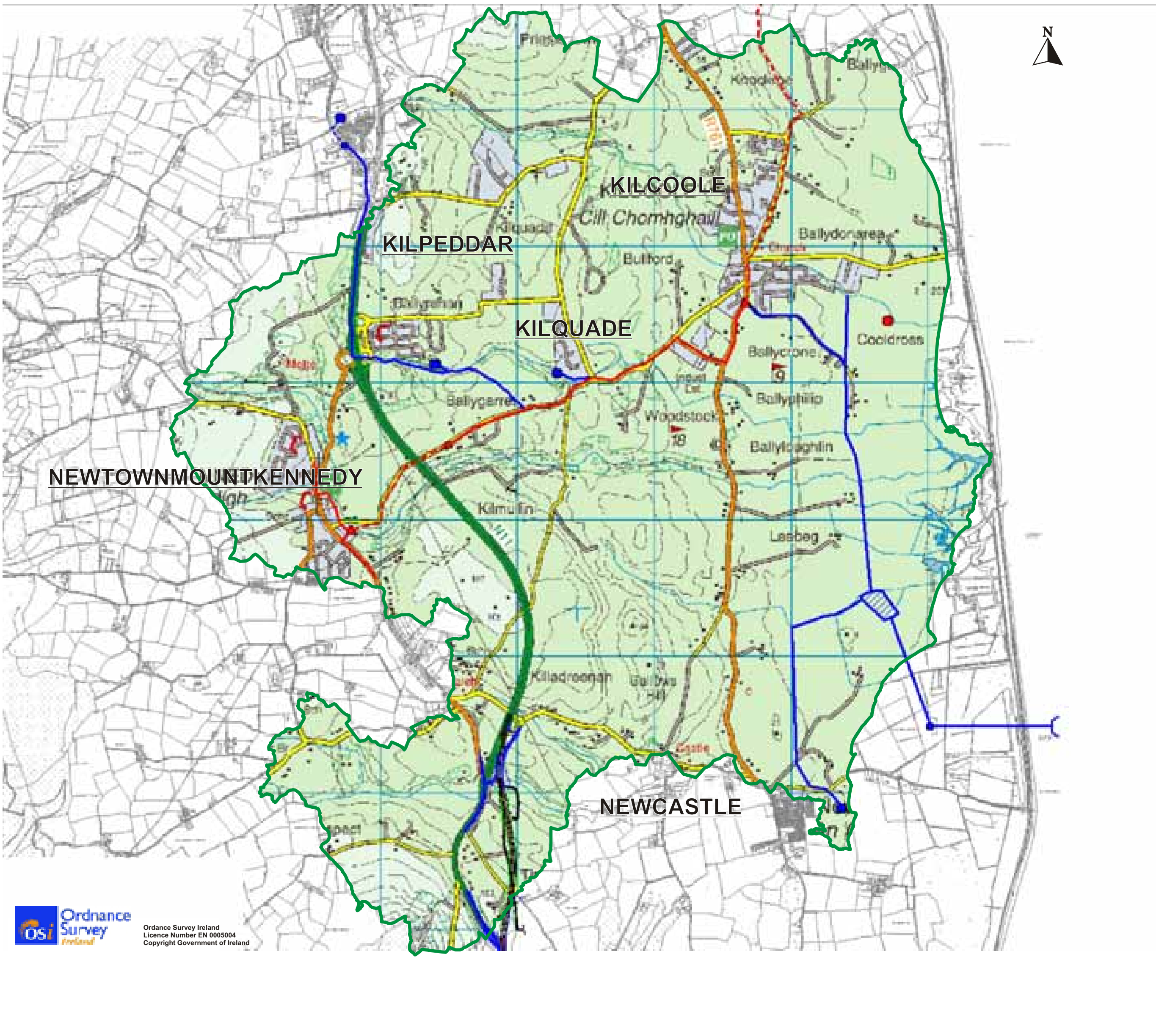
Wicklow County Council

Comhairle Chontae Chill Mhantáin

Newtownmountkennedy & Kilcoole Regional Sewerage Scheme



Preliminary Report - 2004

September 2004

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TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

1 EXECUTIVE SUMMARY

A Preliminary Report on the long term development of a Sewerage Scheme to serve Newtownmountkennedy, Kilcoole and other settlements in the regional area was prepared by MCOS for Wicklow County Council in April, 1999. The report identified a number of criteria as a basis for the sewerage strategy for the area. These criteria have been updated and reproduced below:

- Current sewerage facilities are totally unsatisfactory at Kilcoole, Kilpedder and marginally satisfactory at Newcastle.
- The available receiving waters comprise of a local stream network which drains to Kilcoole marsh. These streams have very low flows and provide extremely limited capacity for accommodating wastewater effluents. Therefore local treatment, based on normal process technologies, is an inappropriate solution. The existing package treatment works should be decommissioned and diverted into the public sewerage system.
- The Kilcoole marshes are subject to inter-tidal conditions and are designated as a Special Protection Area and proposed Natural Heritage Area. Shoreline drift occasionally cuts off the tidal outlet resulting in a temporary freshwater lake.
- The marine waters off the coast are used as recreational use waters as well as important seed mussel and whelk fisheries.
- Greystones Waste water Treatment Plant has a current treatment capacity of 30,000 PE (sludge capacity 27,000) and is capable of being upgraded to 40,000 PE relatively easily. Given that the current load is in the order of 13,000 PE, pumping of the Newtownmountkennedy/Kilcoole sewage to Greystones (approximately 4,500 P.E.) is a satisfactory short term option only.

As an Interim solution, the 1999 Preliminary Report recommended the transfer of flows from Newtownmountkennedy and Kilcoole to Greystones in the short term. This has now been constructed and has been in operation as of January 2003, however this connection will be decommissioned under the long term scheme.

The long term scheme recommended for the catchment is a central collection system with secondary waste water treatment for 22,500 P.E. at Leamore and outfall to the Irish Sea. This plant will have the capacity to be upgraded to 45,000 P.E. ultimately.

The total capital cost for the Scheme is estimated at **€ 15,671,903** (including VAT). The non-domestic marginal cost of the scheme has been calculated to be 15% of the capital cost using the Customised Method. It is recommended that a Design, Build and Operate contract would be the most appropriate procurement route for the treatment plant.

This scheme will become necessary when the capacity at Greystones WWTW can no longer cater for the Greystones/Delgany catchment plus the diverted catchment from Newtownmountkennedy and Kilcoole. It is estimated that the sludge treatment capacity of the Greystones plant will be reached in 2006 and the transfer pipeline from Kilcoole to Greystones will reach capacity in 2007.

With the separation of the Newtownmountkennedy/Kilcoole and Greystones/Delgany catchments, which will occur once the Leamore WWTW has been commissioned, Greystones WWTW can be dedicated to serve the Greystones/Delgany catchment solely. It is recommended that this occurs in 2007, if so it is estimated that Greystones WWTW (27,000 P.E.) will reach its existing capacity at around 2018 and provide up to 40,000 P.E. (with modular expansion) if needed in the long term. It is estimated that further expansion for the Leamore WWTW to 45,000 P.E. will be required around 2021.

2 BACKGROUND

2.1 PREVIOUS STUDIES AND REPORTS

M.C. O'Sullivan & Co Ltd were first commissioned to study the sewerage needs of Newtownmountkennedy in 1980 and submitted a Preliminary Report in May 1981 which concluded as follows:-

- The Main Street sewer (225mm) and many of its branches are overloaded and subject to surcharge
- The 150mm rising main from Killadreenan pumping station is encrusted and inadequate
- The existing (and now defunct) treatment works (inlet chamber, settlement tank, biological filters) was designed for 400 persons, is totally overloaded and incapable of repair/expansion
- A new treatment plant for 6,000 p.e. was proposed downstream of the town.

In November, 1984, a supplementary report was submitted dealing with a Stage 2 Scheme to cover extension to Garden Village, Ballygarrett, Kilquade and Ballyronan. This took account of Planning Permissions for 375 houses in Ballygarrett and 527 houses in Newtown Demesne (Garden Village). A further 110 houses were planned at Kilquade. This study also recommended the inclusion of Kilpedder in the scheme with a design population of 1200. The options for the treatment plant were locally downstream of Newtownmountkennedy or for preliminary treatment at Kilcoole, with marine outfall.

In April, 1985, a detailed Flood and Pollution Study was submitted, which dealt with water quality in the receiving waters, stormwater accommodation from new development and the options for a regional solution to the sewerage problems based on combining Newtownmountkennedy/Kilpedder with Kilcoole and Newcastle. The principal recommendations of the study were:-

- Stormwater flows from the urbanised catchments were evaluated, stream flows derived and channelised works recommended to accommodate them
- Pollution studies indicated unsatisfactory conditions in the 4 rivers in the area. The study recommended that effluent discharge with full secondary treatment could be accommodated by Kilcoole Marsh
- Fennelon's Abattoir discharges to a private treatment works which on occasion fails to handle the load, resulting in pollution of a stream
- The options of individual local or central regional treatment works were evaluated. A central treatment plant at Kilcoole Marsh or marine outfall to the Irish Sea were regarded as the best options for dealing with the sewage load.

In 1993, detailed hydrographic surveys, land and marine borehole investigations, dye/drogue dispersion surveys and modelling studies were carried out by Irish Hydrodata Ltd., for the proposed treatment works and outfall at Kilcoole Marsh. These studies provide the basis for technical and environmental evaluation of the options subsequently considered in the 1999 Report.

In 1999, a Preliminary Report and EIS were prepared by MCOS and submitted for approval which made the following recommendations:

- Provision of a new sewerage network to collect all foul flows to a treatment plant sited at Leamore. Local sewers and a pumping station to be constructed at Newtownmountkennedy to transfer flows to Kilcoole, and intercept Kilpedder, Garden Village and Kilquade, and to include a sewer to transfer Newcastle to Leamore

- Implementation of a treatment plant at Leamore to discharge through a 600mm marine outfall to the Irish Sea (1000m long). The plant capacity would be initially for 15,000PE as a minimum and by 2005 the plant would provide minimum secondary treatment capacity for 22,500 PE, with the facility to duplicate in the long term.

- Implementation of an interim scheme to transfer an existing sewerage load in the order of 5,000 – 6,000 PE from the whole of Newtownmountkennedy and the western area of Kilcoole to Greystones WWTW, and to facilitate new development in the order of 5,000 -7,000PE with additional development over time to include Garden Viillage, Kilquade etc

Since 1999, the interim scheme has been implemented and commissioned (January 2003) and currently transfers flows in the order of 3,200PE to Greystones WWTW.

2.2 CURRENT STUDY

This report reviews the 1999 Preliminary Report having regard to the following publications which are relevant to the study area:-

(i) 1999 County Development Plan
(ii) Census 2002 data
(iii) Strategic Planning Guidelines
(iv) Wicklow County Council Housing Strategy 2001 - 2005
(v) Local Area Plans for Newtownmountkennedy and Kilcoole
(vi) Greystones/Delgany Development Plan
(vii) Planning Permissions granted and awaiting decision
(viii) Metered water data

In addition, this report updates the cost estimates, provides a water charging policy, a procurement strategy and recommendations for meeting the sewerage needs of the area.

3 EXISTING SITUATION

3.1 GENERAL

This study concerns the provision of upgraded sewerage facilities for the communities of Newtownmountkennedy and Kilcoole in County Wicklow. Apart from these two villages, two other residential developments (Garden Village and Kilquade Hill) are served by private package treatment plants and would be intercepted. At the same time, the villages of Kilpedder, to the north of Newtownmountkennedy and Newcastle, to the south of Kilcoole, are also considered to be included in the future **(Fig. 3.1)**.

The catchment containing these dispersed communities is drained by four small rivers, denoted A, B, C, D. These streams are characterised by very low summer flows, making them relatively unsuitable for effluent disposal. Furthermore, all four discharge to the Kilcoole inter-tidal marshes and from there, under the railway line at "The Breaches," to the sea. Effluent discharge to the streams, therefore, results in the risk of pollution to the inter-tidal waters at the marshes and possible bacterial contamination of the marine bathing and recreational waters.

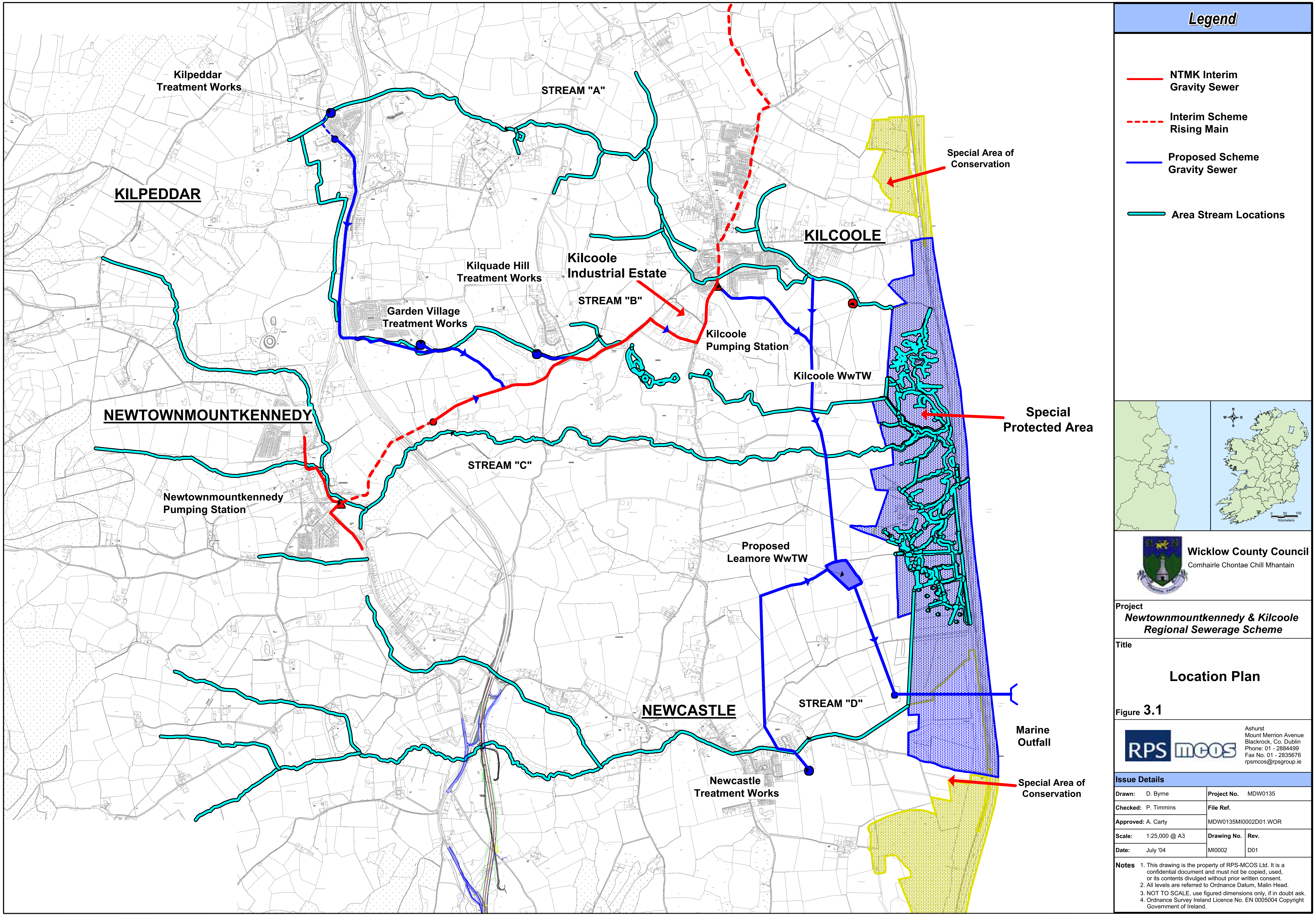
3.2 EXISTING ENVIRONMENT

The area under study borders on the Irish Sea east coast. The shoreline is separated from the land area by the Dublin-Wexford railway line. The beach area is an important amenity and conservation area with a narrow strip of sand dunes, a rich dunes ecology and, in particular, a habit for protected "Little Tern" populations, which reside there in season.

The four small rivers draining the catchment area, **(Fig. 3.2)** are characterised as follows:-

- **Stream A** is the most northerly stream which drains the Kilpedder and Kilcoole areas. This receives the treated effluent discharge from the Kilpedder package type treatment works, immediately west of the N11, and also receives the discharge from the Kilcoole treatment works to the east of the town. Because of the low base flows in the stream, it is significantly polluted at these locations
- **Stream B** flows through Newtownmountkennedy Demesne and via Garden Village, Kilquade, Druids Glen and Kilcoole Golf Clubs, to the Kilcoole marshes. It receives effluent at Garden Village and Kilquade Hill.
- **Stream C** is a larger stream which drains a hilly catchment to the west of Newtownmountkennedy with two significant branches converging near the town before flowing under the N11 and through a steeply sloping wooded valley to the Kilcoole marshes. It receives the effluent from Newtownmountkennedy, with minimal treatment, resulting in significant pollution at this point
- **Stream D** drains the catchment to the south of Newtownmountkennedy including Killadreenan, before flowing easterly through Newcastle, to the Kilcoole marshes, receiving the effluent from Newcastle wastewater treatment works to the east of the village.

In 1992 and 1993, there was extensive sampling of these streams and further sampling was carried out in early 1999. The results are summarised in **Appendix A.** The results confirmed that the treatment plants of Kilpedder, Kilcoole and Newtownmountkennedy cause significant pollution of the receiving waters. The Kilpedder and Kilcoole plants, which provide extended aeration treatment, were not operating satisfactorily, with only limited reduction in BOD_5, ammonia and phosphate. The Newtownmountkennedy plant has since been decommissioned and flows are transferred to Greystones WWTW via Kilcoole under the Interim Scheme.



Kilpeddar
Treatment Works
STREAM "A"
KILPEDDAR
KILCOOLE
Kilcoole
Industrial Estate
Kilquade Hill
Treatment Works
STREAM "B"
Garden Village
Treatment Works
Kilcoole
Pumping Station
Kilcoole WwTW
NEWTOWNMOUNTKENNEDY
STREAM "C"
Newtownmountkennedy
Pumping Station
Proposed
Leamore WwTW
Special Area of
Conservation
Special
Protected Area
STREAM "D"
NEWCASTLE
Marine
Outfall
Newcastle
Treatment Works
Special Area of
Conservation
Legend
NTMK Interim
Gravity Sewer
Interim Scheme
Rising Main
Proposed Scheme
Gravity Sewer
Area Stream Locations
Wicklow County Council
Comhairle Chontae Chill Mhantain
Project
Newtownmountkennedy & Kilcoole
Regional Sewerage Scheme
Title
Location Plan
Figure 3.1
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Issue Details
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Project No. MDW0135
Checked: P. Timmins
File Ref.
Approved: A. Carty
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Scale: 1:25,000 @ A3
Drawing No. MI0002
Rev. D01
Date: July '04
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2. All levels are referred to Ordnance Datum, Malin Head.
3. NOT TO SCALE, use figured dimensions only, if in doubt ask.
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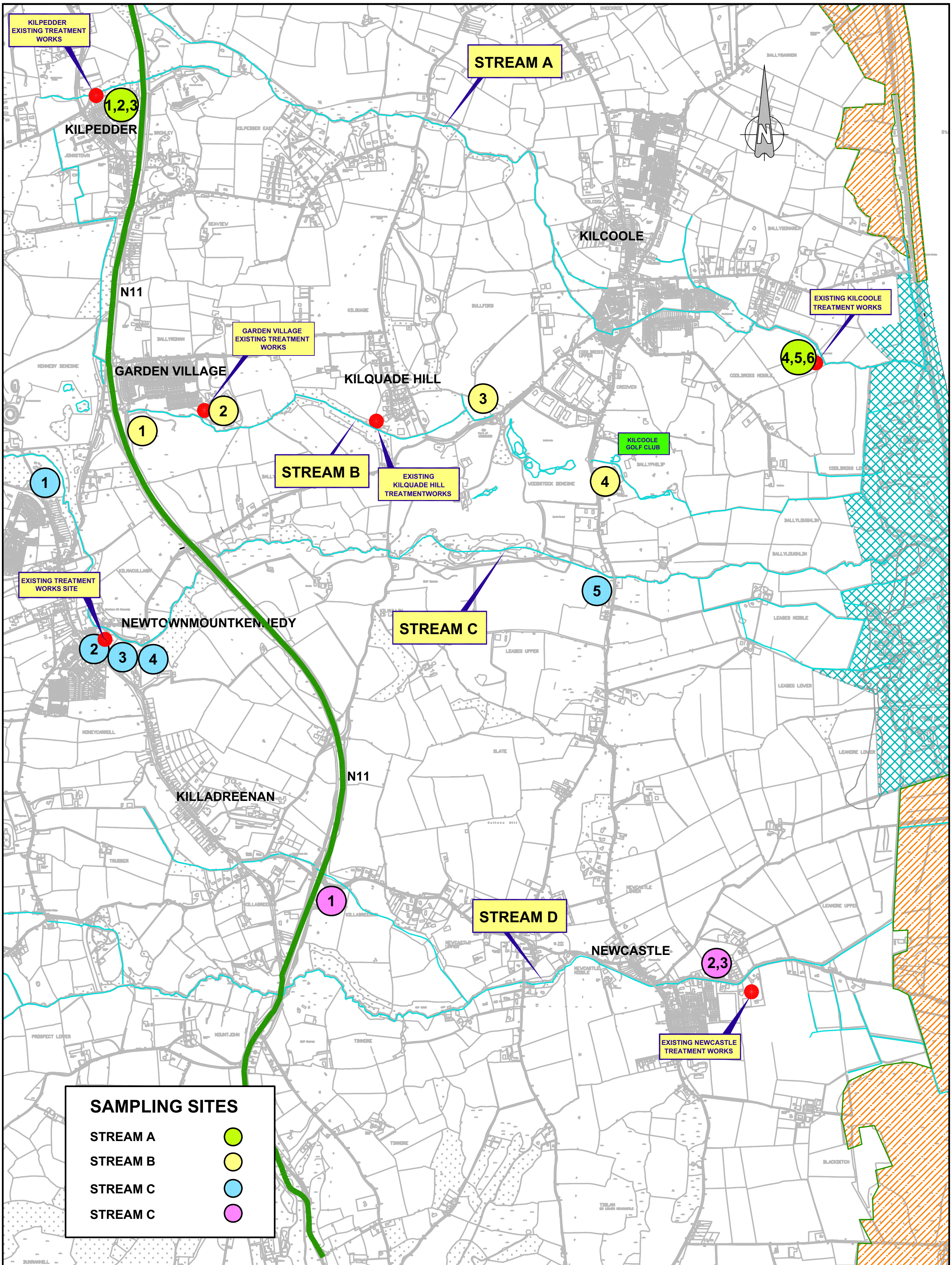


Client: WICKLOW COUNTY COUNCIL	RPS MCOS RPS-MCOS Ltd., West Pier Business Campus, Dun Laoghaire, Co. Dublin, Ireland. T: +353 1 288 4499 - F: +353 1 283 5676 E: rpsmcos@rpsgroup.ie W: www.rpsmcos.ie	Project: NEWTOWNMOUNTKENNEDY & KILCOOLE SEWERAGE SCHEME Title: Sampling Locations- Receiving Streams	Issue Details Drawn: M.M. Checked: P.T. Approved: P.T. Scale: N.T.S. Date: July '04	Office Use Only Job No. MDW0135 File Ref. MDW0135SK0003D01 Fig No. Fig. 3.2 Rev. D01

The river water quality reflects the discharges from these plants and is highly polluted downstream in each case. Flow and chemical parameter measurement at the outfalls to the marsh suggested average daily loadings of 120kgs of BOD_5 per day (population equivalent = 2,000), 21kgs of ammonia (as N) and 11.7kgs of phosphate (as P). These results are something of an underestimation, since the package plants to stream B were not discharging, when the samples were taken.

3.3 KILCOOLE MARSHES AND BEACH ENVIRONMENT

The Kilcoole Marshes comprise an inter-tidal area, which is cut off from the sea by the railway line. It is subjected to normal tidal exchange when the outlet at “The Breaches” is open. Because of the mobility of the beach, the breaches are regularly closed by south easterly storms. At these times, the fresh water levels rise until they are balanced by seepage through the sands. As a result, the area can be occasionally converted to a freshwater lake.

The Kilcoole marshes, between Kilcoole and Newcastle, are a proposed Natural Heritage Area (NHA). Between Kilcoole station and Leamore Lower, the marsh area is a designated Special Protection Area (SPA). In this area, the ecology and environment must be protected and this designation would effectively prohibit major development work, unless absolutely unavoidable. Further south, the area bordering on the railway line is generally designated as a Special Area of Conservation (SAC). The NHA, SPA and SAC are all shown on **Figure 3.1.**

Over the years, the area of the marshes has been reduced by the construction of embankments and other drainage protection works. This has considerably diminished the area affected by tides. To the south of the SPA area, the land is used for a private airstrip and the particular marsh ecology and its associated flora and fauna are not in evidence.

Between the railway line and shore line, there is a narrow strip of sand dune. The sand dune area varies in width from approximately 35 metres to the north of “The Breaches” to less than 15 metres to the south. Although not extensive, surveys indicate a number of plant species considered to be local, or only locally frequent in Ireland.

The inter-tidal area of the marshes has been much reduced by the drainage and embankment works carried out, as already noted. The main area remaining is in the vicinity of “The Breaches” and the north channel. Moving away from “The Breaches,” the limited saltmarsh ecology gives way to a more typically fresh-water ecology. The saltmarsh infauna recorded in the surveys, while limited in its diversity, provide important sources of foods for birds such as Red Shank and Curlew. The organic loading to the marshes contributes to the productivity of the area. Upgraded wastewater treatment will reduce the organic loading, but is unlikely to alter the ecological characteristics.

Bacteriological analysis of the coastal waters showed only marginal contamination arising from the wastewater discharges. Nevertheless, the discharge of untreated or partially treated sewage to the marshes has the potential to cause local bacterial contamination at Kilcoole beach, particularly in the vicinity of the “Breaches”.

3.4 EXISTING INFRASTRUCTURE

3.4.1 Newtownmountkennedy Sewerage System

The old treatment works at Newtownmountkennedy has been decommissioned and flows are transferred to Kilcoole via a new pumping station in Newtownmountkennedy constructed as part of the interim scheme. No additional area is being serviced by the interim scheme, so the Garden Village estate is still being served by its own package treatment plant the operation of which was described as being less than satisfactory in the 1999 Preliminary Report.

The Interim Scheme replaced the existing treatment works with a new pumping station transferring flows to Kilcoole from where flows are further pumped to Greystones WWTW.

3.4.2 Kilcoole Sewerage System

In Kilcoole, the southern half of the village, including the industrial estate, is now serviced by the new pumping station constructed under the interim scheme which transfers around $750m^3$/day to Greystones WWTW including $400m^3$/day from the Kilcoole catchment. The northern portion of the village is still being serviced by the existing extended aeration treatment plant at Kilcoole. The design capacity of this plant is 3,000 P.E., which was overloaded prior to the commissioning of the Interim Scheme. It now treats at around 2,100 P.E. and continues to discharge to the sensitive Kilcoole Marshes, which may cause bacteriological failures at the Kilcoole beach.

3.4.3 Kilpeddar

A package treatment works services the Glenview housing development and receives pumped flows from ribbon development alongside the N11. The Preliminary Report noted that sampling of the stream into which this plant discharges indicates minimal treatment with pollution of the stream during low flows.

The Laneswood development in Kilpeddar East is serviced by septic tanks.

3.4.4 Kilquade Hill

A package treatment plant services a housing estate in Kilquade. The 1999 Preliminary Report reported evidence of minimal treatment before discharging to the stream.

3.4.5 Newcastle

A relatively new extended aeration treatment plant services the village satisfactorily, but will not accommodate future expansion over the design horizon. The package treatment plant requires de-sludging almost daily at present.

4 POPULATION AND DEVELOPMENT

4.1 PLANNING POLICY OVERVIEW

The Wicklow County Development Plan (CDP) sets out the overall strategy for the proper planning and sustainable development of the county and contains information on the likely effects on the environment of implementing the Plan. Currently a draft version of the Development Plan 2004 – 2010 is available, a new Plan will be adopted in March 2005.

The CDP has been prepared within the context of the National Spatial Strategy and the Strategic Planning Guidelines for the Greater Dublin Area (SPG). The SPG's have particular relevance to this project as the Study Area close to the boundary between the Metropolitan Area and Hinterland Area as defined within the SPG's. Within the Hinterland regional development is concentrated within "development centres", within County Wicklow the Primary Development Centre is Wicklow Town with Arklow being a Secondary Development Centre, both of these are outside the Study Area. The SPG's state that development within the Hinterland outside of the development centres should meet local and not regional need, however the SPG Review and Update April 2000 (Reference 11) identified the need for a review of development plans for settlements close to the boundary of the Metropolitan Area and of those along transportation corridors. The Study Area considered for this scheme would qualify for such a review.

Within the Study Area the CDP designates Newtownmountkennedy as a Primary Local Growth Centre with Kilcoole and Newcastle designated as Secondary Local Growth Centres. These centres will have been selected to accommodate growth within the Strategic Green Belt, outside of the Primary and Secondary Development Centres (such as Greystones/Delgany). Kilpeddar has been designated as a Large Village, future development in this area is restricted to allow local growth only. Table 4.1 details the population projections for these growth centres.

Table 4.1 Projected Domestic Populations within the Study Area

Area	No. of Persons 2002[1]	No. of Persons 2007	No. of Persons 2016	No. of Persons 2023[7]
Newtownmountkennedy	2,521	4,528[2]	6,000[2]	6,892
Kilcoole	2,826	3,694[3]	4,500[4]	5,169
Newcastle	851	1,083[5]	1,500[4]	1,783
Kilpeddar	517	675[5]	960[6]	1,141
Total Population	6,715	9,980	12,960	14,985

[1] Source: 2002 Census Data (Reference 6)
[2] Source: Section 2.1.2 Newtownmountkennedy Local Area Plan 2002 (Reference 3)
[3] Source: Section 2.5 Kilcoole Local Area Plan 2002 (Reference 4)
[4] Source: Section 2.2.2 Wicklow County Development Plan 1999 (Reference 2)
[5] Calculated pro-rata from 2002 and 2016 data
[6] Calculated by applying an assumed growth rate, determined by proximity to growth centres (refer to Table 2.2 Wicklow Development Plan 1999)
[7] Calculated by applying assumed growth rates

The CDP provides estimates of population to 2016, but our design horizon extends to 2023 and therefore our assessment of population growth needs to be extended further. Estimates of future population have been published by the Central Statistics Office for the period up until 2031 (Reference 12), however these estimates are on a Regional basis (i.e. the Mid-East region which encompasses Kildare, Meath and Wicklow), the estimated growth rate cannot be applied to specific growth centres such as Newtownmountkennedy, Kilcoole and Newcastle. The population forecasts beyond 2016 are therefore determined using nominal annual growth rates.

The development strategy for Newtownmountkennedy is detailed within the Newtownmountkennedy Local Area Plan 2002. The plan states that expansion of Newtownmountkennedy is hindered by the absence of a satisfactory sewerage system, the sanitary improvements will allow for growth to the local growth centre strategy level. Population growth is to be concentrated along the western edge of the village and will be expected to grow to around 6,892 persons by 2023.

As a Secondary Local Growth Centre, Kilcoole is not planned to develop to the scale envisaged for Newtownmountkennedy. Currently, the two towns have similar populations, however by 2023 Kilcoole is expected to be much smaller in size compared to Newtownmountkennedy. However, it is a policy of the Council to promote the expansion of Kilcoole’s employment base (Reference 4). The settlement strategy would envisage that the population of Kilcoole is likely to increase from an estimated 2,826 in 2002 to 5,169 in 2023.

The development strategy envisaged that Newcastle could expand to approximately double its present size, giving an indicative population in 2023 of 1,783 persons. This would obviously require significant new residential development in the area and a corresponding increase in treatment plant capacity.

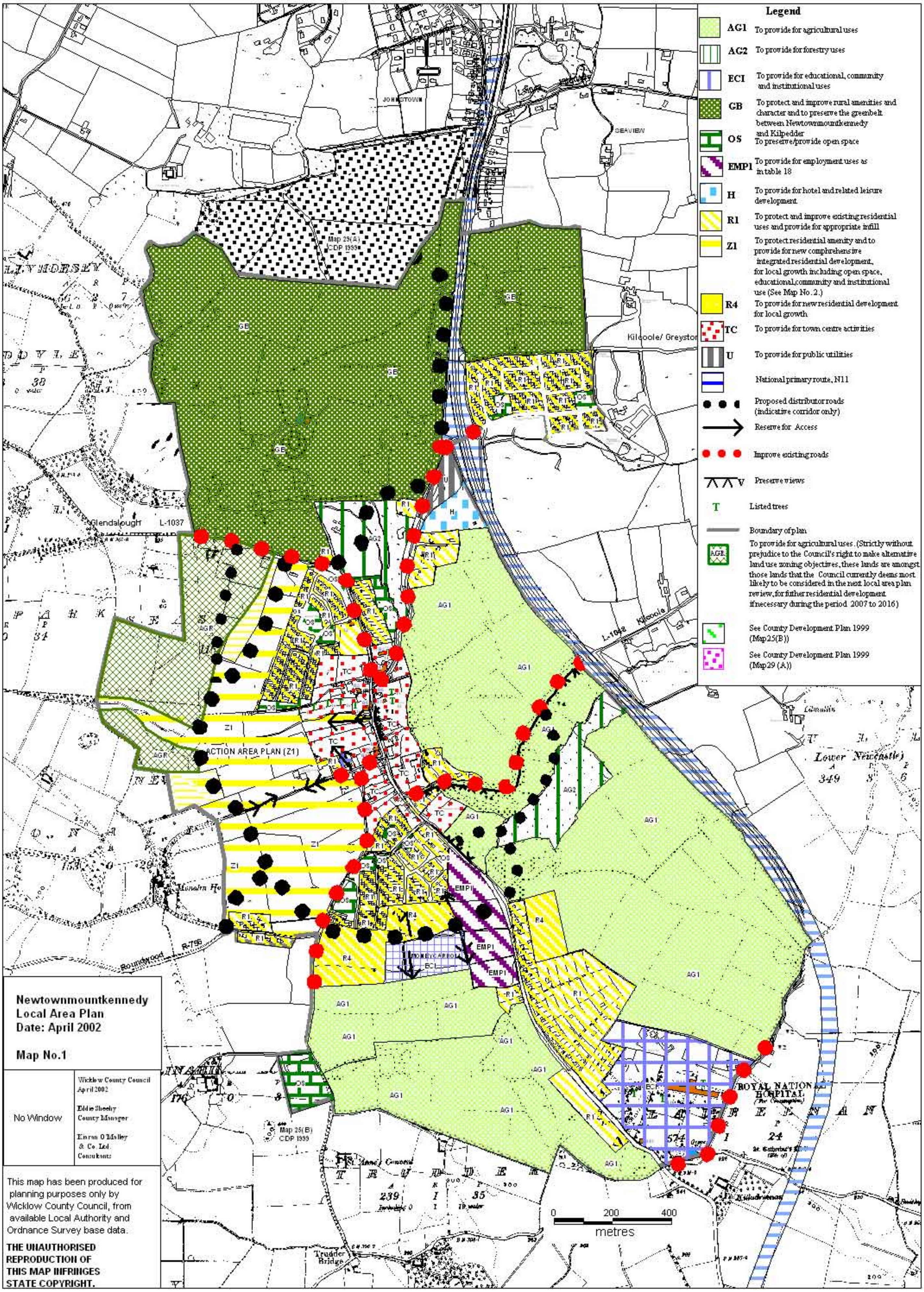
The foregoing summarises the planning context for the consideration of future sewerage needs in the area. For design purposes, however, it is also necessary to consider potential long-term development in order that sewerage infra-structure can cater for all reasonable foreseeable requirements. Therefore, potential development indicated by planning applications and other criteria has been taken into account, together with a design factor for contingency development. The ultimate scope of the project is taken to include Kilpedder and the existing developments at Garden Village and Kilquade Hill.

4.2 NEWTOWNMOUNTKENNEDY SEWERAGE NEEDS

The design of a new sewer system for Newtownmountkennedy is based on an analysis of existing and possible future development, summarised in **Table 4.2**. As an indication of the extent of future development planned for Newtownmountkennedy, the town’s Local Area Plan is reproduced in **Figures 4.1. and 4.2**.

Table 4.2 2023 Newtownmountkennedy Development Loads

	Population	Other (PE)	Total (PE)	Flow (m^3/d)
Residential	6,892			1,378
Commercial		350		79
Schools		200		45
Newcastle Hospital		400		90
Model World Development		2,000		450
Fenelon’s Abattoir				100
Custom Packaging		32		7
			2,982	771
			9,874	2,049



Legend
AG1 To provide for agricultural uses
AG2 To provide for forestry uses
ECI To provide for educational, community and institutional uses
GB To protect and improve rural amenities and character and to preserve the greenbelt between Newtownmountkennedy and Kilpedder
OS To preserve/provide open space
EMP1 To provide for employment uses as in table 18
H To provide for hotel and related leisure development
R1 To protect and improve existing residential uses and provide for appropriate infill
Z1 To protect residential amenity and to provide for new comprehensive integrated residential development, for local growth including open space, educational, community and institutional use (See Map No. 2.)
R4 To provide for new residential development for local growth
TC To provide for town centre activities
U To provide for public utilities
National primary route, N11
Proposed distributor roads (indicative corridor only)
Reserve for Access
Improve existing roads
V Preserve views
T Listed trees
Boundary of plan
AGR To provide for agricultural uses. (Strictly without prejudice to the Council's right to make alternative land use zoning objectives, these lands are amongst those lands that the Council currently deems most likely to be considered in the next local area plan review, for futher residential development if necessary during the period 2007 to 2016)
See County Development Plan 1999 (Map 25(B))
See County Development Plan 1999 (Map 29 (A))
Map 29(A) CDP 1999
Map 25(B) CDP 1999
JOHNSTOWN
SEAVIEW
Kilcoole/ Greystones
Glendalough L-1037
L-1042 Kilcoole
ACTION AREA PLAN (Z1)
Roundwood R-765
ROYAL NATIONAL HOSPITAL
Lower Newcastle
Trudder Bridge
0 200 400
metres
Newtownmountkennedy
Local Area Plan
Date: April 2002
Map No.1
No Window
Wicklow County Council
April 2002
Eddie Sheehy
County Manager
Kieran O'Malley & Co. Ltd.
Consultants
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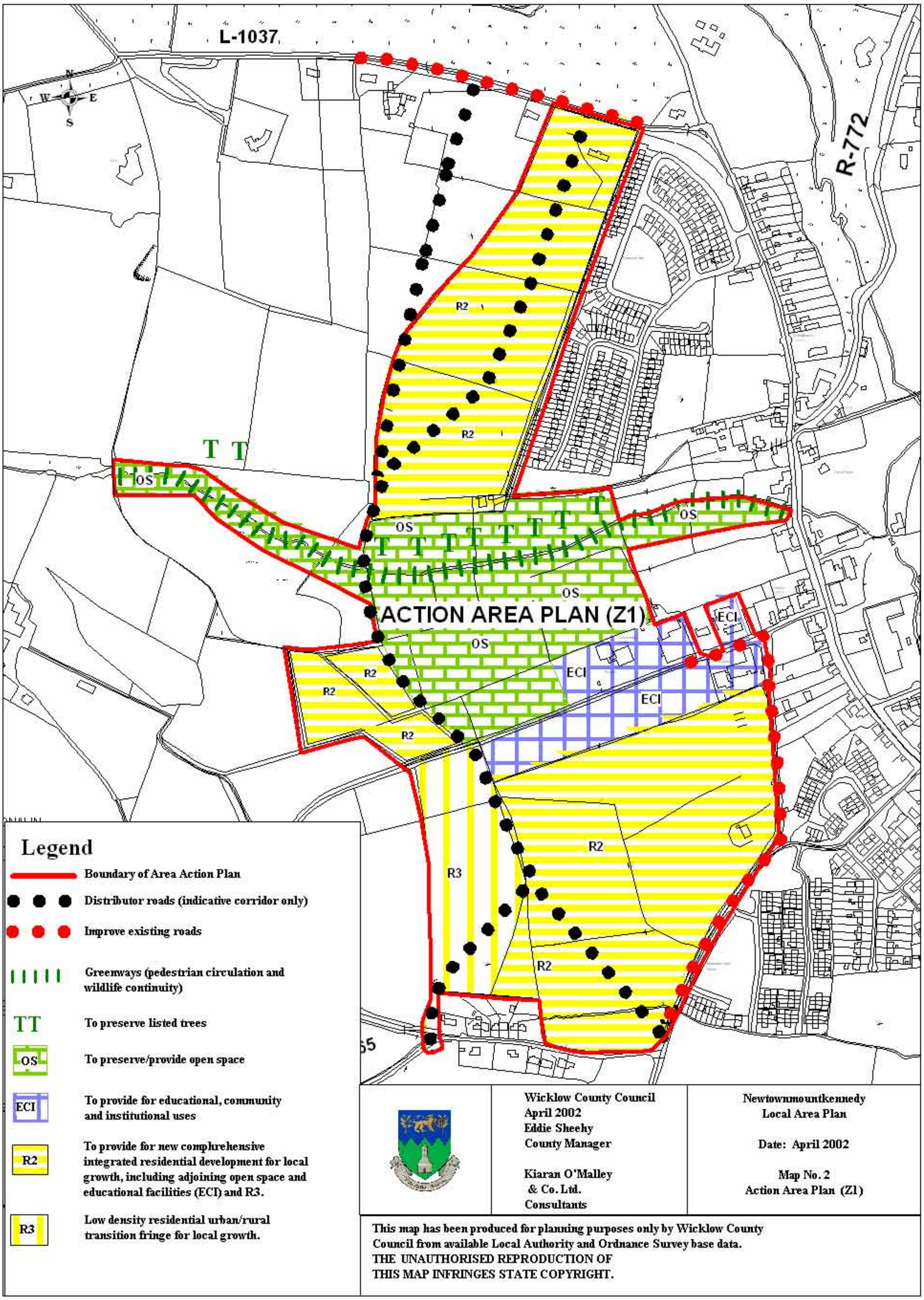
L-1037
R-772
N
S
E
W
R2
R2
R2
R2
R2
R2
R2
R3
OS
OS
OS
OS
OS
ECI
ECI
ECI
ACTION AREA PLAN (Z1)
Legend
Boundary of Area Action Plan
Distributor roads (indicative corridor only)
Improve existing roads
Greenways (pedestrian circulation and wildlife continuity)
TT
To preserve listed trees
OS
To preserve/provide open space
ECI
To provide for educational, community and institutional uses
R2
To provide for new comphrehensive integrated residential development for local growth, including adjoining open space and educational facilities (ECI) and R3.
R3
Low density residential urban/rural transition fringe for local growth.
Wicklow County Council
April 2002
Eddie Sheehy
County Manager
Kiaran O'Malley
& Co. Ltd.
Consultants
Newtownmountkennedy
Local Area Plan
Date: April 2002
Map No. 2
Action Area Plan (Z1)
This map has been produced for planning purposes only by Wicklow County Council from available Local Authority and Ordnance Survey base data.
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Future development in Newtownmountkennedy is assumed to consist of:

- Provision for integrated and balanced growth of the town to a population of 6,000 persons by 2016, in accordance with the policies detailed within the Local Area Plan, and then on to an estimated 6,892 persons by 2023,
- Improvement of the town's social, educational and economic functions in line with population growth,
- Continued use of Newcastle Hospital as an institutional facility,
- The connection of the Model World development, a potential ski-slope amenity with associated hotel and commercial enterprises south of Newtownmountkennedy, into the local sewerage system. In addition, the connection in Fennelon's Abattoir, located close to the Model World development, to the sewerage system.

A review of the trunk system in Newtownmountkennedy may be required to facilitate residential development to the west of Main Street. The pumping station, constructed under the Interim Scheme, has the capacity for the future development of the town.

It should be noted that the Garden Village estate is included within the population estimates for Newtownmountkennedy, however sewerage flows from the existing package plant is intended to be diverted downstream of Newtownmountkennedy P.S.

4.3 KILCOOLE SEWERAGE NEEDS

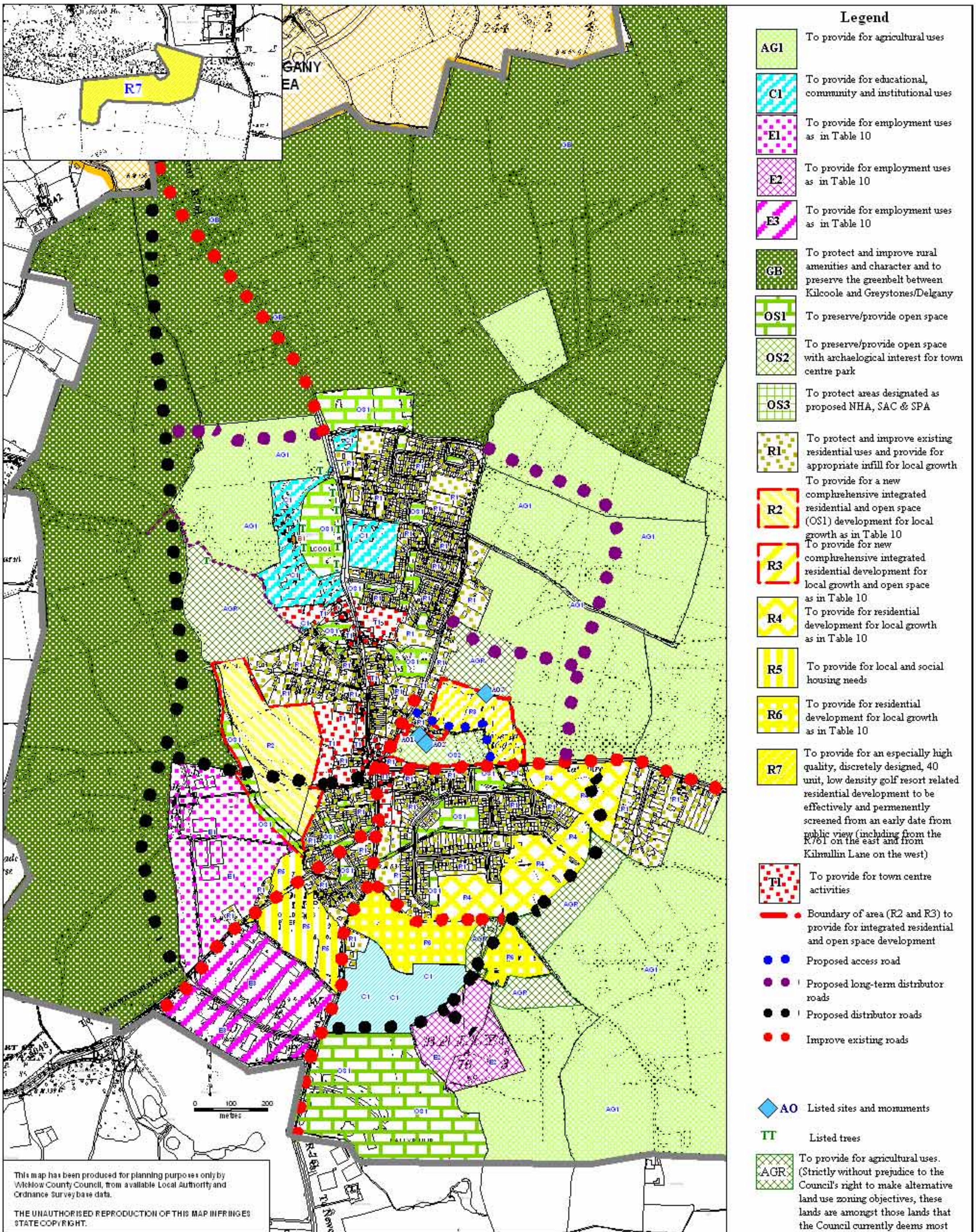
Table 4.3 summarises the sewage loads from Kilcoole, at present there are an estimated 3,000 people in Kilcoole, with a significant industrial load associated with the Industrial Estate, together with commercial and institutional loads. As an indication of the extent of future development planned for Kilcoole, the town's Local Area Plan is reproduced in **Fig. 4.3**.

Table 4.3 2023 Kilcoole Development Loads

	Population	Other (PE)	Total (PE)	Flow (m^3/d)
Residential	5,169			1,034
Commercial		440		99
Schools		350		79
Irish Egg Products		111		25
Druids Glen GC/Hotel		444		100
			1,346	303
			6,514	1,337

Future development in Kilcoole is assumed to consist of:

- Residential development to the east, west and south of the existing village,
- Industrial/employment development zones primarily to the south of the village,
- Improvement of the town's social, educational and economic functions in line with population growth
- Connecting flows from Druids Glen hotel and golf complex into the public system.



Kilcoole Local Area Plan
Date: April 2002
Part Map No. 1

Wicklow County Council
April 2002
Eddie Sheehy
County Manager
Kiaran O'Malley
& Co. Ltd.
Consultants

4.4 NEWCASTLE SEWERAGE NEEDS

Newcastle is a relatively small rural village with a number of residential estates nearby. The estimated population is approximately 850 at present but given its location and the interest in development in the environs of Newcastle, an ultimate population of 1,800 can be envisaged. Table 4.4 below details the expected sewerage loads from the village in 2023.

Table 4.4 2023 Newcastle Development Loads

	Population	Other (PE)	Total (PE)	Flow (m^3/d)
Residential	1,783			357
Commercial		50		11
			1,833	368

The current sewerage system in Newcastle operates satisfactorily at present, it would be prudent to connect the village to the new treatment works to reduce future maintenance costs. However due to the limited development expected within Newcastle within the design horizon, little infrastructural development is envisaged.

4.5 KILPEDDER AND KILQUADE HILL SEWERAGE NEEDS

Kilpeddar is designated as a Large Village within the CDP, therefore development is restricted to local growth only. Specifically, the Plan states that development in Kilpeddar is to be infill development only. Kilquade Hill estate is located within a rural area, the CDP promotes the protection of the County's natural resources, therefore additional development here is unlikely.

The CDP has designated an Employment Zones at Mountkennedy, located south west of Kilpeddar. Around 77 hectares of land has been zoned for light industrial use. A figure of $14m^3$ per hectare per day for industry flow has been applied for this zone. It has been assumed that development will be 20% complete by 2007 and 100% by 2023. It is noted that an Employment Zone at Drummin detailed in the 1999 CDP and in previous reports, does not appear within the 2004 -2010 draft CDP and has now been excluded from our calculations.

Table 4.5 below details the expected sewerage loads from the area in 2023.

Table 4.5 2023 Kilpeddar and Kilquade Hill Development Loads

	Population	Other (PE)	Total (PE)	Flow (m^3/d)
Kilpeddar				
Residential	1,141			228
Mountkennedy development		1,946		438
Commercial		50		11
Kilquade Hill				
Residential	550			70
			3,687	787

4.6 REGIONAL DEVELOPMENT SUMMARY

The total flows expected within the study area is summarised in **Table 4.6**. It indicates the following:-

Table 4.6 Summary of loads to 2023

	2003 Total Load (PE)	2023 Total Load (PE)	Dry Weather Flow (m^3/d)	Dry Weather Flow (l/s)
Newtownmountkennedy	3,164	9,874	2,149	24.9
Kilcoole	3,412	6,515	1,336	15.5
Newcastle	851	1,833	368	4.3
Kilpeddar/Kilquade Hill	633	3,687	787	9.1
Total	**8,060**	**21,909**	**4,641**	**53.7**

The 2023 population equivalent for the region, including all residential, commercial, institutional and industrial development is 22,000 p.e. This compares with a current equivalent population of 8,000 p.e. Therefore, the development needs demonstrates a requirement to treat up to 22,500 P.E. by 2023.

4.7 SUMMARY

Based upon this review of future loadings in the Study area, the following situations will arise:

(i) By 2007, the loading from Newtownmountkennedy, Kilcoole and environs will be around 12,000 P.E. (excluding Kilcoole TW and Newcastle). Therefore the transfer pipeline from Kilcoole P.S. to Greystones WWTW will be at capacity (10,000 PE. - 12,000 P.E.). The loading from the Greystones/Delgany catchment will be around 20,000 P.E. bringing the total load to Greystones WWTW to around 32,000 P.E.

(ii) By 2016, the loading from Newtownmountkennedy, Kilcoole and environs will be around 17,000 P.E. (excluding Kilcoole treatment works and Newcastle). Projected loading from the Greystones/Delgany catchment will be around 25,000 P.E. Therefore the total load to Greystones WWTW will be around 42,000 P.E. which is greater than the capacity of the treatment plant’s outfall (i.e. its ultimate design capacity).

Therefore, by 2007, the capacity of the transfer pipeline will be reached, and the capacity of the Greystones treatment works will be exceeded.

Table 4.7: Future Load estimation (PE)

	2007	2016	2023
Greystones/Delgany	20,000	25,000	29,000
Newtownmountkennedy / Kilcoole[1]	12,000	17,000	21,000
Newcastle & Kilcoole WWTW	3,000	3,500	4,200

Note 1: Assuming no additional treatment facilities are provided in the short-term, all existing package plants to be decommissioned and transferred to the sewerage network and development areas are to contribute at the stated levels.

5 WASTEWATER TREATMENT AND DISPOSAL

5.1 REGIONAL SEWERAGE TREATMENT OPTIONS

To summarise, the existing sewerage infrastructure in the study area is limited to local collection systems in each settlement with varying levels of treatment. Environmental monitoring has indicated that the streams in the area suffer significant pollution from inadequately treated sewage discharge. In turn, the streams discharge to Kilcoole marsh, where the impact appears to be relatively minor. Discharges from the marsh to the Irish Sea through “the Breaches” pose a risk of bacteriological contamination of the marine shoreline waters.

Given the small flows in the river system, the protection of water quality would require that any sewage effluents would have a very high level of treatment. In considering future treatment needs, the development potential of the area, based upon the Strategic Planning Guidelines for the Greater Dublin Area and the current development policies of the County Council must be taken into account. This requires consideration of a strategy which can achieve an integrated overall solution which is best suited to the regional needs as well as flexibility for development in the long-term. This requires that pumping and treatment systems would be capable of modular expansion as the need arises.

The options for upgrading of the sewerage systems in the light of these considerations are:-

5.1.1 Continue to transfer flows to Greystones WWTW

Greystones WWTW currently treats around 17,543 P.E. from Newtownmountkennedy, Kilcoole and Greystones/Delgany (**see Appendix B**). By 2007, this is expected to increase to around 31,442 P.E. which will exceed the plant’s capacity of 27,000 P.E. Therefore an alternative treatment strategy should be formulised now to accommodate these additional flows.

Further treatment capacity can be provided by increasing the modular wastewater treatment and sludge digestion capacity of the plant to 30,000 P.E.. Core elements of the plant are capable of dealing with 30,000 P.E.. This option will provide short-term capacity for future population and industrial growth within the catchment. However, due to the capital investment required for such an upgrade, it may be more economic to upgrade both the sludge digester and sludge treatment plants to the ultimate capacity of 40,000 P.E. having regard to ongoing development potential of Greystones/Delgany.

If the existing Kilcoole WWTW and the various package plants are maintained in operation, the interim scheme could accommodate the balance of the flows to 2007 with treatment at Greystones WWTW. Therefore this option is seen only as a short-term expedient and will continue to damage the sensitive receiving environment by allowing the unsatisfactory treatment plants to discharge into local watercourses.

5.1.2 Upgrade local sewerage treatment facilities

The effluent standards required for discharge to the stream network and to protect the marine waters at Kilcoole cannot readily be achieved locally since the package treatment plants at Kilpeddar and Garden Village currently operate at an unsatisfactory standard. Moreover, the flexibility required to meet the range of present/future loads would be very difficult to satisfy. Operational costs would also be excessive for separate plants located close to the individual settlements. Therefore their immediate inclusion into the public sewerage system is considered essential.

Similarly, the treatment works capacity at Kilcoole and Newcastle are inadequate for medium term conditions and their flows would have to be dealt with.

5.1.3 New treatment works at Leamore

The 1999 Preliminary Report recommended that construction of a new central wastewater treatment works at Leamore should be advanced on a phased basis with an initial stage being construction to a design capacity of 15,000 P.E., followed by an upgrade to 22,500 P.E. with secondary treatment at 2005, followed by final development to 45,000 P.E. as required.

From the most recent studies it is apparent that in order to cater for the regional needs up to 2016, a new treatment works with an initial capacity of 22,500 P.E. is required to be in place by 2007. This plant would be capable of servicing the regional needs for a considerable time and could accommodate all of the existing developments plus residential and commercial development as indicated by the adopted settlement strategy (Reference 14). A future Stage 2 development option to duplicate the major treatment works elements on a modular basis would increase the ultimate capacity for the treatment works to 45,000 P.E..

The design loads for a two stage development at Stage 1 and 2 are summarised in **Table 5.1.**

Table 5.1 Design Loading requiring Treatment - Summary

Stage	Flow (l/s)			Treatment Works P.E.	BOD (kg/day)
	DWF	3 DWF	4.5 DWF*		
Stage 1	54	161	204	22,500	1,350
Stage 2	107	322	402	45,000	2,700

* 3DWF at Pumped Areas

It is proposed that trunk sewers will be sized for up to 4.5 times dry weather flow, giving an ultimate discharge capacity into the works of 402 l/s. However, by combining storm water balancing with the treatment plant, the maximum hydraulic loading on the plant and outfall would be restricted to 322 l/s.

During 2007, on commissioning of Stage 1 of the new treatment works Newtownmountkennedy and Kilcoole can be expected to contribute 8,863 P.E., under the collection system scheme recommended within the 1999 Preliminary Report (see Chapter 6) this would increase to around 11,555 P.E. once the treatment plants at Kilpeddar, Kilquade, Garden Village and Kilcoole were decommissioned. It is estimated that by 2023, the load on the Leamore WWTW will be around 23,582 P.E. so an initial capacity of 22,500 P.E. would probably be reached around year 2021.

Once the Leamore WWTW has been commissioned in 2007, flows to Greystones WWTW from the Greystones/Delgany catchment will be around 20,000 P.E., leaving significant residual capacity for development in the Greystones/Delgany catchment if the transfer pipeline is decommissioned and loads transferred to Leamore WWTW.

5.2 SITE SELECTION

The provision of a new central treatment plant suitably located in order to discharge to the Irish Sea in the Newcastle/Kilcoole area is the recommended option.

In the siting of a central treatment plant, the following constraints must be taken into account:-

- The foreshore area incorporating Kilcoole marshes and extending to North and South and including the beach area comprises a proposed Natural Heritage Area and is designated as a Special Area of Conservation. Furthermore, from Kilcoole station south to Leamore, the marshes area is designated as a Special Protected Area, due to its unique ecology and bird life

- The shoreline area is generally low-lying with significant views from Kilcoole and from the railway line
- Based on experience in the area, it would be desirable to site any new treatment plant as far as possible from existing developments in order to minimise objection to nuisance such as visual intrusion, odour or noise or other adverse impacts of a wastewater treatment plant. Avoidance of these nuisance issues would simplify the design, management and operation of a central wastewater treatment works

Taking account of these constraints, the following site options were considered:-

- Expansion of the existing Kilcoole treatment works with the construction of the marine outfall to the North of the Special Protected Areas in the vicinity of the Kilcoole station
- A central location at Leamore between Kilcoole and Newcastle on a site which is well screened by existing woodland with local access from the Kilcoole – Newcastle Road and very removed from the existing settlements
- Expansion of the Newcastle treatment works site

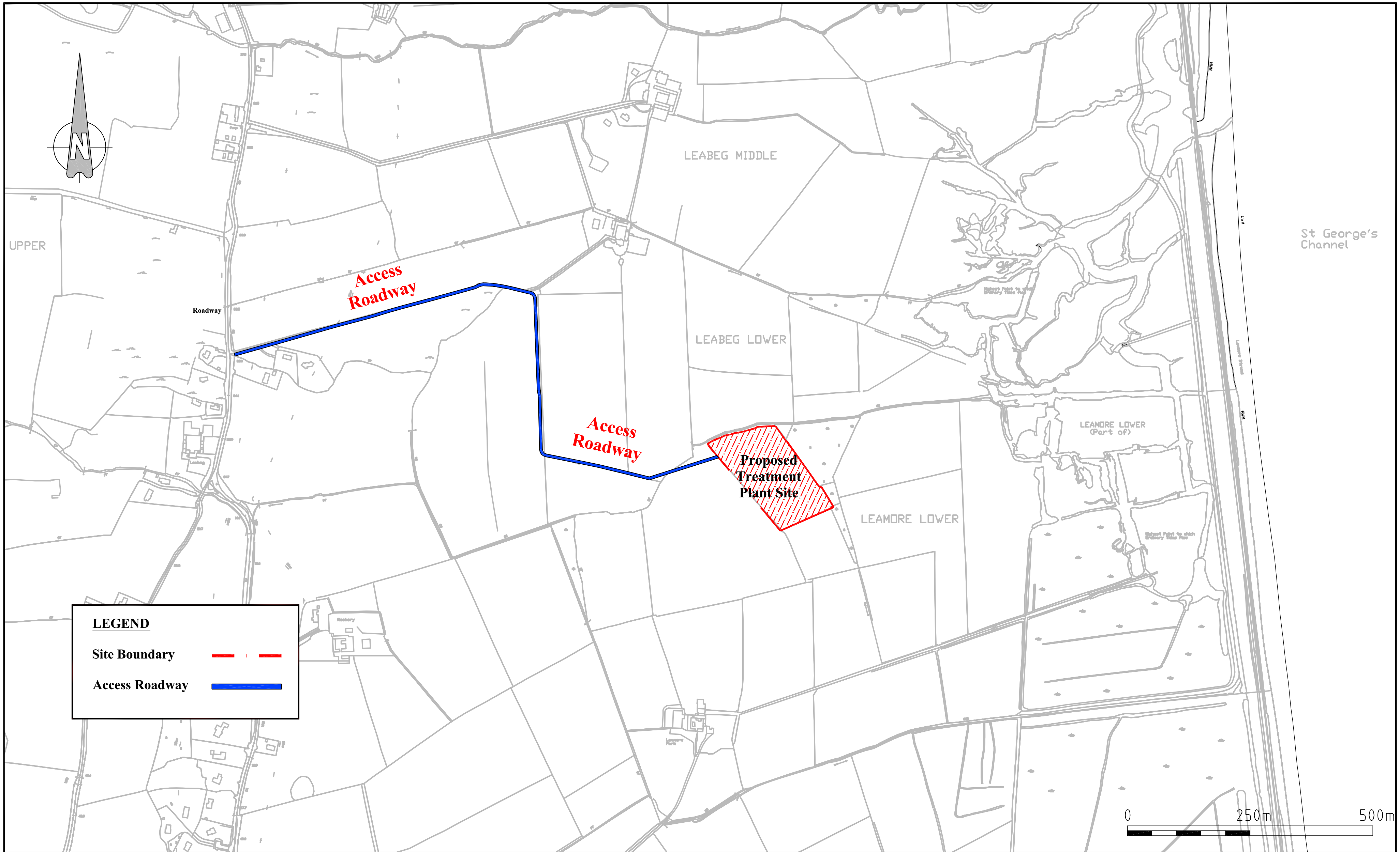
The Kilcoole option is technically feasible if a site was obtained immediately to the northeast of the existing works. The development of a large central treatment works at this location would give rise to significant objection due to its relative proximity to Kilcoole, where the existing treatment plant has been the source of complaint and would be difficult to screen from Kilcoole station and from the shoreline generally. An outfall would be required through the SPA in the vicinity of the railway station which would be strongly objected to, particularly by Birdwatch Ireland who own a site in this area and through whose land the outfall would require to be laid

The Newcastle option would give rise to similar objections and would suffer from the significant disadvantage that the bulk of the flows would have to be carried in a large trunk sewer to the southernmost point of the catchment, where it would have to be pumped to treatment.

The Leamore site is located approximately midway between Kilcoole and Newcastle and between the main road and the foreshore. This offers a number of advantages for a central treatment plant to serve the Newtownmountkennedy/Kilcoole/Newcastle region including:-

- A suitable site, of adequate area is identified, for a variety of treatment types, both small footprint and traditional
- It has effective natural screening, particularly from the foreshore due to developed woodland to its northern and eastern boundaries
- While located a significant distance from the road and all major settlements, it is readily accessed by an existing private road which can be suitably upgraded
- It is located to the south of and outside of the Special Protected Area. It should be possible to construct an outfall through the Special Area of Conservation by conventional means. Environmental consideration, particularly of the bird communities and the existing ecology, would indicate that this location for the outfall should not adversely impact on the area
- The site can provide for stormwater storage in excess of the treatment capacity and an emergency overflow can be provided to the watercourse adjacent to the railway line, by laying an overflow pipe in parallel with the outfall to this point

These observations relating to the alternative sites are supported by a public consultation exercise whereby the central treatment plant at Leamore achieved general public approval. **Accordingly, this site at Leamore has been selected as the most suitable site for a central treatment works to serve the region**. **Fig. 5.1** is a location plan showing the preferred site.



Client:	Project:	Title:	Issue Details	Office Use Only
WICKLOW COUNTY COUNCIL	Newtownmountkennedy & Kilcoole Sewerage Scheme	Location Plan of Treatment Plant	Drawn: M.M.	Job No: MDW0135
RPS mcos			Checked: P.T.	File Ref: MDW0135SK0006D01
RPS-MCOS Ltd., West Pier Business Campus, Dun Laoghaire, Co. Dublin, Ireland.			Approved: P.T.	Fig No: Fig. 5.1
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6 PROPOSED COLLECTION SYSTEM

6.1 GENERAL

A Preliminary design of the proposed foul sewer collection system was prepared and described within the 1999 Preliminary Report. This design was based upon the estimated foul flows as calculated within that report. Since the population growth predictions have been reassessed to conform with the SPGGDA, this design will be reviewed. It is our intention to utilise the corridors identified within the 1999 Preliminary Report for the new trunk sewerage system. The indicative layout of the proposed trunk sewer system, as prepared for the 1999 Preliminary Report is shown in **Fig. 3.1.**

6.2 FOUL SYSTEM AT NEWTOWNMOUNTKENNEDY

As part of the Interim Scheme for this Project, the sewerage system within Newtownmountkennedy has been upgraded and a new pumping station installed to replace the old treatment works. The works involved largely encompassed those described within the 1999 Preliminary Report and currently operate satisfactorily.

6.3 STRATEGIC TRUNK FOUL SEWERS

This section considers the strategic trunk sewer system to connect Newtownmountkennedy, Kilcoole and Newcastle to the proposed new treatment works, including facilities to intercept Kilpeddar, Garden Village and Kilquade. The collection system, treatment plant location and outfall are all indicated in **Fig. 3.1**. Plan and longitudinal section details are more fully described on the attached drawings.

Table 6.1 Schedule of Design Loads (Hydraulic)

Catchment	Existing DWF (l/s)	Future DWF (l/s)	Ultimate DWF (l/s)	Peak Flow at Ultimate (l/s)	Total to Sewer (l/s)
Newtownmountkennedy	8	24	49	135 [1]	135
Kilcoole	8	15	32	143	362
Newcastle	2	4	9	39	39
Kilpedder & Kilquade	1	9	19	84	219
Flow to Treatment		53	108	402	324 [2]

[1] Maximum pumped flow from Newtownmountkennedy P.S.
[2] Design for 3* DWF at inlet to treatment works

7 PROPOSED WASTEWATER TREATMENT WORKS

7.1 TREATMENT PLANT LOADING AND STANDARDS

The development of the treatment plant at Leamore could be implemented in two stages as follows:-

- **22,500 population equivalent;** to incorporate full secondary treatment based on primary sedimentation, aeration and final settlement prior to discharge.
- **Ultimate 45,000 population equivalent;** involving duplication of the main treatment elements and upgrading of effluent pumping to cater for the ultimate situation

An indicative layout of conventional treatment at the Leamore site is shown in **Fig 7.1**. At this stage, this must be regarded as indicative only and is not meant to preclude other treatment process and configuration options, which may prove more economical following a procurement process.

The design loadings at each stage are shown in **Table 7.1:-**

Table 7.1 Treatment Plant Loads

Stage	Design Load (P.E.)	BOD (kg/d)	Flows (l/s)			Comment
			DWF	3 x DWF	Max	
1	22,500	1,350	53	159	201	Secondary Treatment
2	45,000	2,700	106	318	324	Ultimate Design

Effluent standards are based on the Urban Wastewater Treatment Regulations for plants discharging to Marine Waters, not classified as sensitive. These are :-

BOD_5 - less than 25mg/l

Suspended Solids - less than 35mg/l

Chapter 6 examines the bacteriological impact of discharging of effluent, following secondary treatment, to the marine waters. The length of outfall has been selected to satisfy relevant standards without further treatment (disinfection).

7.2 DESCRIPTION OF TREATMENT PLANT

The treatment plant at Leamore can comprise a variety of process options to satisfy the effluent standards required by the Urban Wastewater Treatment Directive for normal conditions, BOD_5 of 25mg/l and suspended solids of 35mg/l. The treatment plant must include the following elements:-

- **Preliminary treatment;** to comprise inlet pumping, stormwater balancing, removal of screenings to a 6mm maximum size, grit removal and flow measurement. This element of the works is generally common to all options, sized for the phase 1 flow of 22,500 population equivalent, but with civil works suitable for duplication of the equipment at ultimate capacity

- **Secondary treatment;** comprising a variety of options with conventional plant including primary settlement, activated sludge and final settlement tanks designed for carbonaceous BOD removal without nitrification or denitrification. This element of the works would be constructed as a modular two or four stream process, with initial development for 22,500 population equivalent and ultimate of double that capacity
- **Sludge handling and treatment;** The Sludge Management Plan for County Wicklow (prepared by Fehily Timoney & Co. in association with J.B. Barry and partners – October 2002) recommends that sludge arisings from the Newtownmountkennedy/Kilcoole area be dewatered on site and transported to the proposed Wicklow Hub Centre for sludge treatment

7.2.1 Preliminary Treatment Works

In general, the preliminary treatment works should be designed to cater for the ultimate throughput with pipe sizes, channels and tanks constructed accordingly. In this case, the following elements are needed:-

- **Storm water balancing;** flows in excess of the maximum treatment capacity, must be balanced and recirculated for treatment. Initial capacity of 400m³ is proposed with a facility for its future duplication if necessary. Storm water balancing tanks would be provided with cleaning equipment (tipping bucket or equivalent) and recycle submersible pumps (duty and standby) sized at approximately 60l/s each. An emergency 600mm overflow pipe should be provided, with a capacity of at least 300l/s to be protected by 6mm screens to cater for flows in excess of the treatment and storage capacity (major storm condition) or emergency overflow due to plant failure
- **Screening plant**; 6mm mechanically raked screens are proposed, with two units in parallel at ultimate load, each rated at 200l/s. Screenings washing and compaction plant would be incorporated to produce a baled clean screenings end product, suitable for storage on site and disposal to landfill
- **Aerated grit trap;** the provision of an aerated grit trap unit is recommended to trap heavy grit particles which would be intercepted, washed and stored in a suitable receptacle for disposal. A single unit is recommended
- **Flow measurement;** Inlet flow measurement should comprise a flume or parallel flumes which could be used to divide flow between plant streams. The maximum capacity should be 318l/s, with flows in excess of this value overflowed to storage

A compact design of the preliminary treatment works is necessary, in order that the pumping and screening plant can be accommodated within a preliminary treatment building, where air extraction and odour treatment facilities would be provided to avoid odour nuisance frequently associated with wastewater inlet works.

7.2.2 Secondary Treatment

The development of the plant is likely to be specified in terms of performance standards in a Design/Build contract format, by means of which alternative process options could be tendered for evaluation and selection of the Most Economically Advantageous Option.

At this stage, therefore, indicative design options are outlined as a basis for technical, economical and environmental appraisal and to establish boundary conditions for the works. **Fig 7.1** shows a conventional activated sludge plant, with primary sedimentation, activated sludge treatment and final clarifiers.

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NOTES

1. This drawing is the property of RPS-MCOS Ltd., it is a confidential document and must not be copied, used, or its content divulged without prior written consent.
2. All Levels refer to Ordnance Survey Datum, Malin Head.
3. DO NOT SCALE, use figured dimensions only, if in doubt ask.

No.	Date	Dr.	Chk.	Amendment / Issue	App.
D01	July '04			DRAFT ISSUE	PBT

Drawn by:	M.M.	Job No:	MDW0135
Checked by:	P.T.	File No:	MDW0135SK0007
Approved by:	P.T.	Drg. No:	Rev:
Scale:	1:1000 @ A3	Fig. 7.1	D01
Date:	July '04		

The typical performance criteria and requirements are summarised in **Table 7.2** and in detail in Appendix C and are briefly described as follows:-

- **Primary settlement;** for plants over 5,000 population equivalent, it is considered appropriate to incorporate primary sedimentation with associated sludge stabilisation. Primary sedimentation tanks, in this case would typically require two 18.5m diameter tanks in Phase 1, duplicated in Phase 2 to limit the upward flow-rate to 1.2m/hr and to reduce the BOD_5 load by approximately 30%. The primary sedimentation tanks are likely to be circular hopper bottom tanks with half-bridge scraper mechanisms to remove and concentrate the sludge in a circular sump for extraction and treatment. The extraction of primary sludge should be in a closed system to prevent release of foul odours
- **Activated sludge;** the principal treatment unit could be an activated sludge system based on extended aeration with approximately 10 hours storage at Dry Weather Flow. This should ensure removal of 90% of BOD_5 and suspended sides complying with the specified standard. The plant could be modified in the future to incorporate nitrification/denitrification if deemed necessary
- **Final settlement clarifiers;** using a loading rate of 1.0m/hr, 2 x 20m diameter tanks of similar configuration to the primary settlement tanks would be required with facilities for further duplication in phase 2. These tanks would provide for consolidation of the secondary sludge, which would be recirculated to the activated sludge tank. Facilities for wasting surplus activated sludge would be incorporated and this would be combined with the primary sludge for further treatment

Table 7.2 Treatment Process Summary – Conventional Design

Unit	Criteria	Phase 1	Phase 2
Storm Water Balancing	2 hours x DWF	400m^3	400m^3 added
	300 l/s Overflow Capacity	600mm Overflow pipe	
Screening Plant	6mm at 0.5 m/s	200 l/s Unit & Bypass	200 l/s Unit
Aerated Grit Trap	2 minutes	20m^3 Unit	-
Flow Measurement	Flume	Up to 360 l/s	-
Primary Settlement	1.2m/hr	2 x 187.5m∅ Tanks	2 x 17.5m∅ Tanks
Activated Sludge	MLSS = 3500 mg/l BOD_5 = 945 kg/d F/M = 0.15 O_2 Ratio 2.5:1	Vol. = 1620m^3 O_2 = 96kgs/hr	Duplicate
Final Clarifiers	1.0m/hr	2 x 20m ∅	2 x 20m ∅
Dewatering Plant	20% Dry Solids	500kgs D.S./hour	Possible Duplicate
Disposal Unit	2 days sludge	20m^3	40m^3

Provided primary sludge is drawn off in a closed system and channels and surfaces are maintained clean, this plant should not produce unacceptable odours at or in the vicinity of the plant. With diffused aeration and mechanical mixing systems, the operation of the activated sludge plant can be optimised to suit the actual loadings from day to day, including seasonal variations and the affects of weather conditions such as temperature. Online monitoring would be incorporated to assist in process control (suspended soils, MLSS, dissolved oxygen etc).

7.2.3 Sludge Disposal

The objective of sludge treatment is to achieve stabilisation by digestion of the putrescible element, destruction of pathogens and substantial reduction in volume to make it suitable for re-use or disposal. The Sludge Management Plan for County Wicklow recommends that sludge treatment hub centres be located at Wicklow and at Greystones WWTW, however the plant at Greystones is a stand-alone plant and will not accept imported sludge.

Dewatering facilities will be incorporated into the design of the Leamore WWTW with the dewatered sludge then transferred by road to Wicklow hub centre for treatment and disposal.

As a minimum, the following facilities are required in the phase 1 development of the plant:-

- The provision of effective de-watering plant, either beltpress or centrifuge technologies, to produce a minimum 15% solids concentration cake, suitable for transportation offsite. This plant would require holding tanks, positive displacement pumps and polyelectrolyte conditioning for effective de-watering. The stage 1 throughput (22,500 PE) is estimated at 2000 kg dry solids equivalent per day
- A disposal unit or container for a minimum of two days sludge should have the capacity of 20m³ volume in phase 1 and double that capacity in phase 2.

The design of these sludge treatment elements must avoid open surfaces, whereby foul odours would be released to the atmosphere. This calls for a compact design, building enclosure and air extraction and treatment, in order to meet the odour control standard considered appropriate.

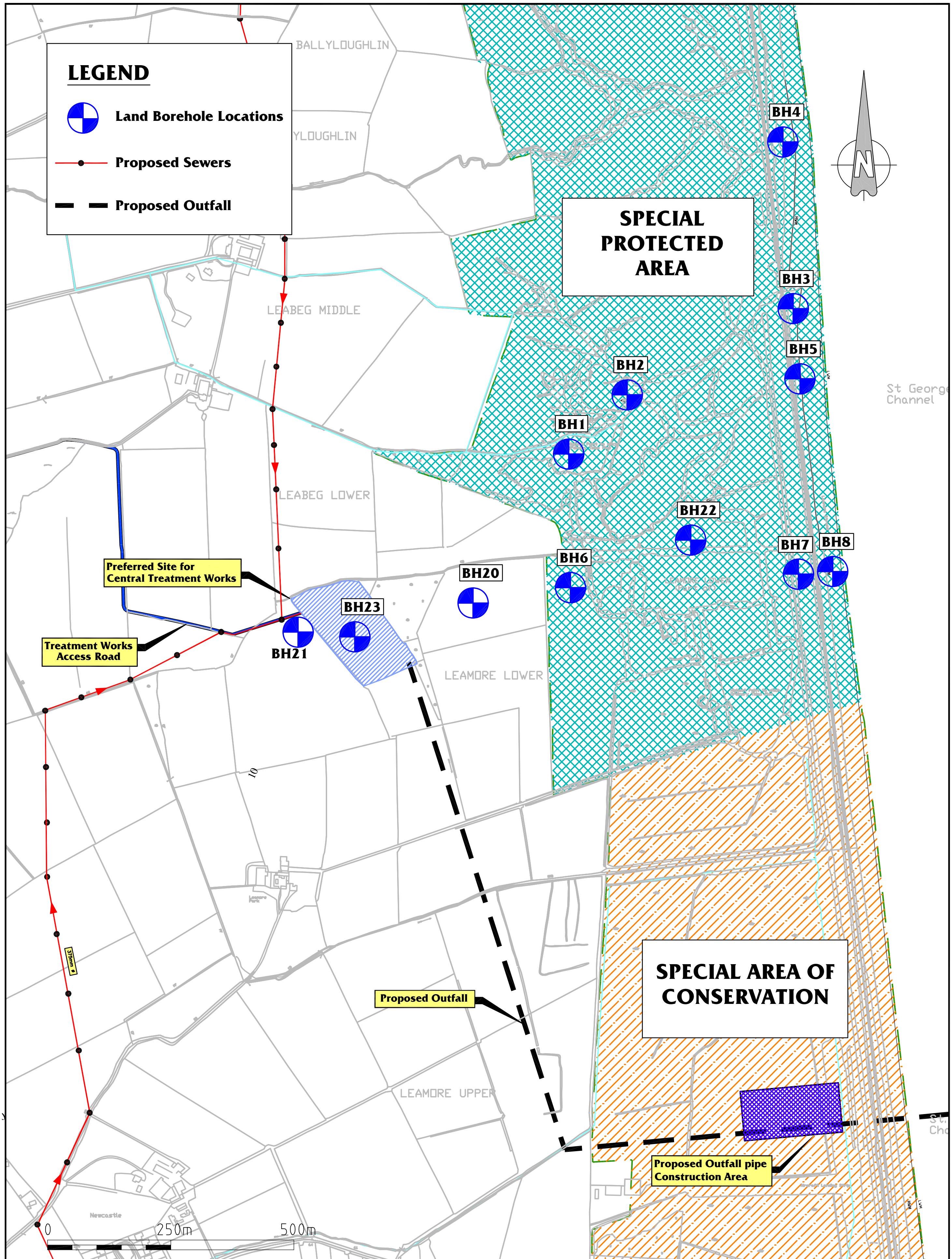
7.2.4 Ancillary Works

Apart from the foregoing treatment elements, the following ancillary works are required at the treatment plant:-

- Development of the access road from the public road to the plant as indicated in **Fig. 5.1**
- Secure fencing to site boundaries and entrance gate with circulation roads and pathways throughout the site
- Provision of services including power, telephone, site drainage, water supply to meet the needs of the site
- Landscaping plans to improve screening to the site boundaries in order to preserve amenity
- Odour treatment by fixed media or biofilter technology to meet the air quality standards required within the site and in its vicinity

7.3 SITE INVESTIGATION

In the preliminary investigations, a number of boreholes and trial pits were carried out in the vicinity of the treatment plant site and at the Kilcoole Marshes at the locations shown in **Fig. 7.2**. The results indicated the following:-



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			Checked:	P.T.	File Ref.	MDW0135SK0008D01
		Title:	Approved:	P.T.	Fig No.	Rev.
		Land Borehole Locations	Scale:	1:10,000 @ A4	Fig. 7.2	D01
			Date:	July '04		

- **Kilcoole Marshes (BH. 1, 2, 22)**; Soft overburden strata with a top layer of soft fibrous silt some 2m thick overlying strata of silty clays, sands and gravels. BH. 2 showed a peat layer at 3.6 - 4.0m. BH. 22 showed sandy gravel to 10m with an intermediate silty sand layer
- **Treatment Plant Site (BH. 6, 20, 21, 22);** Sandy clay overburden on alternative sandy gravel and clay strata to 10m with water at 1.8m (BH. 6). Occasional fine sand strata. No rock encountered to 14m (BH. 20, 21). Trial pits confirmed silt overlying gravel with rapid collapse in water/gravel zone
- **Foreshore Area (BH. 3, 4, 5, 8)**; dense fine to coarse rounded gravel overlying soft silt to 7.0 - 7.5m on dense sandy gravel. Silt strata very weak on firm gravel at depth.

These results indicated satisfactory foundation conditions for works subject to systematic support to excavations and provision for water control at depths below 1.5-2.0m. The soft strata underlying the beach indicate the need for special measures in tunnelling which may include ground treatment, full face support and possible use of tunnel boring techniques. In light of these conditions, the site is confirmed as suitable with a need for well-controlled excavations and ground water control.

7.4 ENVIRONMENTAL ASPECTS

An odour dispersion modelling study was carried out for the development of the treatment plant site by Aquavarra Research Limited. Setting an odour threshold of 1 OU/m³ (odour unit), the maximum radial spread in the predominant east-west directions were calculated as follows:-

- **Without treatment;** from 375m for 2% exceedance of the threshold to 550m for 0.5% exceedance
- **With odour treatment;** from 110m for 2% exceedance to 230m for 0.5% exceedance.

Without odour control and treatment, this could result in marginal nuisance at the nearest residential property to the site. With odour treatment covering the inlet works, sludge thickening and storage areas, the risk of odour nuisance beyond the site boundary can be practically eliminated

A visual assessment of the plant has also been carried out by Paul O'Toole, Architects. This assessment recognises that the existing buildings in the rural area in which the plant is located comprise farmhouse buildings and metal clad outbuildings. This arrangement and vernacular building types are suggested as appropriate, therefore, for the development of buildings in the plant. The existing wooded areas, together with additional boundary woodland, would provide effective screening which is shown as rendering the plant discreet from the various potential viewpoints.

The receiving water standards and impacts relating to the outfall are discussed in detail below within Chapter 8. An overflow pipeline is necessary to the local watercourse, draining to the salt water and inter-tidal section of the Kilcoole marsh. This overflow would operate very infrequently under extreme storm conditions and with the protection of storage and screening at the plant. For this very unusual event, the environmental impact in Kilcoole marsh would be negligible, particularly having regard to the relatively good state of the marsh waters at present for more significant loads and the daily turnover of the salt water from the marshes to the Irish Sea.

The proposed plant is located in an agricultural area relatively removed from human settlement apart from two isolated farmhouses which are over 300m from the site boundary. The site selection, development and environmental mitigation measures are all designed to ensure that the environmental impacts of the proposed development will be minor.

Construction impacts can also be moderated by good site practices and some mitigation measures, for example:

- Tunnelling to limit impacts on the railway line and neighbouring dunes
- Use of sedimentation to reduce particulate solids in groundwater discharge to marsh waters
- Seasonal limitation on beach foreshore activities to minimise wildbird impacts
- Upgrade local access road to accommodate construction traffic
- Good practice standards for noise and vibration impacts.

7.5 SUMMARY

To summarise, a central treatment plant is proposed at Leamore to cater for the Newtownmountkennedy/Kilcoole catchment. The site and the proposed treatment facilities have been selected to ensure that adverse environmental impacts are minimised and are not significant. The plant can be developed in stages to suit the loading from the catchment with disposal of effluent through a marine outfall to the Irish Sea.

To cover the various requirements, a surrogate standard of 100 faecal coliforms per 100ml is taken.

Marine modelling studies have been undertaken on this project with this objective standard and including interaction from existing outfalls at Bray, Greystones, Wicklow and further afield. The objective is a protection of water quality for recreational and bathing water use and for the protection of all marine habitats in the area.

At the same time, the construction of an outfall at Kilcoole must also take account of the following:-

- Outfall design having regard to bed bathymetry and geotechnical conditions
- Protection of beach habitats and taking account of bed mobility
- Pipeline fabrication and installation facilities

8 PROPOSED MARINE OUTFALL

The following analysis of the proposed marine outfall pipeline has been taken from the 1999 Preliminary Report and was assessed upon those loads calculated within that report. The range of loads estimated within the 1999 Preliminary Report and this contemporary update is presented in **Table 8.1** below.

Table 8.1 Comparison between outfall flow rates assessed in 1999 and 2004

Stage	Design Load (P.E.)	Max outfall rate (1999)	Max outfall rate (2004)	Comments
1	15,000	120	N/A	
2	22,500	180	159	Secondary Treatment
3	45,000	360	318	Ultimate Design Capacity

As can be seen by the table, the range of flows to be assessed are similar, therefore the assessment presented within the 1999 Preliminary Report and reproduced here, is still valid. The main difference to be noted in the design of the outfall would be the reduced power requirement for pumping the treated effluent through the outfall pipe.

8.1 OUTFALL LOCATION

In 1992-93, preliminary investigations were carried out for an outfall from the proposed treatment plant at Leamore directly to the Irish Sea. These investigations included a number of marine boreholes, marine modelling and calibration surveys (dye surveys, drogue surveys and current speed measurements).

Arising from the designation of the Kilcoole marshes as a Special Area of Conservation supported by ecological surveys which have identified areas of particular sensitivity from the point of view of wild bird populations (notably the little tern), it has been necessary to revise the route to a location approximately 1km to the south (outfall no. 2, **Fig 8.2**). In light of the environmental studies, this route is considered to have a significantly less adverse impact in environmental terms and therefore is more likely to succeed as a viable option.

This chapter examines the environmental and physical aspects of the outfall site, its design and operational characteristics. In designing the outfall the relevant standards are summarised in Table 8.2

Table 8.2 Relevant Standards

Ref.	Description	Comment
91/271/EEC	Urban Wastewater Treatment Directive	25/35 Effluent Standard from 2005
79/923/EEC	Shellfish Waters Directive	Bacterial/Metals Standards
76/160/EEC	Bathing Waters Directive	Bacterial Limit and Guideline Standards
NLV (1979)	D.O.E. Bathing Water Standards	
Shellsan	Dept. of Marine, Shellfish Waters, Hygiene Standards	
Blue Flag	EU Sponsored Beach Monitoring Programme	Equates to Guideline Standards

Note: Desirable Standard of faecal coliform level below 100 per 100ml in all conditions, including combined impact of outfalls at Bray, Greystones, Wicklow etc.

8.2 ENVIRONMENTAL STUDIES

Comprehensive hydrographic, geotechnical and environmental studies were carried out in 1992 and updated in 1999 to facilitate the technical and environmental assessment of the proposed outfall. The study area is shown in Fig 8.2. These studies had the following objectives:-

- To provide comprehensive hydrographic data for the routing and design of a marine outfall
- To assess the environmental baseline conditions along the land and foreshore pipeline sections
- To provide preliminary geotechnical data along the pipeline route
- To examine the dispersion of effluent in the marine waters at various discharge locations including the development of a calibrated model which could reliably predict these affects for a full range of tidal and weather conditions. The technical studies prepared by Irish Hydrodata Limited and their associated specialist contractors and consultants are provided in technical reports attached to the Environmental Impact Study.

The baseline environmental studies of the marine waters and benthos are summarised as follows:-

- Ecological benthic surveys showed a number of community types associated with the gravel/sand/silt matrix. Inshore, the community was typical of gravel – stone substrates, including a large number of attached and mobile epibenthic species. Further offshore, the substrate consisted of mobile sand waves, with a typical low diversity community present. The possible effects of treated wastewater discharge on these communities would only be discernible on a local scale, if at all, due to the high current regime in the area. The diversity of filter-feeders could possibly be slightly enhanced, due to the increased availability of food particles
- Water quality conditions in the marsh waters vary considerably depending on whether “The Breaches” are open or closed and the state of the tide. With “The Breaches” opened, measurements indicated BOD_5 levels in the range 2-4mg/l with moderate levels of phosphates and nitrates. When they are closed due to strong south-easterly winds, the marsh volumes will have retention times ranging from 1 to 10 days or more, during which changes in water quality could be anticipated associated with algal growth. The effect of the proposed scheme, however, will be to substantially remove the pollution load from the marshes, apart from very infrequent stormwater or emergency overflows
- Bacteriological analysis of marine waters at two sites on the foreshore, close to the outlet from the marshes, indicated relatively low levels of bacteriological contamination. Nevertheless, elevated total and faecal coliform counts were identified on 9th November, 1992, which are evidence of some degree of impact from the sewage load entering the marshes, upstream
- The shoreline fronting Kilcoole marsh forms a typically steep coarse beach similar to that extending along the coastline from Wicklow Town to Greystones. Boreholes have shown fine to coarse rounded or sub-angular gravel overlying soft silt strata for some 3m and 4m respective, typically. As a whole, this shoreline is relatively stable, though localised areas of erosion of up to 1.5m per annum have been recorded. Storm wave action associated with North-east, East and South-east winds would cause significant mobility of the beach sands outside the railway line of Kilcoole marsh. This has the affect of closing “The Breaches” from time to time, effectively impounding the marshes. The offshore limit of significant sediment movement was considered from the studies to coincide approximately with the –6.0m contour, which is approximately some 160m from the railway track. Therefore, it is prudent to regard the initial 200m strip of foreshore as having a significant degree of mobility with the seabed relatively stable beyond that limit
- Samples of mussels were taken from three seabed dredges and analysed for total and faecal bacterial levels. The sites were between 600m and 1250m from the shoreline and indicated that the samples would be considered fit for human consumption without the need for depuration or processing in accordance with EC Directive 91/492/EEC. A more

extended sampling period would be necessary to draw firm conclusions about the microbiological condition of shellfish stock, however. Nevertheless, these results point to good water quality conditions for shellfish in the area.

To summarise, baseline surveys indicate clean water quality and ecological conditions in the marine waters off Kilcoole marshes. Surveys of the surface streams and of the marsh waters themselves confirmed the impact of upstream sewage discharges, though the water quality has recovered significantly by the time it reaches the marshes proper. Minor contamination was identified in the shoreline marine waters close to the outlet from the marshes. The principal issues arising for the proposed scheme, therefore, are:-

- The optimum location for effluent discharges in order to protect water quality in the marsh
- The impact of beach mobility between the railway line and a point approximately 200m offshore, for the construction and general stability of the outfall
- Minimising the impact on the terrestrial and dunes ecologies at the crossing point
- The scheme should have a significantly beneficial effect on water quality in Kilcoole marshes by removing the existing foul sewerage discharges, with only periodic stormwater overflows occurring in the future

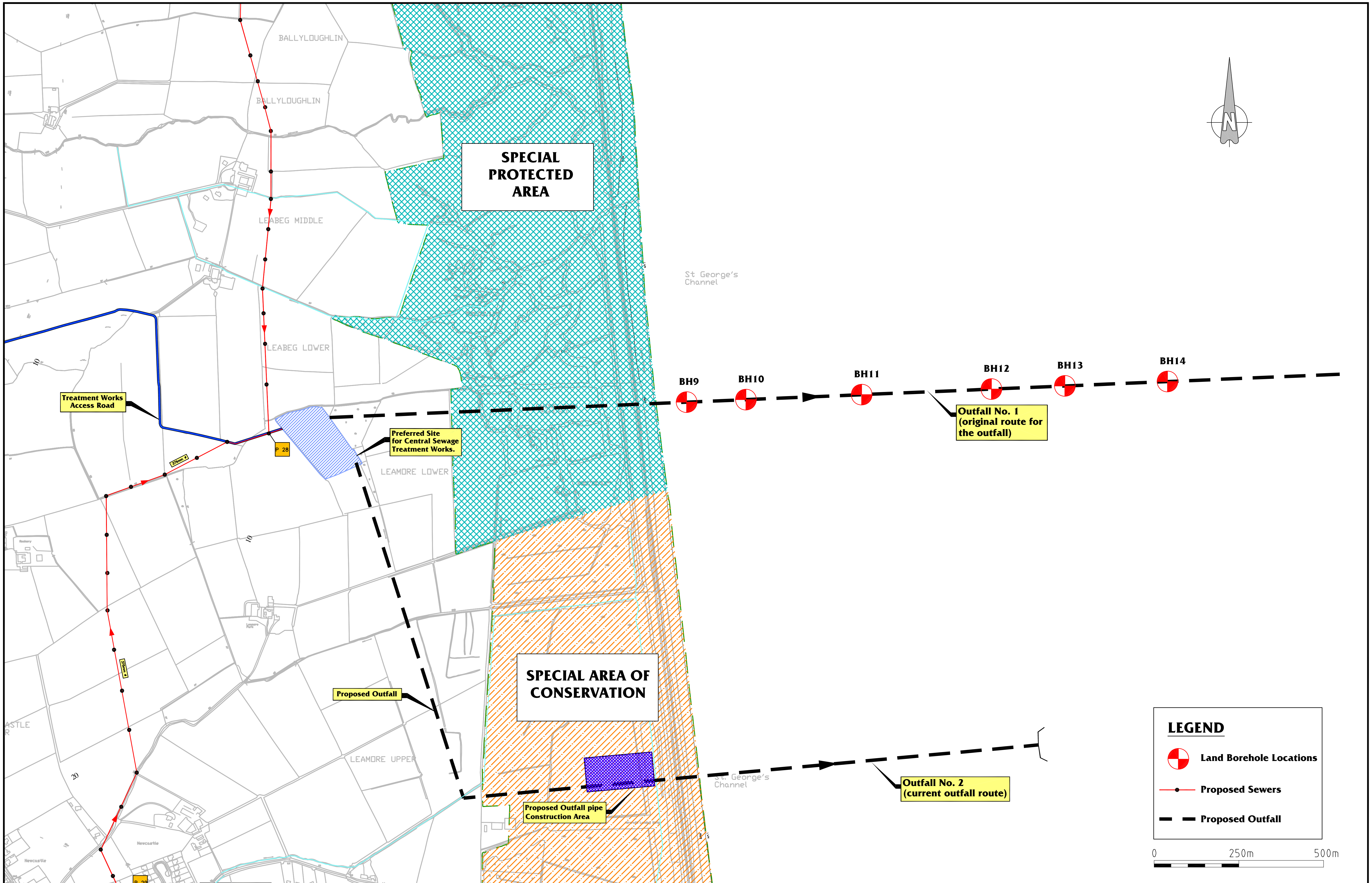
8.3 MARINE GEOTECHNICAL CONDITIONS

A total of nine marine boreholes were carried out along the original route selected for the outfall at the locations shown in **Fig. 8.1**. (directly offshore from the treatment plant site). Briefly, these boreholes indicated the following:-

- **Borehole No. 9;** 90m offshore at seabed level –5.0 showed silty fine to coarse sandy gravel with occasional thin layers of sandy clay overlying stiff silty clay at 5m depth
- **Borehole No. 10;** 265m offshore at –8.0m depth, showed firm grey silty clay and sandy gravel of 1m depth overlying brown silty clay with some sand and coarse gravel
- **Borehole No. 11;** 607m from the shoreline and –9.8m depth, indicated shallow layers of fine to coarse gravel and silty clay overlying fine to coarse sand with some silt and gravel to 4.5m depth overlying stiff sandy clay
- **Borehole No. 12;** 990m offshore at approximately –11.8m depth, indicated soft grey silty clay to 2.2m depth overlying medium to coarse sandy gravel
- **Borehole No. 13;** 1207m offshore at –12.9m depth, indicated medium to coarse sandy gravel, ultimately changing to coarse sand below 2.7m depth
- **Borehole No. 14;** at 1510m offshore and –15.1m depth, indicated medium to coarse sandy gravel over fine to medium gravelly sand to 3.9m, overlying silty clay at 3.9m with silty fine sand and fine sandy silt to stiff silty clay at 6.2m

These geotechnical conditions represent a generally suitable environment for the construction of a marine outfall subject to the following provisos:-

- The outfall should be relatively deep in order to cross under the railway line at the foreshore and this will ensure that it is below the levels of the mobile beach materials in the upper sections of the beach. Soft silt is indicated underlying the gravels in this area requiring special tunnelling techniques
- Generally, the pipeline should be suitably weighted in order to ensure stability against buoyancy and the action of marine currents



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No.	Date	Dn. / Chk	Amendment / Issue	App.
D01	July '04	CB / PBT	DRAFT ISSUE	PBT

Project: Newtownmountkennedy & Kilcoole Sewerage Scheme

Title: Location Plan of Outfall Options

Drawn by:	M.M.	Job No:	MDW0135
Checked by:	P.T.	File No:	MDW0135SK0009D01
Approved by:	P.T.	Drg. No: Fig. 8.1	Rev: D01
Scale:	1:10,000 @ A3		
Date:	July '04		

- It would be appropriate to backfill over the pipeline in a stable rockfill material, capable of resisting bed forces due to vigorous tidal currents during storm conditions

In summary, the dense granular soils and stiff gravelly clays will provide a competent founding medium for the pipeline. The excavation of the alluvial soils and the issues of trench stability and erosion will be matters for Contractors to consider based on the geotechnical information provided. Softer strata close to the shoreline and under the railway embankment will need careful consideration in the design of the tunnel crossing of the railway.

8.4 NUMERICAL MODELLING OF MARINE DISCHARGES

Numerical modelling of the marine environment was carried out to facilitate the selection and assessment of effluent discharges from a variety of outfall lengths. The extent of the area considered in the modelling studies was sufficient to include the combined impacts of the existing outfalls serving Wicklow, Greystones and Bray (**Fig. 8.2**). Note was also taken of the Shanganagh outfall, to the North of Bray with its significant effluent load.

Extensive field surveys were carried out to enable the marine model to be developed and calibrated. These surveys included the following:-

- Bathymetric surveys in the vicinity of the outfall to confirm sea-bed profile and levels
- Measurement of current speed and direction at fixed sites for calibration purposes
- A number of drogue tracking surveys were carried out to confirm speed, direction and travel journey with respect to outfall sites. **Fig. 8.3** shows the typical results of these surveys
- Dye release surveys were similarly carried out with concentration measurements to provide calibration data for the dispersion modelling. Typical results of the dye release surveys are illustrated in **Fig. 8.4**.

The detailed results and interpretative reports resulting from these surveys are included in Technical Appendices issued in support of the Environmental Impact Statement. These results were used in verification of the models described hereafter.

A 2D coastal dispersion model was established using the following data:-

- Bathymetric data taken from Admiralty Chart data and related to Irish National Grid (ING) co-ordinates, supplemented by local field data
- Tidal height data used measured data from Wicklow, Greystones and Kilcoole and from admiralty type tables
- Data on currents in the nearshore area covered by the three outfall survey reports previously carried out by Irish Hydradata Limited in relation to Bray, Greystones and Wicklow Town projects. These were supplemented by the direct reading surveys at fixed stations and drogue tracks which gave the speed between successive fixes. Further offshore, current data was taken from Admiralty Charts
- Wind conditions for a worst case analysis were taken as equivalent to a 7m/s onshore wind which is considered to have an exceedance of approximately 1%, which would comply comfortably with the 5% failure limit set in the Bathing Water Regulations.

In addition to the 2D model, a 3D coastal circulation and dispersion model was established to examine specific cases (Kilcoole outfall and onshore wind) in order to confirm the validity of the 2D results. The calibrated 3D model provided estimates of effluent concentrations at different layers within the water

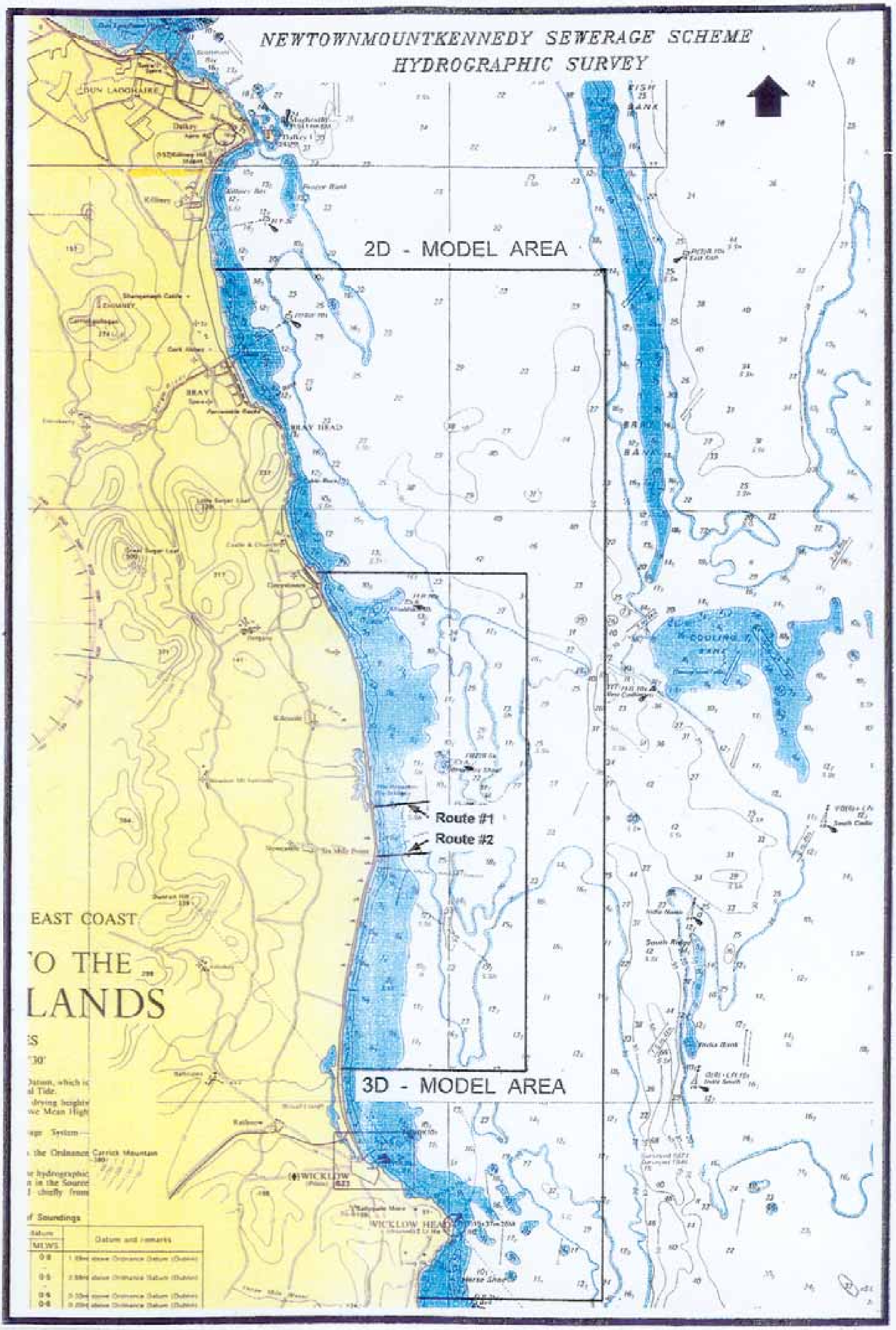


Figure 6.2
Outfall Model Survey Area

NEWTOWNMOUNTKENNEDY SEWERAGE SCHEME - HYDROGRAPHIC SURVEY

2-D MODEL

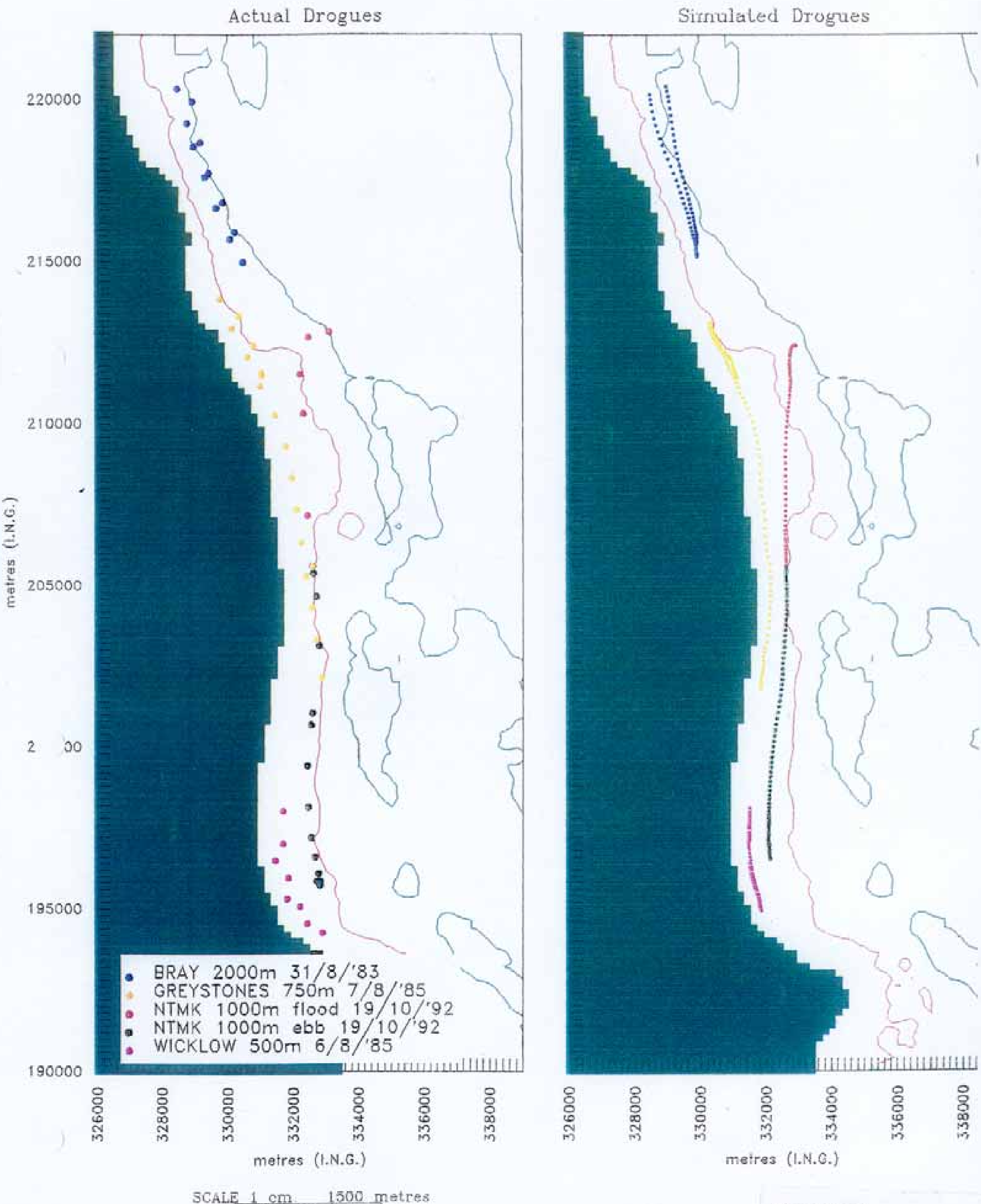


Figure 6.3
Drogue Survey Result

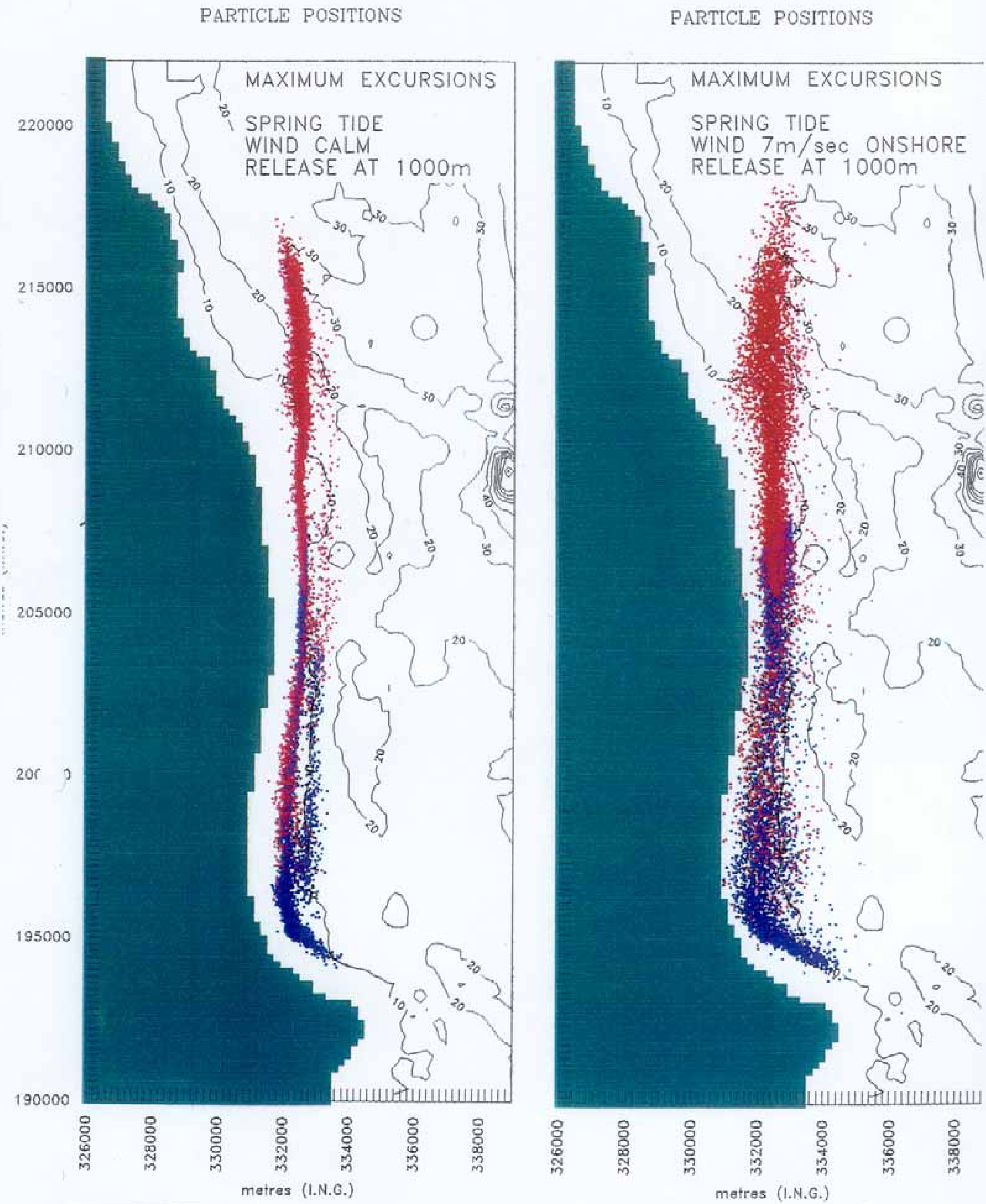


Figure 6.4
Dye Release Survey Results

column, whereas the 2D model provides only depth averaged estimates of concentrations at each location in plan. Both models were calibrated using the field data summarised above.

Faecal coliform concentrations were used as the contamination indicator with a value of 100fc/100ml as the target standard under adverse conditions. The 2D and 3D model results were consistent, confirming the overall reliability of the predictions. A maximum outfall flow rate of 360 litres/second (for 45,000 P.E.) was used, assuming normal secondary treatment.

For the Kilcoole outfall, the modelling indicated that a 1000m long outfall would result in shoreline coliform concentrations well below the 100fc/100ml target. The values would be negligible at the shoreline for calm conditions and for adverse onshore wind, the peak values would remain below 50fc/100ml. An 800m long outfall gave marginally higher values, remaining within the target standard.

When the combined affect of the proposed and existing outfalls was considered, appreciable increases in concentration were noted. In calm weather, peak levels were indicated at 70fc/100ml with onshore wind conditions giving rise to maximum value of 120fc/100ml. The Greystones outfall is primarily responsible for the increased concentrations in the Kilcoole area. Modelled concentrations of faecal coliforms for the combination of outfalls and neap tide conditions are illustrated in **Fig. 8.5a** and **8.5b** for model runs of 18 and 24 hours respectively. These graphically illustrate the results in terms of concentration bands.

The seabed area of Kilcoole contains several important seed mussel shellfish beds and is also fished for mature whelks. The field work and model predictions have shown that the plume from the proposed outfall will remain relatively compact and travel along a line parallel to the coast. Simulations of the vertical mixing in the far-field (greater than 1500m from the discharge point) suggests that bacterial concentrations near the seabed and along this line will not normally be greater than 50fc/100ml. Higher levels may occur closer to the outfall for short periods during the tidal cycle. However, as these have no affect on seed mussels, which are harvested for re-laying in other waters, they are not considered significant in determining the outfall length.

The near field dynamics of the effluent plume were considered using a jet discharge model and indicated that initial dilutions will be approximately 1 in 450 for mean flow conditions. For short duration slack water conditions, approximately 1 in 60 dilutions would be achieved over short periods.

In summary, the modelling studies indicate that a 1000m long outfall will perform satisfactorily under calm and adverse wind conditions and taking into account the combined effects of other outfalls at Greystones, Bray and Wicklow Town. Under most weather conditions, shoreline coliform concentrations will not exceed 50fc/100ml and during calm weather conditions no contamination will be recorded within 200-400m of the coast. While an 800m long outfall would also be generally satisfactory having regard to the standard, the longer length extends further east than the track of the Greystones plume, thereby minimising the combination effects. The 1000m outfall length, therefore, is recommended as providing an increased factor of safety.

The model predictions are based on a decay time of 12 hours which is realistic for Irish Coastal Waters, though a lower value could be expected during warm and sunny summer conditions. This is a conservative approach. Onshore wind conditions are considered for a fairly extreme situation (7m/s wind) which would occur for less than 1% of the time.

Water depth at the 1000m discharge location is approximately 12m at mid-tide. A jet dilution model indicates that an initial dilution of 1 in 50 can be achieved with a ten port diffuser at slack water. Slack water periods are relatively short and speeds below 0.1m/s are normally only experienced for about 20 minutes. Under mean flow conditions of 0.4m/s, the predicted dilution is 1 in 450. These conditions would be very satisfactory.

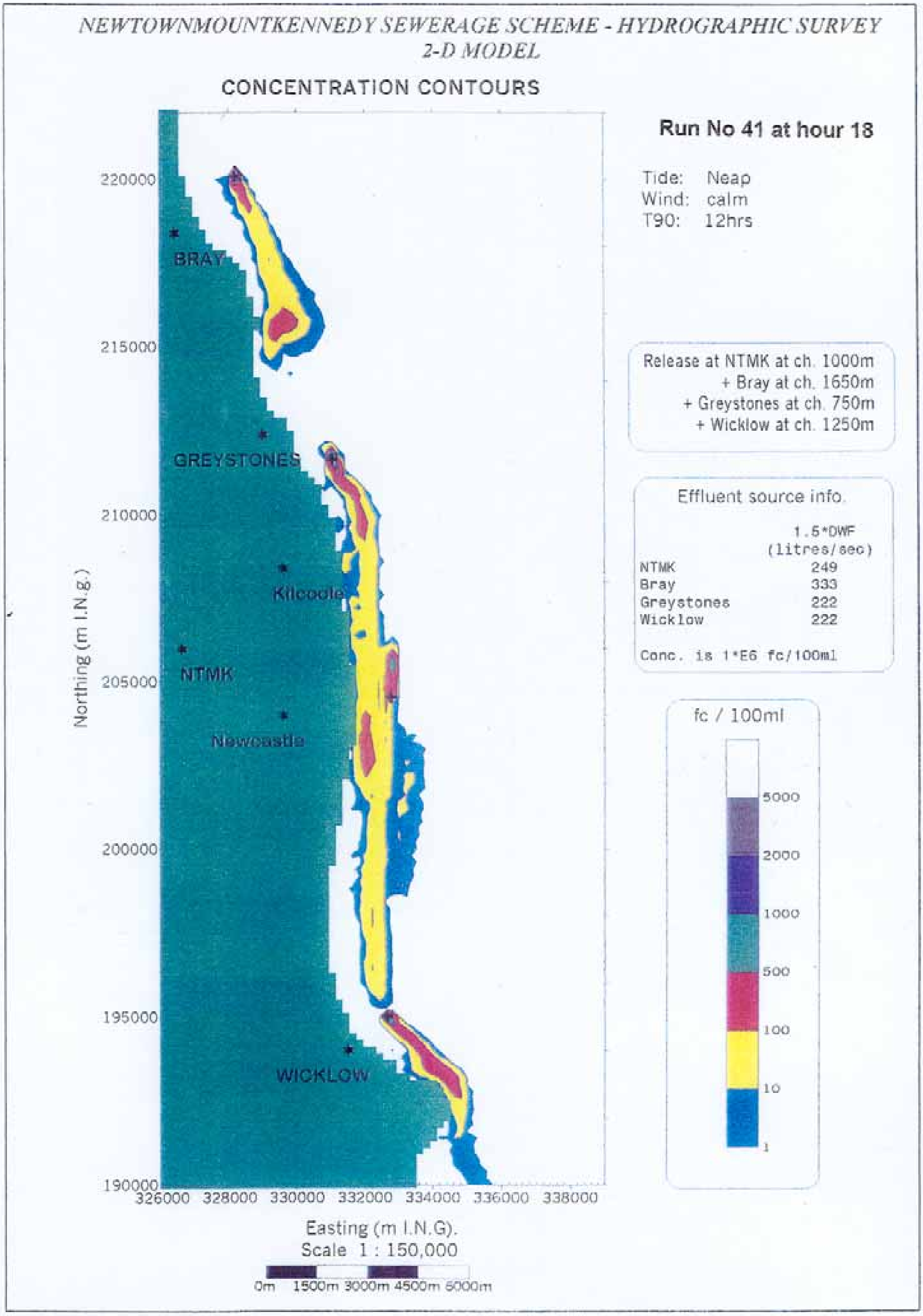


Figure 6.5a
Modelled F.C. Concentrations for Combined East Coast Outfalls at 18 hours

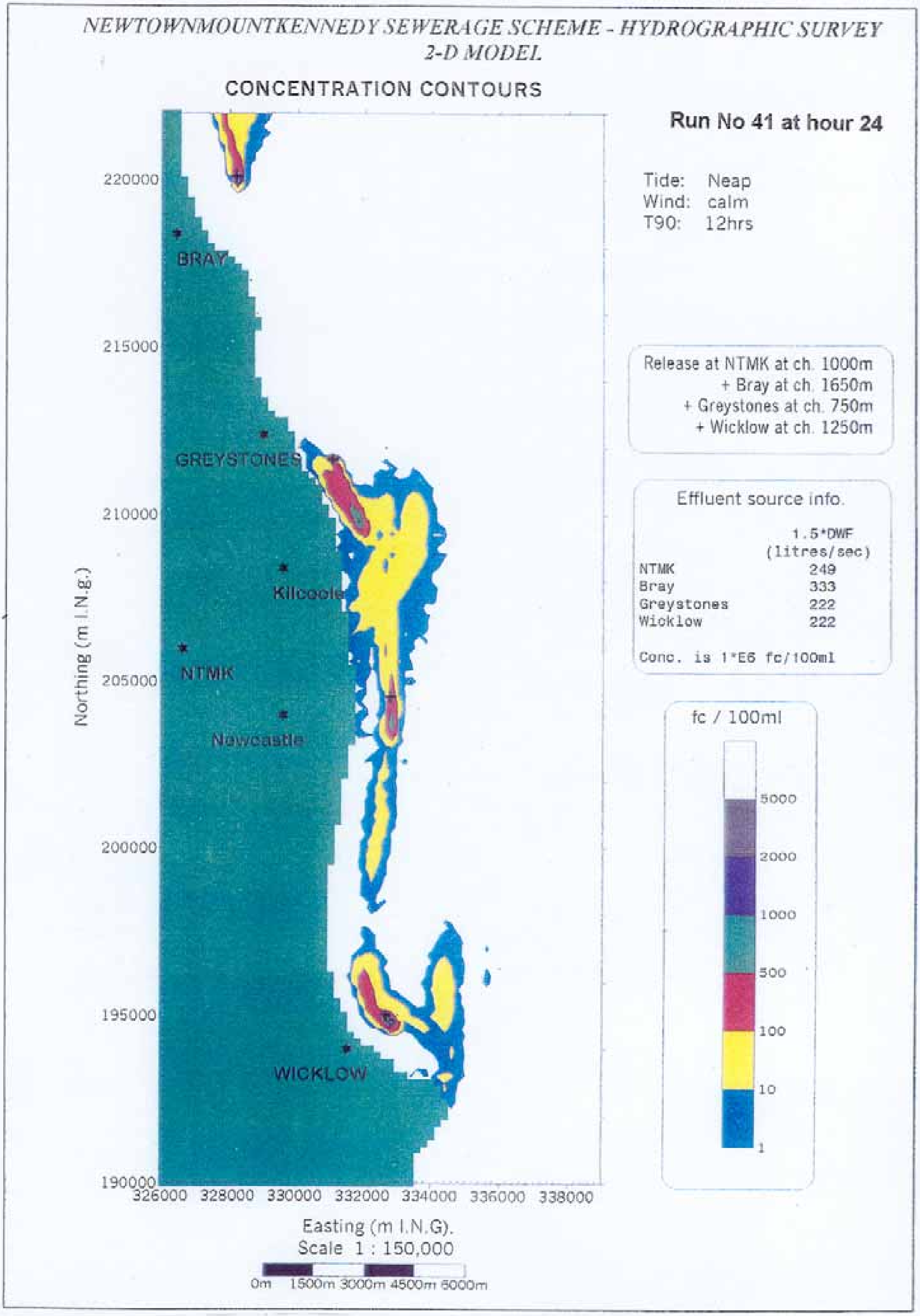


Figure 6.5b
Modelled F.C. Concentrations for Combined East Coast Outfalls at 24 hours

8.5 HYDRAULIC DESIGN OF OUTFALL

The satisfactory disposal of effluent requires a 1000m long outfall from the shoreline discharging through a 10 port diffuser in approximately 12m depth of water at mid-tide. This will give rise to an effluent plume which is predicted to remain reasonably compact and travel parallel to the coast, somewhat further offshore than the existing plume from the Greystones outfall.

The maximum throughput of the Kilcoole treatment plant is estimated at 360l/s, with balancing of excess stormwater inflows in order to limit the outflow to this figure. An emergency overflow will be provided in parallel with the landward section of the outfall as far as the Newcastle stream draining to Kilcoole marsh. This overflow would operate only in extreme conditions or in an emergency.

In designing the outfall, the following parameters apply:-

- Peak flow ranging from 180l/s in stage 1 to 360l/s in stage 2
- Overall length 3,000m
- Roughness (ks) value = 0.3mm
- Diameter options = 500, 550 and 600mm
- Maximum/extreme tide level = 2.7m OD

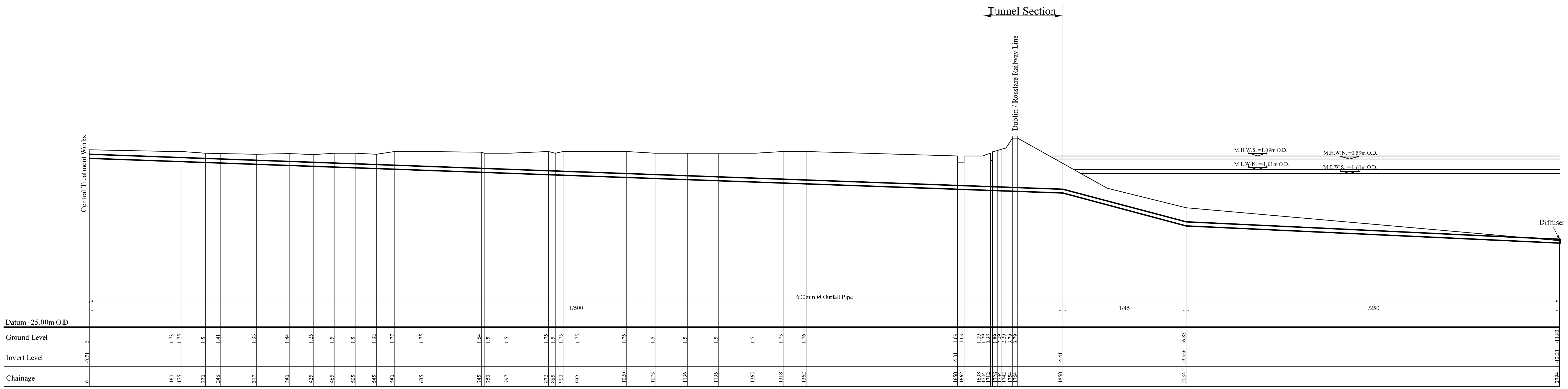
For these options, the hydraulic conditions are summarised in **Table 8.3.** The longitudinal profile of the proposed outfall is shown in **Fig. 8.6.**

Table 8.3 Outfall options (500,550, 600mm diameters)

Discharge (l/s)	Head (m)			Power (kW)		
	500	550	600	500	550	600
120	5.9	4.3	4.5	9.9	8.5	7.6
180	8.7	6.9	5.8	22.1	17.3	14.6
240	12.7	9.4	7.5	42.7	31.6	25.2
280	15.9	11.5	8.9	62.5	45.0	34.9
320	19.7	13.8	10.5	88.2	62.0	47.1
360	23.9	16.5	12.3	120.5	83.4	62.2

A 600mm diameter outfall can cater for the full range of discharges with modest pumping head (12.3m). This could be satisfied by an elevated flushing tank to which effluent would be pumped on site, which could then discharge by gravity through the outfall. This is the maximum practical height of discharge column which could be used having regard to visual and aesthetic factors. The advantage of this system is that the pumps would elevate the discharge locally to the level required to cater for the flow and tidal conditions as they exist from time to time. The velocity range would be 0.65m/s for the stage 1 maximum discharge of 180l/s, increasing to 1.3m/s at the maximum ultimate output of 360l/s. The maximum power requirement would be approximately 62kW, with variable speed units employed to deal with the range of duties arising from time to time and over the life of the plant.

A 550mm rising main would also perform satisfactorily, with a maximum pumping head of 16.5m and a maximum power requirement of approximately 83kW. The peak velocities would be in the range



Longitudinal Section of Sea Outfall

Client: WICKLOW COUNTY COUNCIL Comhairle Chontae Chill Mhantáin	RPS MCOS **RPS-MCOS Ltd., West Pier Business Campus, Dun Laoghaire, Co. Dublin, Ireland.** T: +353 1 288 4499 - F: +353 1 283 5676 E: rpsmcos@rpsgroup.ie W: www.rpsmcos.ie	**NOTES** 1. This drawing is the property of RPS-MCOS Ltd., it is a confidential document and must not be copied, used, or its content divulged without prior written consent. 2. All Levels refer to Ordnance Survey Datum, Malin Head. 3. DO NOT SCALE, use figured dimensions only, if in doubt ask.	Project: **Newtownmountkennedy & Kilcoole Sewerage Scheme**	Title: **Longitudinal Section of Proposed Outfall**

No.	Date	Drn.	App.	Amendment / Issue	App.
D01	July '04	SB	PBT	DRAFT ISSUE	PBT

Drawn by:	M.M.	Job No: MDW0135	
Checked by:	P.T.	File No: MDW0135SK0010D01	
Approved by:	P.T.	Drg. No: Fig. 8.6	Rev: D01
Scale:	N.T.S.		
Date:	July '04		

0.76m/s initially, increasing to 1.5m/s ultimately. This height of tower would be excessive at the site and an alternative arrangement would be necessary involving direct pumping to the outfall. Similarly, for a 500mm pipeline, the head would increase to approximately 24m with a power requirement of up to 120kW and a velocity range from 0.92 to 1.85m/s.

The outfall diameter options, therefore, range from 500mm diameter minimum up to 600mm or more. Additional pumping costs associated with the smaller main are likely to be modest, given that the peak flow conditions only arise periodically. On the other hand, the marginal cost of the outfall for this range of pipe diameters is also likely to be very small.

From the point of view of maximum operational flexibility, therefore, it is proposed that a 600mm diameter outfall would be used with provision for flushing volumes to ensure occasional high velocity discharges in order to assist in keeping the outfall clear. A 10-port diffuser would be provided at the discharge point at the end of the outfall in approximately 12m depth of water at mid-tide.

Duty and standby variable speed pumps would be installed to deliver 180l/s in the short term with provision for two pumps in parallel to deliver 360l/s. In order to provide standby for the ultimate situation, provision for a third pumping unit would be allowed.

8.6 OUTFALL CONSTRUCTION

The 600mm outfall pipeline from the treatment plant outlet to the Newcastle stream crossing, adjacent to the railway line, would be constructed in conventional open-cut using a pipeline rated for pressure conditions to 7.5 bar. A second pipeline (600mm diameter overflow) would be laid in the same trench to deal with excess storm flows, overflowed from the stormwater balancing tank after screening.

The 600mm outfall pipeline would be laid under the bed of the Newcastle stream in an open-cut construction. Temporary dams would be constructed to either side, with a connecting temporary pipeline to maintain flows. The pipeline would be laid to a thrust shaft between the stream and the railway embankment.

The following sequence of operations would be required for the construction of the outfall pipeline:-

- A man-entry tunnel (900mm diameter) would be constructed under the railway line and continuing under the dunes in the upper foreshore area to a temporary receiving pit on the Kilcoole beach. This would be constructed as a thrust bore operation using suitable high strength pipes. Tunnelling techniques to deal with soft silts and overlying gravels would be required. This may include advance stabilisation, full face support or other measures
- A temporary construction site on the western side of the Newcastle stream/railway line would be required for the duration of the contract, in which the 600mm pipeline would be fabricated in strings, aligned on suitable running tracks with the tunnel and prepared for pulling out to the final position
- A trench would be dredged to the levels and profile indicated in **Fig. 8.6** to accommodate the pipeline. It is likely that this trench would have side slopes in the range 1:3 to 1:5, depending on the soil characteristics, in order to achieve a reasonably stable trench
- When the trench is ready to receive the pipeline, a pulling operation using suitable tugs would be used to winch the pipeline from the fabrication area to the trench. At the beach, the pipeline would be fitted with buoyancy aids in order to reduce the effective weight of the pipeline during the pulling operation. Strings would be added to the pipeline progressively, until the full 1,000m length is launched and in position
- At the head of the outfall pipe, the diffuser would be attached prior to final pull at Kilcoole beach or alternatively installed underwater using suitable jointing techniques

- When the pipeline is in position, the buoyancy aids would be removed and the pipe stabilised at the correct profile and position. A stone backfill would then be placed to surround and cover the pipeline.

Given the tidal environment at the site, physical recovery of the seabed strata would be expected within a relatively short time. Experience would also indicate that the biotic communities would similarly recover within a matter of months.

The pipeline route and construction sites have been selected to minimise adverse environmental impact, particularly on the more sensitive environments in the area. The pipeline is to the south and outside of the Special Protection Area (SPA). Some impacts will be experienced locally on the beach area due to the need for construction plant and some construction operations. However, this would be very localised and would not significantly impact on the sand dunes in the area. At the chosen site, the width of dunes is a minimum compared with that to the north, in particular.

8.7 SUMMARY

To summarise, the effluent from the proposed Kilcoole wastewater treatment plant serving Newtownmountkennedy and the regional area, would be discharged through approximately 3,000m of 600mm outfall pipeline, extending some 1,000m from the shoreline to discharge at approximately 12m water depth at mid-tide conditions. The landward section would be constructed in a conventional trench along the route indicated in **Fig. 8.1**. The marine section would be constructed in a dredged trench by Bottom-Pull Method, with fabrication on land and pulling of the completed pipeline through a specially constructed tunnel under the railway line into position and backfilling below seabed level.

9 COSTINGS

The Capital and Operating Costs for the Scheme are presented in **Table 9.1** below, a further breakdown of these values is provided within Appendix D.

9.1 CAPITAL COSTS

9.1.1 Collection system

The unit rates quoted are based upon 2004 construction estimates.

Table 9.1 Estimated cost for Collection system

Description	Size (mm)	Length (m)	Number (no.)	Rate (€)	Amount (€)
Newtownmountkennedy Sewers					
Area NTMK 1					
Sewers in Roads	225	249		298.00	74,202.00
Manholes in Roads			5	2,200.00	11,000.00
Sewers in Fields	375	120		248.00	29,760.00
Manholes in Fields			4	1,800.00	7,200.00
Sub-total					122,162.00
Area NTMK 2					
Sewers in Roads	200	279		320.00	89,280.00
	225	586		298.00	174,628.00
Manholes in Roads			12	2,200.00	26,400.00
Sewers in Fields	225	75		164.00	12,300.00
	300	872		200.00	174,400.00
Manholes in Fields			11	1,800.00	19,800.00
Sub-total					496,808.00
Kilcoole to Leamore WWTW					
Area KC					
Sewers in Roads	450	465		499.00	232,035.00
	750	1793		729.00	1,307,097.00
Manholes in Roads			28	2,200.00	61,600.00
Decommision Kilcoole WWTW				20,000.00	20,000.00
Sub-total					1,620,732.00

Description	Size (mm)	Length (m)	Number (no.)	Rate (€)	Amount (€)
Newcastle WWTW to Leamore WWTW					
Area NC					
Sewers in Fields	375	1728		248.00	428,544.00
Manholes in Fields			17	1,800.00	30,600.00
Decommision Newcastle WWTW				15,000.00	15,000.00
Sub-total					474,144.00
Kilpeddar P.S to Kilcoole Road gravity sewer					
Area KPGV					
Sewers in Fields	150	200		160.00	32,000.00
	375	2041		248.00	506,168.00
	450	1486		272.00	404,192.00
Manholes in Fields			44	1,800.00	79,200.00
New Kilpeddar P.S.					
Civil Works					60,000.00
M&E works					130,000.00
Decommision Kilpeddar WWTW				15,000.00	15,000.00
Decommision Garden Village WWTW				15,000.00	15,000.00
Sub-total					1,241,560.00
Kilquade Hill estate to Kilcoole Road gravity sewer					
Area KQ					
Sewers in Fields	225	252		164.00	41,328.00
Manholes in Fields			5	1,800.00	9,000.00
Sub-total					50,328.00
Net Total					€ 4,005,734.00
Prelims @ 15%					€ 600,860.10
Sub - Total					**€ 4,606,594.10**
VAT @ 13.5 %					€ 621,890.20
Gross Total					**€ 5,228,484.30**

9.1.2 Treatment Works

These costs have been updated from the 1999 Preliminary Report costs estimates.

Table 9.2 Summary of estimated cost for Treatment Works

Description	Amount (€)
Civil Works	
Buildings	1,037,000
Inlet Works	125,000
Concrete Tanks	984,000
Site Works	670,000.
M&E Works	
Inlet Works	€ 288,500
Storm Tanks	€ 88,500
Aeration Tanks	€ 390,000
Secondary Settling	€ 231,000
Activated Sludge Thickening	€ 75,000
Sludge Thickening	€ 175,000
Flow Control	€ 25,000
Instrumentation	€ 64,000
Miscellaneous	€ 60,000
SCADA system	€ 150,000
Domestic Services	€ 40,000
High Pressure water/Fire fighting Installation	€ 25,000
Electrical Installation	€ 579,000
Ventilation & Odour Control	€ 65,000
General Items	€ 311,000
Net Total	**€ 5,383,000**
Design @ 10%	€ 538,300
Preliminaries @ 15%	€ 807,450
Sub - Total	**€ 6,728,750**
VAT @ 13.5%	€ 908,381
Gross Total	**€ 7,637,131**

9.1.3 Outfall Pipeline

These costs have been updated from the 1999 Preliminary Report costs estimates.

Table 9.3 Estimated cost for Outfall pipeline

Description	Amount (€)
Land Pipeline	900,000
Tunnel / Diffuser	1,250,000
Net Total	**€ 2,150,000**
Preliminaries @ 15%	€ 322,500
Sub - Total	**€ 2,472,500**
VAT @ 13.5%	€ 333,788
Gross Total	**€ 2,806,288**

9.1.4 Capital Cost Summary

Collection system	€ 4,606,594
Treatment Works	€ 6,728,750
Marine Outfall	€ 2,472,500
Sub – Total	€ 13,807,844
VAT @ 13.5 %	€ 1,864,059
Total	**€ 15,671,903**

9.2 OPERATIONAL COSTS

The estimated annual operating costs have been based upon secondary treatment for a design population of 22,500 P.E.

Table 9.4 Estimated costs for Operation and Maintenance of the Treatment Works

Element	Unit Type	Amount	Cost/Unit (€)	Total (€)
Power	100kW approx.			44,328
Labour	Plant Manager	1	50,000	50,000
	Plant Operative	1	30,000	30,000
	Lap Tech.	1	25,000	25,000
	General Operatives	2	20,000	40,000
Grit Removal	Skip	66	63.50	4,191
Sludge Disposal	Skip	183	63.50	11,621
Polyelectrolyte dosing	PE	22,500	1.12	25,200
Chemicals	Total	Sum	6,350.00	6,350
Maintenance	2.5% of Capital Costs	Sum		168,219
	Sub Total			€ 404,908
	10% of Operation Costs			€ 40,491
	Total O & M Costs (ex VAT)			**€ 445,399**

Equivalent Cost / P.E **€ 19.80**

10 WATER CHARGING POLICY

This report is being prepared as a framework for Wicklow County Council to recover costs of the provision of an improved and upgraded sewerage scheme for the Newtownmountkennedy, Newcastle and Kilcoole areas under the Newtownmountkennedy and Kilcoole Sewerage Scheme.

It has been prepared in accordance with circular L/16/02 (Consolidation of Water Services Pricing Policy Circulars) issued 29th September 2002 by the Department of the Environment and Local Government. This circular offers guidance to local authorities on the policy framework agreed by Government for the development of a more comprehensive and transparent system for charging water services in the non-domestic sector.

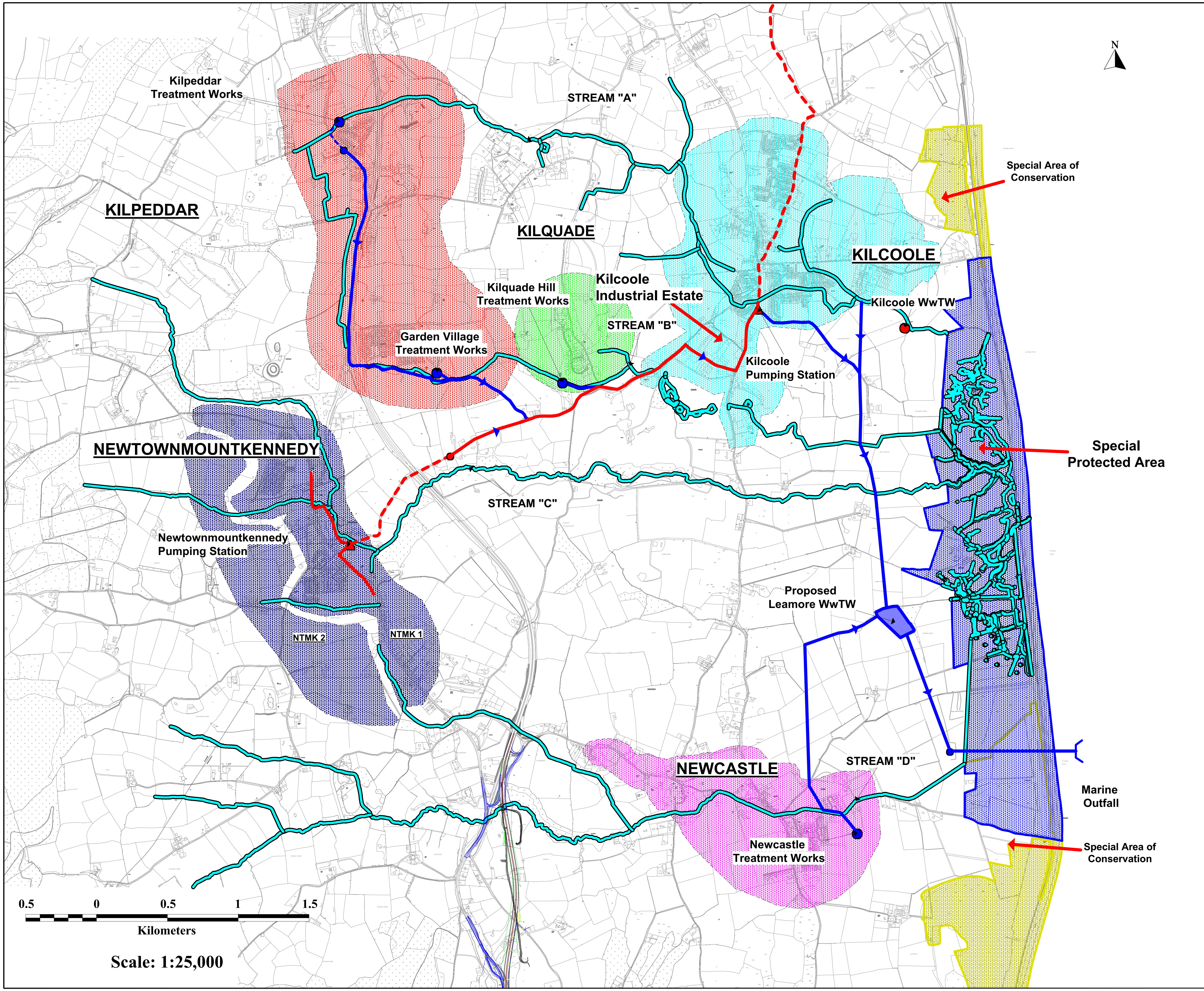
An assessment has been made of the Non Domestic Marginal Cost (NDMC) of Stage 1 of the Scheme only and considers two options; the Elemental Method and the Customised Method.

10.1 LOADS

The loads for the scheme are detailed in **Appendix E** of this report, and summarised in **Table 10.1** for the purposes of the marginal cost calculation. The catchment areas are shown on **Figure 10.1**

Table 10.1 Summary of Loadings

Catchment area	Domestic Loads		Non-Domestic Loads		Total (l/s)
	Existing (l/s)	Organic Growth (l/s)	Future Residential (l/s)	Industrial (l/s)	
NTMK1	33.64	5.86	38.74	4.55	82.79
NTMK2	1.56	0.00	5.90	18.75	26.22
Kilcoole	15.60	6.25	21.33	10.51	53.69
Newcastle	7.95	3.13	5.00	0.39	16.46
Kilpeddar	10.90	3.33	3.20	15.59	33.02
Kilquade	1.59	0.52	2.41	0.00	4.52
	71.25	19.09	76.58	49.79	216.70
Load Factor	**0.33**	**0.09**	**0.35**	**0.23**	
Load Factor	**0.42**		**0.58**		**1.0**

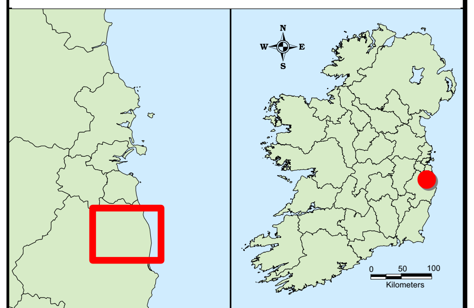


Legend

- NTMK Interim Gravity Sewer
- Interim Scheme Rising Main
- Proposed Scheme Gravity Sewer
- Area Stream Locations

Population Centres

- Kilpeddar
- Kilquade
- Kilcoole
- Newcastle
- Newtown-mountkennedy (1&2)



Wicklow County Council
Comhairle Chontae Chill Mhantain

Project
Newtownmountkennedy & Kilcoole Regional Sewerage Scheme

Title
Population Centres for the Newtownmountkennedy Sewerage Scheme

Figure 10.1

Ashurst
Mount Merrion Avenue
Blackrock, Co. Dublin
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rpsmcos@rpsgroup.ie

Issue Details

Drawn: D. Byrne	**Project No.** MDW0135		
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Date: July '04	MI0004	D01	

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10.2 ELEMENTAL METHOD

The following methodology is consistent with the Elemental Method of calculation of the marginal costs of the scheme as recommended by DoEHLG in L16/02.

Step 1. Split the scheme into a number of discrete components

Step 2. Identify level of dependency of individual scheme components

Step 3. Calculate load factor for each dependent element

Step 4. Calculate marginal cost of each dependent element

Step 5. Calculate total non-domestic marginal cost (NDMC) for the scheme

10.2.1 Collection System

Step 1: The scheme was split into component parts as set out below

1. Pipework
2. Manholes
3. Decommissioning of existing treatment plants
4. Kilpeddar P.S.
    a. Civil Works
    b. M&E Works

Step 2: All dependent elements of the scheme were identified as set out in **Table 10.2** (Dependency levels are based upon previous studies).

Table 10.2 Load-Dependent Scheme Elements of the Collection system

Element	Dependency	Explanation
Pipework	40%	The dependent costs include the full cost of materials, excavations, connections, etc. However the cost of labour, plant, saw cutting, reinstatement and crossings is partially independent of the pipe size. (i.e. a minimum pipelaying crew is required irrespective of the pipe size)
Manholes	60%	The dependent costs include the full cost of materials, excavations, connections, etc. However the cost of labour and plant is partially independent of the manhole size.
Decommissioning of existing treatment plants	0%	Decommissioning of plants is independent of flows
<u>Kilpeddar P.S.</u> Civil Works	80%	Building size partially dependent on pump size
M&E Works	50%	Pump size and commissioning for the pumping stations are dependent on scheme size.

Step 3: The Calculations for the Load Factor (LF) relating to Future Residential Load and Industrial Load are presented in **Table 10.1** above

Step 4: Using the dependency levels explained in **table 10.2** and the estimated full cost of each element **(Chapter 9)**. The marginal cost of each dependent element was calculated and is set in **Table 10.3** below.

Table 10.3 Marginal Cost for each element of the Collection System

Element	Dependency	Full Cost of Element	Non-Domestic MC Future Residential		Non-Domestic MC Industrial Commercial	
			LF	Cost	LF	Cost
Pipework	40%	€ 3,505,934.00	0.35	€ 495,569.41	0.23	€ 322,214.92
Manholes	60%	€ 244,800.00	0.35	€ 51,904.31	0.23	€ 33,747.73
Decommissioning of treatment plants	0%	€ 65,000.00	0.35	€ 0.00	0.23	€ 0.00
Kilpeddar P.S.						
Civil Works	80%	€ 60,000.00	0.35	€ 16,962.19	0.23	€ 11,028.67
M&E Works	50%	€ 130,000.00	0.35	€ 22,969.64	0.23	€ 14,934.66
			€ 587,405.55		€ 381,925.98	
Sub-total			€ 969,331.53			
Preliminaries (15%)			€ 145,399.73			
Total (excl VAT)			**€ 1,114,731.26**			
VAT @13.5%			€ 150,488.72			
TOTAL (incl VAT)			**€ 1,265,219.98**			

Therefore the total Non-Domestic Marginal Cost of the Scheme for the collection system using the Elemental Method is **€ 1,114,731.26 (excl VAT)** or **24%** of the full collection system cost (€ 4,606,594.10)

10.2.2 Treatment Works

Step 1: The scheme was split into component parts as set out below

Civil Works
1. Building
2. Inlet Works
3. Concrete Tanks
4. Siteworks

M&E Works

5. Inlet Works
6. Storm Tanks
7. Aeration Tanks
8. Secondary Settings
9. Activated Sludge Thickening
10. Sludge Thickening
11. Flow Control
12. Instrumentation
13. Miscellaneous
14. SCADA system
15. Domestic Services
16. High Pressure water / Fire fighting Installation
17. Electrical Installation
18. Ventilation & Odour Control
19. General Items

Step 2: All dependent elements of the scheme were identified as set out in **Table 10.4** (Dependency values are based upon previous studies).

Step 3: The Calculations for the Load Factor (LF) relating to Future Residential Load and Industrial Load are presented in **Table 10.1** above

Step 4: Using the dependency levels explained in **Table 10.4** and the estimated full cost of each element **(see Chapter 9)**. The marginal cost of each dependent element was calculated and is set in **Table 10.5** below.

Table 10.4 Load-Dependent Scheme Elements of the Treatment Works

Element	Dependency	Explanation
Civil Works		
Building	80%	Building size is dependant on controls
Inlet Works	75%	
Concrete Tanks	100%	Directly related to loading
Siteworks	10%	Majority of siteworks is independent of works size
M&E Works		
Inlet Works	80%	Mechanical equipment is dependant on load
Storm Tanks	100%	
Aeration Tanks	75%	
Secondary Settings	75%	
Activated Sludge Thickening	15%	
Sludge Dewatering	80%	
Flow Control	0%	
Instrumentation	0%	
Miscellaneous	15%	
SCADA system	15%	
Domestic Services	10%	
High Pressure water / Fire fighting Installation	0%	
Electrical Installation	10%	
Ventilation & Odour Control	15%	
General Items	10%	

Table 10.5 Marginal Cost for each element of the Treatment Works

Element	Dependency	Full Cost of Element	Non-Domestic MC Future Residential		Non-Domestic MC Industrial	
			LF	Cost	LF	Cost
Civil Works						
Building	80%	€ 1,037,000.00	0.35	€ 293,163.24	0.23	€ 190,612.19
Inlet Works	75%	€ 125,000.00	0.35	€ 33,129.28	0.23	€ 21,540.37
Concrete Tanks	100%	€ 984,000.00	0.35	€ 347,724.96	0.23	€ 226,087.74
Siteworks	10%	€ 670,000.00	0.35	€ 23,676.39	0.23	€ 15,394.19
M&E Works						
Inlet Works	80%	€ 288,500.00	0.35	€ 81,559.88	0.23	€ 53,029.52
Storm Tanks	100%	€ 88,500.00	0.35	€ 31,274.04	0.23	€ 20,334.11
Aeration Tanks	75%	€ 390,000.00	0.35	€ 103,363.36	0.23	€ 67,205.96
Secondary Settling	75%	€ 231,000.00	0.35	€ 61,222.92	0.23	€ 39,806.61
Activated Sludge Thickening	75%	€ 75,000.00	0.35	€ 19,877.57	0.23	€ 12,924.22
Sludge Thickening	80%	€ 175,000.00	0.35	€ 49,473.06	0.23	€ 32,166.96
Flow Control	0%	€ 25,000.00	0.35	€ 0.00	0.23	€ 0.00
Instrumentation	0%	€ 64,000.00	0.35	€ 0.00	0.23	€ 0.00
Miscellaneous	15%	€ 60,000.00	0.35	€ 3,180.41	0.23	€ 2,067.88
SCADA system	15%	€ 150,000.00	0.35	€ 7,951.03	0.23	€ 5,169.69
Domestic Services	10%	€ 40,000.00	0.35	€ 1,413.52	0.23	€ 919.06
Fire fighting Installation	0%	€ 25,000.00	0.35	€ 0.00	0.23	€ 0.00
Electrical Installation	10%	€ 579,000.00	0.35	€ 20,460.65	0.23	€ 13,303.33
Ventilation & Odour Control	15%	€ 65,000.00	0.35	€ 3,445.45	0.23	€ 2,240.20
General Items	10%	€ 311,000.00	0.35	€ 10,990.09	0.23	€ 7,145.66
			€ 1,091,905.84		€ 709,947.68	
Sub-total			€ 1,801,853.52			
Preliminaries (15%)			€ 270,278.03			
Total (excl VAT)			**€ 2,072,131.55**			
VAT @13.5%			€ 279,737.76			
TOTAL (incl VAT)			**€ 2,351,869.30**			

Therefore the total Non-Domestic Marginal Cost of the Scheme for the treatment works using the Elemental Method is **€ 2,072,131.55 (excl VAT)** or **33%** of the full treatment works cost **(€ 6,190,450)**

10.2.3 Outfall pipeline

Step 1: The scheme was split into component parts as set out below

1. Land Pipeline
2. Tunnel / Diffuser

Step 2: All dependent elements of the scheme were identified as set out in **Table 10.6** (Dependency values are based upon previous studies).

Table 10.6 Load-Dependent Scheme Elements of the Outfall Works

Element	Dependency	Explanation
Land Pipeline	10%	
Tunnel / Diffuser	10%	

Step 3: The Calculations for the Load Factor (LF) relating to Future Residential Load and Industrial Load are presented in **Table 10.1** above.

Step 4: Using the dependency levels explained in **Table 10.6** and the estimated full cost of each element **(see Chapter 9)**. The marginal cost of each dependent element was calculated and is set in **Table 10.7** below.

Table 10.7 Marginal Cost for each element of the Outfall works

Element	Dependency	Full Cost of Element	Non-Domestic MC Future Residential		Non-Domestic MC Industrial	
			LF	Cost	LF	Cost
Land Pipeline	10%	€ 900,000.00	0.35	€ 31,804.11	0.23	€ 20,678.76
Tunnel / Diffuser	10%	€ 1,250,000.00	0.35	€ 44,172.38	0.23	€ 28,720.50
			€ 75,976.49		€ 49,399.25	
Sub-total			€ 125,375.74			
Preliminaries (15%)			€ 18,806.36			
Total (excl VAT)			**€ 144,182.10**			
VAT @13.5%			€ 19,464.58			
TOTAL (incl VAT)			**€ 163,646.69**			

Therefore the total Non-Domestic Marginal Cost of the Scheme for the outfall works using the Elemental Method is **€ 144,182.10 (excl VAT)** or **5%** of the full outfall works cost (**€ 2,472,500**)

10.2.4 Marginal Cost summary for the Elemental Method

Table 10.8 Marginal Cost Summary for the Elemental Method

Phase	Total Phase Cost	Non-Domestic Marginal Cost	NDMC as Percentage of Total
Collection system	€ 4,606,594.10	€ 1,114,731.26	24%
Treatment Works	€ 6,190,450.00	€ 2,072,131.55	33%
Outfall pipeline	€ 2,472,500.00	€ 144,182.10	6%
Total	**€ 13,269,544.10**	**€ 3,331,044.91**	**25%**

The Non-Domestic Element of the Scheme costs account for 25% of the total.

10.3 CUSTOMISED METHOD

The following methodology is consistent with the Customised Method of calculation of the marginal costs of the scheme as recommended by DEHLG in L16/02.

Step 1. Split the scheme into a number of discrete components [as before] and identify components which are independent of load

Step 2. Calculate the Cost of Independent Elements

Step 3. Calculate the Modified Cost = Cost of scheme – Cost of Independent Elements

Step 4. Calculate Marginal Cost Factors = $1\text{-}(1\text{-load factor})^{0.75}$

Step 5. Calculate Non Domestic Marginal Cost = Modified Cost * Marginal Cost Factor

10.3.1 Collection system

Step 1&2: Identify Independent Elements of the Scheme and calculate the cost of Independent elements. The Independent costs are broken down within **Chapter 9.1**.

Table 10.9 Cost of Independent Elements of collection system

Independent Element	Cost of Element
Pipework	€ 2,103,560.40
Manholes	€ 97,920.00
Decommissioning of existing treatment plants	€ 65,000.00
Kilpeddar P.S.	
Civil Works	€ 12,000.00
M&E Works	€ 65,000.00
Sub- Total	**€ 2,343,480.40**
Preliminaries (15%)	€ 351,522.06
Total Cost (excl VAT)	**€ 2,695,002.46**

Step 3: Calculate the Modified Cost = Cost of scheme **(Table 9.1)** – Cost of Independent Elements **(Table 10.4)**

Modified Capital Cost = **€ 4,606,594.10** - **€ 2,695,002.46** = € 1,911,591.64

Step 4: Calculate Marginal Cost Factor (MCF) = 1-(1-load factor) $^{0.5}$

Non-Domestic Load Factor = 0.58 (See **Table 10.1** above)

MCF = 1-(1-.58)$^{0.5}$ = 0.354355

Step 5: Calculate Non Domestic Marginal Cost = Modified Cost * Marginal Cost Factor

NDMC = € 1,911,591.64 x 0.354355 = € 677,382.73

The total Non-Domestic Marginal Cost is the sum of the marginal cost for commercial/industrial demand plus the future residential demand. This equates to **€ 677,382.73 (excl VAT)** or **15 %** of the full cost of the collection system works.

10.3.2 Treatment Works

Step 1&2: Identify Independent Elements of the Scheme and calculate the cost of Independent elements. The Independent costs are broken down within **Table 9.2**.

Table 10.10 Cost of Independent Elements of the Treatment Works

Independent Element	Cost of Element
Civil Works	
Building	€ 207,400.00
Inlet Works	€ 31,250.00
Concrete Tanks	€ 0.00
Site Works	€ 603,000.00
M&E Works	
Inlet Works	€ 57,700.00
Storm Tanks	€ 0.00
Aeration Tanks	€ 97,500.00
Secondary Settling	€ 57,750.00
Activated Sludge Thickening	€ 18,750.00
Sludge Thickening	€ 35,000.00
Flow Control	€ 25,000.00
Instrumentation	€ 64,000.00
Miscellaneous	€ 51,000.00
SCADA system	€ 127,500.00
Domestic Services	€ 36,000.00
High Pressure water/Fire fighting Installation	€ 25,000.00
Electrical Installation	€ 521,100.00
Ventilation & Odour Control	€ 55,250.00
General Items	€ 279,900.00
Sub- Total	**€ 2,293,100.00**
Preliminaries (15%)	€ 343,965.00
Total Cost (excl VAT)	**€ 2,637,065.00**

Step 3: Calculate the Modified Cost = Cost of scheme (**Table 9.2**) – Cost of Independent Elements **(Table 10.10)**

Modified Capital Cost = € **6,190,450.00** - **€ 2,637,065.00** = € 3,553,385.00

Step 4: Calculate Marginal Cost Factor (MCF) = 1-(1-load factor) $^{0.5}$

Non-Domestic Load Factor = 0.58 (See **Table 10.1** above)

MCF = 1-(1-.58)$^{0.5}$ = 0.354355

Step 5: Calculate Non Domestic Marginal Cost = Modified Cost * Marginal Cost Factor

NDMC = € 3,553,385.00 x 0.354355 = € 1,259,160.99

The total Non-Domestic Marginal Cost is the sum of the marginal cost for commercial/industrial demand plus the future residential demand. This equates to **€ 1,259,160.99 (excl VAT)** or **20 %** of the full cost of the treatment plant works.

10.3.3 Outfall pipeline

Step 1&2: Identify Independent Elements of the Scheme and calculate the cost of Independent elements. The Independent costs are broken down within **Table 9.3**.

Table 10.11 Cost of Independent Elements of the Treatment Works

Independent Element	Cost of Element
Land pipeline	€ 810,000.00
Tunnel/diffuser	€ 1,125,000.00
Sub- Total	**€ 1,935,000.00**
Preliminaries (15%)	€ 290,250.00
Total Cost (excl VAT)	**€ 2,225,250.00**

Step 3: Calculate the Modified Cost = Cost of scheme **(Table 9.1**) – Cost of Independent Elements **(Table 10.11)**

Modified Capital Cost = € **2,472,500.00** - **€ 2,225,250.00** = € 247,250.00

Step 4: Calculate Marginal Cost Factor (MCF) = $1-(1\text{-load factor})^{0.5}$

Non-Domestic Load Factor = 0.58 (See **Table 10.1** above)

MCF = $1-(1-.58)^{0.5}$ = 0.354355

Step 5: Calculate Non Domestic Marginal Cost = Modified Cost * Marginal Cost Factor

NDMC = € 247,250.00 x 0.354355 = € 87,614.36

The total Non-Domestic Marginal Cost is the sum of the marginal cost for commercial/industrial demand plus the future residential demand. This equates to **€ 87,614.36 (excl VAT)** or **4 %** of the full cost of the outfall pipeline works.

10.3.4 Marginal Cost summary for the Customised Method

Table 10.12 Marginal Cost Summary for the Customised Method

Phase	Total Phase Cost	Non-Domestic Marginal Cost	NDMC as Percentage of Total
Collection system	€ 4,606,594.10	€ 677,382.73	15%
Treatment Works	€ 6,190,450.00	€ 1,259,160.99	20%
Outfall pipeline	€ 2,472,500.00	€ 87,614.36	4%
Total	**€ 13,269,544.10**	**€ 2,024,158.08**	**15%**

The Non-Domestic Element of the Scheme costs account for 15% of the total.

10.4 CONCLUSIONS OF THE WATER CHARGING POLICY ASSESSMENT

In summary, the two methods demonstrate a marginal cost (excluding VAT) as follows:

Table 10.13 Marginal Cost Summary

Method	Collection System		Treatment Works		Outfall pipe		Total	
	€	%	€	%	€	%	€	%
Elemental	1,114,731	24	2,072,132	33	144,182	6	**3,331,045**	**25%**
Customised	677,383	15	1,259,161	20	87,614	4	**2,024,158**	**15%**

11 PUBLIC/PRIVATE PARTNERSHIP (PPP) ASSESSMENT

11.1 INTRODUCTION

The aim of this chapter is to identify the most suitable procurement route for the proposed upgrade to the central treatment works at Leamore. This chapter lists the risks associated with the project, assigns the likely owner of each risk i.e. contractor/employer and discusses the relative merits of the Design-Build (DB), Design, Build and operate (DBO) and conventional contract options in this context.

A preliminary identification of key risks to the project has been carried out as shown in **Table 11.1**. These risks can be defined as any factor, event or influence that threatens the successful completion or operation of the project in terms of cost, time or quality. When considering PPP options, the scope for transfer of these risks must be evaluated. The key criterion is that the risk should lie with the party who is in the best position to manage it. This fundamental principle should usually result in the best value for money outcome.

In the past the notion of a shared risk was accepted, however it is considered that the operating contracts at present underway will highlight the fact that many of the so-called shared risks ultimately return to the Employer, this idea will be discussed further later in this chapter.

11.2 RISK ASSESSMENT PROCESS

The risk review has been undertaken consistent with the contents of Guidance Note 11 to the Policy Framework for Public Private Partnership.

Key considerations in this exercise are:

- Identification of all significant risks in the various stages of the project;
- Allocation of risk in the various contract options using the principle that it should be allocated to the party best able to manage it, and
- Optimum risk transfer will respect this principle so that the extent of the risk transfer is that which delivers best value for money.

The objectives of the Risk Management Strategy in the project are:

- Consider how long term cost can be reduced by optimum risk allocation and management;
- To improve the quality, time and cost targets by risk management;
- To improve the quality of service delivered by managing risks which affect quality performance or to accommodate change;
- To achieve a more sustainable expenditure profile by providing for contingent risks in the long term cost profile.

11.3 BASIS FOR ASSESSING RISKS

Risks have been identified and assessed in terms of ownership and whether they occur during the construction or operation phase of the project.

11.4 FORMS OF CONTRACT ASSESSED

The traditional form of Contract is defined as one where the Contractor builds a detailed design prepared by others, all of the work is publicly funded and the public sector operates the facility. The traditional form of Contract is compared to the following PPP forms in terms of risk management.

The PPP forms considered are:

Design & Build where the Contractor designs and builds the facility to criteria specified by the public sector, all of the work is publicly funded and the public sector operates the facility. This form of Contract is shortened to DB for reference and seeks to transfer design and construction risk to the Contractor;

Design, Build, Operate where the Contractor designs and builds the facility to criteria specified by the public sector and operates the facility for a fixed period of time. All of the capital works is publicly funded. This form of Contract is shortened to DBO for reference and involves transfer of design, construction and operational risk over the life of the contract.

11.5 IDENTIFICATION OF RISK

At each stage of the project the general risk assessment outcome is identified in:

- **Procurement**; PPP options will require new contract and procurement arrangements, currently being adopted on some projects but which are still under development. Key considerations will be qualification criteria for contractors, tender compliance requirements and evaluation criteria.

- **Planning**; a successful Environmental Impact Assessment must be achieved and this is best dealt with by the Local Authority. In process, it would provide a framework for the design, construction and operation stages to be compatible with environmental constraint requirements.

- **Design**; Transfer of design risk provides the opportunity for innovative solutions. It is imperative therefore, that the solutions should not be unnecessarily prescriptive. In order to ensure “fitness for purpose”, minimum quality and track record criteria should apply

- **Construction**; The availability of the site should permit satisfactory definition of ground archaeology, and other site conditions. Compliance with environmental standards during construction would be vital in this relatively built up rural area.

- **Operation and Maintenance**; Traditional and Design Build options effectively result in operational risk being retained by the client. In these options, achievement of performance standards, availability of plant capacity, and equipment maintenance, places a significant burden on existing organisational structures and resources. As a result, failure to achieve the specified performance levels is a significant risk even for well designed and constructed plant facilities.

A comprehensive table of risks associated with the proposed project is given below. Some of these risks do not merit discussion for this report as they are the same regardless of whether the contract is DB, DBO or conventional contract, they are included for completeness. Those risks that require comprehensive discussion are mainly confined to the Operation and Maintenance phase of the contract and are referenced later in this chapter.

Table 11.1 Key risks encountered during the Project lifetime

Risk Number	Risk Item	Risk Owner
PLANNING AND PROCUREMENT		
Planning and Procurement – Financial Management		
P1	Delays in obtaining funding from DEHLG for domestic element of capital expenditure	Employer
P2	Failure by Employer to recover charges from non-domestic users	Employer
P3	Over/Under take-up by significant non-domestic users	Employer
Planning and Procurement – Objections		
P4	Any known or potential new objections from stakeholders	Employer
P5	Objections by unsuccessful Applicants/Tenderers at Pre-qualification and Tender Stage	Employer
Planning and Procurement – Planning Permission, Permits, Licenses or Approvals		
P6	Failure to obtain planning permission, permits, licenses or approvals	Employer
P7	Onerous conditions in Planning Permission (incl. EIS where applicable)	Employer
Planning and Procurement – Land Acquisition/Wayleave		
P8	Delay in acquiring land and/or wayleaves	Employer
P9	Legal actions related to land acquisition	Employer
P10	Extra Cost associated with Land Acquisition	Employer
P11	Unexpected Land Acquisition or Wayleave	Employer
P11	Unforeseen legal covenant or right of way	Employer
Planning and Procurement – Planning and Development Co-ordination		
P12	Failure to coordinate planning and development of catchment with plant capacity	Employer
Planning and Procurement – Time and Cost Overrun		
P13	Approval delays or changes during procurement resulting in additional time and cost	Employer
Planning and Procurement – Changes in Legislation		
P14	Discriminatory Legislative Changes	Employer
P15	Non-Discriminatory Legislative Changes	Employer
Planning and Procurement – Employer Staff Management		
P16	Industrial action by Employer's employees	Employer
P17	Existing Employees Rights (redundancy/redeployment/transfer)	Employer
Planning and Procurement – Project Specific Risks		

Risk Number	Risk Item	Risk Owner
DESIGN		
Design – Time and Cost Overrun		
D1	Delay in design review period or to receipt of information by the Contractor from the Employer	Employer
D2	Re-Design result of poor initial design or design not meeting Employer's Requirements	Contractor
D3	Missing, variable or inaccurate design information and site data from the Employer resulting in redesign or additional design work	Contractor
D4	Inadequate level and quality of design team resources	Contractor
D5	Delay in provision of detailed design by Contractor	Contractor
Design – Variations		
D6	Employer directed design changes	Employer
Design – Inflation		
D7	Inflation Costs above Indexation	Contractor
Design – Changes in Legislation		
D8	Discriminatory (e.g. changes applying specifically to the project, the Contractor or PPP projects except with regard to sludge disposal and registered pay agreements)	Employer
D8	Descriminatory changes with regard to disposal of sludge	Contractor
D9	Descriminatory changes with regard to registered pay agreements	Contractor
D10	Non-descriminatory (e.g general legislative or regulatory changes)	Contractor
Design – Defects		
D11	Correction of Design Defects	Contractor
Project Specific		
BUILD		
Build – Time and Cost Overrun		
B1	Employer unable to make required DBO payments	Employer
B2	Adverse weather conditions, flooding, poor ground conditions	Employer
B3	Unforeseen site conditions as a result of missing or inaccurate site data (incl. existing works problems after demolition, unknown services) resulting in additional delay or cost in remedy of problem	Contractor
B4	Unforeseeable surface conditions causing delay to project	Employer
B5	Unforeseeable surface conditions causing additional cost to project	Contractor
B6	Unforeseeable sub-surface conditions – discovery of fossils causing additional delays and cost to project	Employer

Risk Number	Risk Item	Risk Owner
B7	Subcontractor performance problems or default	Contractor
B8	Unavailability of site services (water, power, telecoms) to enable construction works	Contractor
B9	Delays in transfer of site to contractor preventing access for construction works to begin	Employer
Build – Variations		
B10	Employer directed construction charges	Employer
Build – Inflation		
B11	Inflation costs above indexation	Employer
Build – Changes in Legislation		
B12	Discriminatory (e.g. changes applying specifically to the project, the Contractor or PPP projects except with regard to sludge disposal and registered pay agreements)	Employer
B13	Discriminatory changes with regard to the disposal of sludge	Contractor
B14	Discriminatory changes with regard to registered pay agreements	Contractor
B15	Non-descriminatory (eg general legislative or regulatory changes)	Contractor
Build – Construction Problems		
B16	Construction Process Problems	Contractor
B17	Incompatibility between existing systems (e.g. sewer network and new plant)	Contractor
B18	Adjustments to quantities during construction in excess of original tendered amounts	Contractor
Build – Objections		
B19	Any known or potential new objections from stakeholders other than the Contractor, Employer and Employer's Representative (incl. Public Protest and disruption to construction)	Employer
Build – Pollution and Contamination		
B20	Pollution to Watercourse from construction works	Contractor
B21	Pollution from existing plant during construction (e.g. spillage of wastewater or sludge)	Contractor
B22	Site contamination as a result of construction process	Contractor
Build – Other Risks Common to Traditional & DBO Projects		
B23	Construction, Workmanship and quality problems	Contractor
B24	Inadequate cost control leading to need for additional resources	Contractor
B25	Defects correction at commissioning	Contractor
B26	Site security/trespass	Contractor
B27	Noise and dust suppression and related disputes	Contractor
B28	Health and Safety risks or mitigation measures	Contractor
B29	Construction labour and material resource shortages	Contractor
B30	Industrial action by Contractor's staff	Contractor
B31	Industrial Action by Employer's staff	Employer

Risk Number	Risk Item	Risk Owner
B32	Off site traffic and Related Disputes	Contractor
B33	Damage to 3rd Parties, adjacent land and facilities	Contractor
B34	Interface with other construction	Contractor
B35	Interface problems with owner's other facilities	Employer
B36	Force majeure event above insured limits	Employer
B37	Contractor default costs higher than performance bond	Employer
Build – Project Specific Risks		
OPERATION AND MAINTENANCE		
Operation and Maintenance – Contract Management		
OM1	Failure to insist on contract standards	Employer
OM2	Default of contractor resulting in termination of contract	Employer
OM3	Default of sub-contractor	Contractor
Operation and Maintenance – Demand		
OM4	Quantity of water/wastewater is lower than predicted due to lower anticipated customer demand or influent discharge	Contractor
OM5	Quantity of water/wastewater is higher than predicted and is in excess of limits set out in the Guarantee Schedules of Contract Documents	Employer
OM6	Pollutant load is higher than predicted and is in excess of Pollution incident detailed in contract documents	Employer
OM7	Abstracted water quality is lower than acceptable standards (e.g. from pollution incident or longer term deterioration)	Employer
Operation and Maintenance – Pollution		
OM8	Inlet main or sewer failures due to breakdown, maintenance, repair, replacement, inspection or interruption to elements of the sewerage systems	Contractor
OM9	Contamination of influent above pollution incident limits detailed in Employer's Requirements	Employer
OM10	Failure of wastewater discharge – influent within pollution incident limits detailed in Employer's Requirements	Contractor
OM11	Failure of wastewater discharge – influent outside pollution incident limits detailed in employers requirements	Employer
OM12	Failure of sludge quality limit	Contractor
OM13	Failure of Noise, odour, dust limits causing nuisance	Contractor
OM14	Pollution of watercourse directly from the plant (e.g from wastewater discharge, tank overflow, chemical spill, sludge spill on site)	Contractor

Risk Number	Risk Item	Risk Owner
OM15	Pollution in catchment (e.g. sludge spill during transport, pollution during land application sludge/biosolid)	Contractor
Operation and Maintenance - Financial Change Management		
OM16	Employer unable to make required DBO payments	Employer
OM17	Capital Replacement Fund inadequate to meet major plant replacement requirements – due to poor management of the fund	Employer
OM18	Capital Replacement Fund inadequate to meet major plant replacement requirements due to inadequacy of the costs provided in the Schedule of Major Plant Replacement	Contractor
OM19	Inflation costs above indexation	Contractor
OM20	Insurance cost inflation and availability	Contractor
OM21	Cost Variations in O and M consumables including Power/Water/Telecoms	Contractor
OM22	Inability of contractor to obtain O and M performance bond	Contractor
Operation and Maintenance - Variations		
OM23	Employer directed Operations and Maintenance Changes	Employer
Operation and Maintenance - Legislative Changes		
OM24	Discriminatory (e.g changes applying specifically to the project, the Contractor or PPP projects except with regard to sludge disposal and registered pay agreements)	Employer
OM25	Discriminatory changes with regard to the disposal of sludge	Contractor
OM26	Discriminatory changes with regard to registered pay agreements	Contractor
OM27	Non-descriminatory (eg general legislative or regulatory changes incl. financial)	Employer
Operation and Maintenance - Staff Management		
OM28	Industrial Action by Employers staff	Employer
OM29	Industrial Action by Contractor’s staff	Contractor
OM30	Contractor’s Employee Rights at the end of the contract period	Contractor
OM31	Contractor’s Staff shortages and wage inflation	Contractor
Operation and Maintenance – Health and Safety		
OM32	Health and Safety Risks	Contractor
OM33	Health and Safety Claims in excess of Insurance	Contractor
Operation and Maintenance – Security		
OM34	Plant Security	Contractor
Operation and Maintenance – Utility Services		
OM35	Failure of water/power/telecom utility services outside site	Employer
Operation and Maintenance – Maintenance		
OM36	Technological obsolescence leading to replacement of plant earlier than planned	Contractor

Risk Number	Risk Item	Risk Owner
OM37	Premature obsolescence due to poor design, poor quality plant, poor maintenance, poor maintenance programme etc.	Contractor
Operation and Maintenance – Defects		
OM38	New plant defects occurring during O and M phase	Contractor
OM39	Latent defects after hand over of the works at the end of the contract period	Employer
OM37	Premature obsolescence due to poor design, poor quality plant, poor maintenance, poor maintenance programme etc.	Contractor
Operation and Maintenance – Damage		
OM40	Damage caused to third party by operational activities	Contractor
OM41	Force Majeure event	Employer
OM42	Damage caused by third party to treatment facilities, costs of which are unrecoverable	Employer
Operation and Maintenance – Upgrades, Alterations and Improvements		
OM43	Future planning permission, permits, licenses or approvals in relation to upgrades, alterations and/or improvements	Contractor
OM44	Failure to agree upgrades and/or improvements	Employer
OM45	Consequences to project if upgrades, alterations and/or improvements are carried out by third party contractor (incl. latent defects)	Employer
OM46	Under-estimation of Design Horizon for new plant or existing plant upgrade	Employer
OM47	Poor planning for cost and timing of expansion	Employer
OM48	Poor O&M performance of expansion	Contractor
Operation and Maintenance – Existing Works – Specific Risks		
OM49	Transition phase risk transfer process (e.g. Phase out problems with existing operator)	Employer
OM50	Incorrect assessment of expectancy of existing plant	Contractor
OM51	Existing plant defects after transition period	Contractor
Operation and Maintenance – Specific Project Risks		

11.6 CONVENTIONAL CONTRACT AND DESIGN BUILD – RISK ISSUES

The Design Build (DB) PPP option permits transfer of some design and construction risk over and above the traditional contract approach. However, it is usually noted that in most cases it would not mitigate and may in fact increase operational risk. The increased operational risks usually highlighted are listed below

- The DB option facilitates construction risk transfer but makes no contribution to operational risk. A robust contract model, incorporating rigorous commissioning and proving requirements and strict quality assurance are essential to ensure that operation risk in the DB stage is not increased compared to the traditional approach. As in the previous DB contract the proposed DB Contractor would be obliged to remain on site at their own cost until all the plant operates to the required specification.

- Reduced control over process and equipment selection which may result in less robust solution.

- The chosen solution in a DB or conventional contract may involve a higher level of operational skill and training than would be normal for a conventional design.

- Technological obsolescence risk could be increased, if spare parts are not guaranteed during the operational life of the plant – A capital replacement fund would be put in place to ensure the adequate provision of spares for maintenance purposes.

- Sensitivity to price increases, for example energy, may increase the cost of operation compared with a conventional solution.

11.7 DESIGN, BUILD AND OPERATE – RISK ISSUES

Design/Build/Operate (DBO) procurement has the potential to successfully transfer these operational risks from the Client to the Contractor, by including a significant operational period in the contract. The Contractor must ensure that the choice of process, design and construction of the plant is capable of delivering the specified performance standards. By linking payment to performance criteria, the client is in a position to ensure that this risk transfer is affected.

Up to now, for the purposes of preliminary risk assessment the impact of flow, load and pollution incidents outside the realms of those specified in the contract documents have been considered as shared risks between the Employer and the Contractor. In reality such risks ultimately lie with the Employer, as once the flow, load or pollution incidents are outside specified limits the DBO contractor is no longer obliged to meet effluent standards contained in the contract even if compliance is still a possibility. Given that design loads are based on population industrial projections that may or may not come to fruition there is always a risk of under/overestimation of flow or load rates.

The EPA, Regional Fisheries Board and other relevant bodies would pursue the Local Authority as opposed to the Contractor following pollution incidents or non-compliant effluent results. The Employer does not have any come back on the Contractor for those situations where the influent to be treated was unexpected in quantity or quality with reference to the contract. This highlights a situation where a Design Build/Conventional Contract option with Wicklow County Council as the operator would be advantageous whereby the Wicklow County Council Operator would be obliged to treat the influent to the highest quality effluent possible regardless of fluctuations in flow and load. They would also be more aware of the catchment situation and its likely impact at the works.

11.8 SUMMARY

Design, Build and Operate is the most appropriate procurement model of future wastewater treatment for Newtownmountkennedy, Kilcoole and the surrounding area. This would allow Wicklow County Council to shed the risk of operating the treatment plant satisfactorily and complying with the performance requirements.

This recommendation provides the best guarantee that Wicklow County Council will be in a position to comply with its statutory requirements in respect of wastewater and sludge treatment.

12 RECOMMENDATIONS AND IMPLEMENTATION

It is therefore recommended that a central treatment plant should be provided at Leamore to cater for the Newtownmountkennedy and Kilcoole catchment, with phase 1 designed for **22,500 P.E**.

It is estimated that the total capital cost for this scheme is € 15,671,903 including VAT (€ 13,807,844 exclusive of VAT). The non-domestic marginal cost of the scheme has been calculated as € 2,024,158 (or 15% of the ex VAT capital cost) using the Customised Method.

It is recommended that a Design, Build and Operate contract would be the most appropriate procurement route for the treatment plant. A programme for implementation of the Scheme is attached in Appendix F which details the activities normally expected for such a large capital project procured through a Public-Private Partnership Agreement.

It is estimated that further expansion for the treatment plant to 45,000 P.E. would be required around 2021. With the separation of the Newtownmountkennedy/Kilcoole and Greystones/Delgany catchments, Greystones WWTW can be dedicated to serve the Greystones/Delgany catchment solely from 2007 onwards. It is estimated that Greystones WWTW (27,000 P.E.) will reach its existing capacity at around 2018 and with modular expansion providing up to 40,000 P.E. if needed in the long term.

13 REFERENCES

1. Strategic Planning Guidelines for the Greater Dublin Area
2. Wicklow County Council Development Plan 1999
3. Newtownmountkennedy Local Area Plan
4. Kilcoole Local Area Plan
5. Wicklow County Council Housing Strategy 2001 – 2005
6. 2002 census data
7. Newtownmountkennedy Water Supply Scheme Preliminary Report
8. 1996 Census Data
9. W.S. Atkins' National Water Study
10. MCOS/Generale des Eaux Greater Dublin Water Supply Strategic Study - Year 2000 review
11. Strategic Planning Guidelines - Review and Update April 2000
12. Estimates of future population have been published by the Central Statistics Office for the period up until 2031
13. CSO data derived from Census 2002
14. Wicklow County Council Development Plan 2004 - 2010

APPENDIX A

Water Quality Data

Table A.1: Water Quality Data within Streams A, B, C, and D

Stream	Location	Data (mg/l)				Comments
		BOD_5	S.S.	Ammonia as N	Phosphate as P	
A	1. u/s Kilpedder Plant	2.1	7-15	0.017-0.018	0.086 - 0.091	Satisfactory
	2. Kilpedder Effluent	49 - 80	34 - 106	40.6 - 34.2	10.48 - 11.07	Very Poor Treatment Performance
	3. d/s Kilpedder Plant	5.8 - 10.3	6 - 14	.51 - 1.65	0.42 - 0.84	Gross Pollution
	4. u/s Kilcoole Plant	1.6 - 2.4	13 - 15	.035 - .038	0.17 - 0.18.	Recovered but enriched
	5. Kilcoole Effuent	86 - 112	30 - 48	48.5 - 49.5	11.23 -13.04	Very Poor Treatment
	6. d/s Kilcoole Effluent	14.4 - 16.4	36 - 39	3.3 - 3.6	0.96 - 1.05	Gross Pollution
B	Note: No Effluent Discharge Average Data (4 sites)	1.0 2.8	2 - 18	0.008 - 0.032	0.021 - 0.17	Satisfactory
C	1/2 u/s S.T.W.	2.1 - 3.0	2 -4	.002 - .025	.013 - .032	Satisfactory
	3. NTMK S.T.W	235 - 260	184 -216	31 -62	11.6 - 15.8	Untreated Sewage
	4. d/s S.T.W.	14.4 - 24	19 - 31	2.7 - 3.04	0.9 - 1.2	Gross Pollution
	5. Downstream	3.0 - 3.2	4 - 19	0.086 - 0.091	0.5 - 0.57	Enriched, Moderate Pollution
D	Killadreenan	3.4 - 4.8	17 - 31	0.31 - 0.34	- 1.39	Moderate Pollution, Enriched
	2/3 Average	1.2 - 3.0	4 - 8	0.014 - 0.023	0.16 - 0.19	Reasonable

APPENDIX B

Calculations for projected populations and flows

Flows to Greystones WWTW from 2002 to 2023

	2002				2007				2016				2023			
	Population	Other (PE)	Total (PE)	Flow (m3/d)	Population	Other (PE)	Total (PE)	Flow (m3/d)	Population	Other (PE)	Total (PE)	Flow (m3/d)	Population	Other (PE)	Total (PE)	Flow (m3/d)
Greystones																
Residential	11,871			2,374	18,000			3,600	22,000			4,400	25,271			5,054
			11,871	2,374			18,000	3,600			22,000	4,400			25,271	5,054
Commercial		1,000		225		1,500		338		2,200		495		2,700		608
Schools		150		34		250		56		300		68		350		79
IDA site										485		109		550		124
ZAPI industrial development						137		31		344		77		400		90
			1,150	259			1,887	425			3,329	749			4,000	900
Kilcoole																
Residential	2,826				3,694				4,500				5,169			
Served by new Pumping Station	1,498			300	1,958			392	2,385			477	2,740			548
Served by existing WWTP	1,328				1,736				2,115				2,429			
			1,498	300			1,958	392			2,385	477			2,740	548
Commercial		164		37		222		50		356		80		440		99
Schools		150		34		250		56		300		68		350		79
Irish Egg Products		40		9		67		15		89		20		111		25
Druids Glen GC/Hotel		231		52		311		70		378		85		444		100
			586	132			850	191			1,122	253			1,346	303
Newtownmountkennedy																
Residential	2,521	60			4,528				6,000			1,200	6,892			
Served by new P.S	1,795			359	3,802			760					6,892			1,378
Garden Village WWTP	726				726											
			1,795	359			3,802	760			6,000	1,200			6,892	1,378
Commercial		200		45		250		56		300		68		350		79
Schools		100		23		140		32		170		38		200		45
Newcastle Hospital		311		70		356		80		400		90		400		90
Model World Development						1,476		332		1,600		360		2,000		450
Custom Packaging		32		7		32		7		40		9		50		11
			643	145			2,253	507			2,510	565			3,000	675
Package plants																
Kilpeddar, Kilquade Hill and Garden Village (inc. development areas)							2,692	538			5,062	1,012			7,243	1,449
Total			17,543	3,568			31,442	6,413			42,408	8,656			50,491	10,307

Total from Greystones/Delgany =	19,887		Total from Greystones/Delgany =	25,329		Total from Greystones/Delgany =	29,271	
Total to Greystones by 2007 =	31,442	> 27,000 P.E.	Total to Greystones by 2016 =	42,408	> 40,000 P.E.	Total to Greystones by 2023 =	50,491	> 40,000 P.E.
Total from NTMK/Kilcoole in 2007 =	8,863		Total from NTMK/Kilcoole in 2016 =	12,017	> 12,000 P.E.	Total from NTMK/Kilcoole in 2023 =	13,977	> 12,000 P.E.
Total from NTMK/Kilcoole inc package plants in 2007 =	11,555	<12,000 P.E.	Total from NTMK/Kilcoole inc package plants in 2016 =	17,079	>12,000 P.E.	Total from NTMK/Kilcoole inc package plants in 2023 =	21,220	>12,000 P.E.

Assumptions
1. Ida site in Greystones developed to 30% capacity in 2016, 60% by 2023
2. Zapi industrial site developed to 20% in 2007, 50% in 2016 and 100% by 2023
3. Model World will be developed to 100% by 2007
4. Drummin and Mountkennedy sites will be developed to 20% in 2007, 60% by 2016 and 100% by 2023

Flows to Leamore WWTW between 2007 and 2023

	2,007				2,016				2,023			
	Population	Other (PE)	Total (PE)	Flow (m3/d)	Population	Other (PE)	Total (PE)	Flow (m3/d)	Population	Other (PE)	Total (PE)	Flow (m3/d)
Kilcoole												
Residential	3,694			739	4,500			900	5,169			1,034
			3,694	739			4,500	900			5,169	1,034
Commercial		222		50		356		80		440		99
Schools		250		56		300		68		350		79
Irish Egg Products		67		15		89		20		111		25
Druids Glen GC/Hotel		311		70		378		85		444		100
			850	191			1,122	253			1,346	303
Newtownmountkennedy												
Residential	4,528			906	6,000			1,200	6,892			1,378
			4,528	906			6,000	1,200			6,892	1,378
Commercial		250		56		300		68		350		79
Schools		140		32		170		38		200		45
Newcastle Hospital		356		80		400		90		400		90
Model World Development		1,476		332		1,600		360		2,000		450
Custom Packaging		32		7		32		7		32		7
			2,253	507			2,502	563			2,982	671
Kilpeddar												
Residential	675			135	960			192	1,141			228
			675	135			960	192			1,141	228
Commercial										50		11
Drummin development		345		78		1,034		233		1,724		388
Mountkennedy development		389		88		1,167		263		1,946		438
			734	165			2,202	495			3,719	837
Kilquade Hill	200		200	30	250			30	350			30
Residential development						100		20		200		40
			200	30			350	50			550	70
Newcastle												
Residential	1,083			217	1,500			300	1,783			357
			1,083	217			1,500	300			1,783	357
Commercial						50		11		50		11
							50	11			50	11
Leamore WWTW (PE)			14,017				19,136				23,582	
Capacity at Leamore WWTW			22,500	Ok for Stage 1			22,500	Ok for Stage 1			22,500	To be upgraded around 2021

Assumptions
1. Kilpeddar and Newcastle will connect to Leamore and never flow to Greystones
2. Drummin and Mountkennedy sites will be developed to 20% in 2007, 60% by 2016 and 100% by 2023
3. Model World will be developed to 100% by 2007
4. Garden Village and Kilcoole WWTW will be connected to Leamore, but not to Greystones

APPENDIX C

Treatment Plant design

NEWTOWNMOUNTKENNEDY and KILCOOLE SEWERAGE SCHEME
TREATMENT WORKS DESIGN CALCULATIONS

			Medium Term		Long Term	
1	**Loadings**					
1.1	**Hydraulic Loading**					
	Design Population		22,500	PE	45,000	PE
	~~Unit hydraulic load~~	DWF	53.7	l/s	108.0	l/s
	Hydraulic load DWF		4641	m3/d	9327	m3/d
	Peak Flow	3 DWF	161	l/s	324	l/s
1.2	**Organic Loading**					
	Design Population		22500	PE	45000	PE
	Unit Organic Load		60	g/h/d	60	g/h/d
	Organic Load		1350	kg/d	2700	kg/d
1.3	**Nitrogen Loading**					
	Unit TKN Load		13	g/h/d	13	g/h/d
	Ammonia NH4-N (60%)		7.8	g/h/d	7.8	g/h/d
	Total N- Load		292.5	kg/d	585	kg/d
1.4	**Storm balancing**					
	Spill Volume		80.6	l/s	161.9	l/s
	2 hours Spill		580.1	m3	1165.9	m3
	Provide Storm Tank					
	Provide:	No of tanks	**1**		**2**	
		Depth invert to overflow	**4**	m	**4**	m
		Width	6	m	6	m
		Length	25.0	m	25.0	m
		Tank Volume	600.0	m3	1200.0	m3
	Check Tank area		*OK*		*OK*	
2.1	**Screening- Fine & Coarse**					
	Peak Hydraulic Load		161	l/s	324	l/s
			580	m3/hr	1166	m3/hr
2.2	**Aerated Grit Removal**					
	Peak Hydraulic Load		161	l/s	324	l/s
			580	m3/hr	1166	m3/hr
	Design Retention		**2**	mins	**2**	mins
	Volume Required		19	m3	39	m3
	Provide:	No of tanks	**2**		**4**	
		Depth	**2**	m	**2**	m
		Width/Depth Ratio	**1**		**1**	
		Width	2	m	2	m
		Length	2.4	m	2.4	m
		Length/Width Ratio	1.2		1.2	
		Tank Area	9.7		19.4	

Air Requirements

Design Demand	**5.0**	ft3/min.ft length	**5.0**	ft3/min.ft length
	0.465	m3/min.m length	**0.465**	m3/min.m length
Capacity required	1.12	m3/min	1.13	m3/min
	67	m3/hr	68	m3/hr

2 **Primary Settlement**

Peak Flow	161	l/s	324	l/s
	580	m3/h	1166	m3/h
Design Overflow Rate	1.2	m3/m2/h	1.2	m3/m2/h
No. of Tanks	2		4	
Required Area	242	m2	243	m2
Tank Diameter	17.5	m	17.6	m
Design Retention (@ Max. Flow)	2	hrs	2	hrs
Side Wall Depth	2.4	m	2.4	m
Check Tank area	*242*	*m2*	*243*	*m2*
	OK		*OK*	

3 **Aeration Unit**

3.1 **Tank Sizing**

Influent Organic Load	1350		2700	
% Removal in PST	**30%**		**30%**	
Organic Load to Aeration tank	945	kg/d	1890	kg/d
%BOD Removed	90%		90%	
Design SLR	**0.15**	gBOD/gMLSS/d	**0.15**	gBOD/gMLSS/d
Design MLSS	**3.5**	kg/m3	**3.5**	kg/m3
Required Tank Volume	1620	m3	3240	m3
Hydraulic Retention Time	8.4	hr	8.3	hr
Sludge Growth Factor	**1.00**	kgSS/kgBOD removed	**1.00**	kgSS/kgBOD removed
Excess Sludge	851	kg/d	1701	kg/d
Sludge Age	6.7	d	6.7	d
Provide Tank				
- No.of Tanks	**1**	No.	**2**	No.
- Length /Width Ratio	**2**		**2**	
- Length	28	m	28	m
- Width	14	m	14	m
- Liquid Depth	**4**	m	**4**	m
Check Volume	*1620*	*m3*	*3240*	*m3*
	OK		*OK*	

3.2 **Actual Oxygen Requirement (AOR)**

Daily BOD Load	945	kg/d	1890	kg/d
Daily N- Load	263	kg/d	527	kg/d
Nitrogen assimilated in Act.Sludge	**5%**	of BOD	**5%**	of BOD
	47.25	kg/d	94.5	kg/d
%BOD Removed	90%		90%	
% Nitrification	25%		25%	
Peak Respiration rate demand Carbonaceous Oxidation (AOR)	96	kgO2/hr	191	kgO2/hr

3.3 **Standard Oxygen Requirement (SOR)**

Temp	8	deg c	8	deg c
Pressure	1	atm	1	atm
Alpha Factor (Diffused Air)	0.6		0.6	
Beta Factor	0.98		0.98	
Theta Factor	0.97		0.97	
Basin DO	2	mg/l	2	mg/l
DO Deficit Ratio	0.83		0.83	
Correction Factor	0.48		0.48	
Peak Standard Oxygen Required (SOR)	199	kgO2/hr	398	kgO2/hr

3.4 **Air Blower Power Requirement**

Oxygen Transfer Efficiency	20%		20%	
Peak Air Required @ Std. Blower Condtions	3588	m3/hr	7177	m3/hr
Peak Power Reqd. @ 65% o/a Efficiency	77	kW	153	kW
Average Power Reqd. @ 65% o/a Efficiency	35	kW	70	kW
Oxygenation Efficiency (AOR)	1.25	kgO2/kWhr	1.25	kgO2/kWhr
Oxygenation Efficiency (SOR)	2.62	kgO2/kWhr	2.62	kgO2/kWhr

4 **Clarifier**

Peak Flow 3DWF	161	l/s	324	l/s
	580	m3/h	1166	m3/h
Design Overflow Rate	1.0	m3/m2/h	1.0	m3/m2/h
No. of Tanks	2		4	
Required Area per tank	290	m2	291	m2
Tank Diameter	19	m	19	m
Design Retention (@ Max. Flow)	2	hrs	2	hrs
Side Wall Depth	2	m	2	m

5 Sludge Treatment

5.1 Sludge Quantities

5.1.1 Primary Sludge

Sludge Production in PST	50	g/h/d	50	g/h/d
Total Primary Sludge	1125	kg/d	2250	kg/d

5.1.2 Waste Activated Sludge (WAS)

Influent BOD to Aeration Tank	42	g/h/d	42	g/h/d
Sludge Growth Factor	1.0	g/gBOD removed	1.0	g/gBOD removed
BOD Removal	90%		90%	
Unit Sludge Production	38	g/h/d	38	g/h/d
Total WAS Production	851	kg/d	1701	kg/d

5.2 Sludge Pumping

5.2.1 Primary Sludge Pumping

Total DS	1125	kg/d	2250	kg/d
%DS Range	1%		1%	
Total Volume	112.5	m3/d	225	m3/d
No. of Hours Pumping	30	hr/wk	30	hr/wk
Pumping Capacity Required	26.3	m3/hr	52.5	m3/hr
	262.5	kg/hr	525.0	kg/hr
Provide Pumping Capacity	30	m3/hr	55	m3/hr
Positive Displacement Variable Speed	300	kg/hr	550	kg/hr

5.2.2 WAS Pumping

Total DS	851	kg/d	1701	kg/d
%DS Range	0.20%		0.20%	
Total Volume	425	m3/d	851	m3/d
No. of Hours Pumping	30		30	
Pumping Capacity Required	99	m3/hr	198	m3/hr
	198.5	kg/hr	396.9	kg/hr
Provide Pumping Capacity	100	m3/hr	200	m3/hr
Positive Displacement Variable Speed	200	kg/hr	400	kg/hr

5.2.3 Return Activated Sludge Pumping

Assume SSVI (Range)	200	ml/g	200	ml/g
MLSS (Range)	3000-5000	mg/l	3000-5000	mg/l
Provide Submersible Pump Capacity (3DWF Capacity)	193		389	

5.4 Sludge Thickening Tank

Total Solids Feed	1976	kg/d	3951	kg/d
Total Volume	538	m3/d	1076	m3/d
%DS Feed (average)	0.37%		0.37%	
Design Loading rate	4	kg/m2/hr	4	kg/m2/hr
Combined Loading Rate(average)	461	kg/hr	922	kg/hr
Area Required	115	m2	230	m2
Provide Tank				
- No.of Tanks	2		4	
- Area	90	m2	180	m2
- Diameter	7.6	m	7.6	m
- liquid depth	4.0	m	4.0	m
Target %DS	4%		4%	
Thickened Sludge Volume	49.4	m3/d	98.8	m3/d
Supernatant Volume	488		977	

5.5 Thickened Sludge Pumping

Thickened Sludge Volume	49	m3/d	99	m3/d
Time to Desludge	3.0	hr/d	3.0	hr/d
Required Pump Rate	16.5	m3/hr	32.9	m3/hr
Provide Pumping Capacity	30	m3/hr	30	m3/hr
Positive Displacement Variable Speed				

5.6 Sludge Storage Tank

Thickened Volume	49	m3/d	99	m3/d
Storage Days Required (say)	7	days	7	days
Storage Required	346	m3	691	m3
Provide Tank				
- No.of Tanks	1.0		2.0	
- liquid depth	4.0	m	4.0	m
- Area per Tank	86	m2	86	m2
- Diameter	10.5	m	10.5	m
- Volume	345.7	m3	691.4	m3

5.7 Sludge Dewatering

Peak Feed Rate	16.5	m3/hr	32.9	m3/hr
	461	kg/hr	922	kg/hr
Feed %DS	4%		4%	
Provide Equipment Capacity	500	kg/hr	500	kg/hr
Target %DS	20%		20%	
Dewatered Sludge Volume	10	m3/day	20	m3/day

APPENDIX D

Capital and Operating Costs for the proposed Scheme

CAPITAL COST ESTIMATE - CIVIL WORKS

	Description		Amount
A.	**Buildings**		
1	Inlet Works (12x20x€650/m2)		156,000
2	Control and Administration Building (300m2 x €950/m2)		285,000
3	Power & Maintenance & Storage (400m2 x €500/m2)		200,000
4	Aeration Building (180m2 x€900/m2)		162,000
5	Sludge dewatering (260m2 x €900/m2)		234,000
		Sub Total	**1,037,000**
B.	**Inlet Works**		
1	Channels		45,000
2	Grit Tank		40,000
3	Chambers		40,000
		Sub Total	**125,000**
C.	**Concrete Tanks**		
1	Storm Tank (~500m^3 = 2hrs DWF)		150,000
2	Aeration Tanks (~750m^3 each)		350,000
3	Secondary Settlement Tanks (600m^3)		324,000
4	Pump Tower		160,000
		Sub Total	**984,000**
E.	**Site Works**		
1	Earthworks		60,000
2	Process Pipework		285,000
3	Landscaping		20,000
4	Roads (incl. Access road)		125,000
5	Hard Standing Area		30,000
6	Site Drainage		60,000
7	Site Services (Water,Ducting)		90,000
		Sub Total	**670,000**
		Treatment Works Total	**2,816,000**

CAPITAL COST ESTIMATE - MECHANICAL & ELECTRICAL PLANT

	Description		Amount €
1	**Inlet Works**		
1.1	Coarse Screens		30,000
1.2	Grit Traps, Classifier, Air lift Pump, Air Blower assembly		95,000
1.3	Fine Screens and Screenings launder system		100,000
1.4	Sump Dewatering		6,000
1.5	Penstocks		12,500
1.6	Overhead Crane		25,000
1.7	Handrailing & Walkways		20,000
		Sub Total	**288,500**
2	**Storm Tank**		
2.1	Tipping Bucket Cleaning System		70,000
2.2	Storm Return Pumps		12,500
2.3	Handrailings & Walkways		6,000
		SubTotal	**88,500**
3	**Aeration Tanks**		
3.1	Diffusers, Air Pipework & Valves		100,000
3.3	Airblowers		200,000
3.4	Flow Control Wiers		25,000
3.5	Handrailings & Walkways		65,000
		Sub Total	**390,000**
4	**Secondary Settling**		
4.1	Secondary Tank Equipment		110,000
4.2	Sludge & Scum Removal		26,000
4.3	Final Effluent Pumps		95,000
		Sub Total	**231,000**
5	**Activated Sludge Pumping**		
5.1	Return Sludge Pumping		50,000
5.2	Waste Sludge Pumping		25,000
		Sub Total	**75,000**
6	**WAS Sludge Thickening**		
6.1	Picket Fence Thickeners Complete		150,000
6.2	Thickened Sludge Pumping		25,000
			-
		Sub Total	**175,000**
7	**Flow Control**		
7.1	Flow Splitters		25,000
		Sub Total	**25,000**
		Page Total c/f	**1,273,000**

CAPITAL COST ESTIMATE - MECHANICAL & ELECTRICAL PLANT

	Description		Amount €
		Page Total b/f	**1,273,000**
8	**Instrumentation**		
8.1	Inlet Flow		6,000
8.2	Storm Overflow		6,000
8.3	Return Sludge		6,000
8.4	Waste Activated Sludge		6,000
8.6	D.O. Aeration Tanks		12,000
8.7	MLSS, Aeration Tanks		10,000
8.8	Solids Level Detector -		
	Secondary Tanks		8,000
	Picket Fence Thickeners		4,000
8.9	Level measurement -		
	Inlet Works		3,000
	P.F.T.		3,000
		Sub Total	**64,000**
9	**Miscellaneous**		
9.1	Laboratory Equipment		30,000
9.2	Maintenance Equipment		30,000
		Sub Total	**60,000**
10	**SCADA System**		
10.1	Hardware		150,000
10.2	Software		
10.3	Mimics		
		Sub Total	**150,000**
11	**Domestic Services**		
			40,000
		Sub Total	**40,000**
12	**High Pressure Wash Water / Fire Fighting Installation**		
12.1	High Pressure Pumps		
12.2	Fire Extinguishers		25,000
		Sub Total	**25,000**
		Page Total c/f	**1,612,000**

CAPITAL COST ESTIMATE - MECHANICAL & ELECTRICAL PLANT

	Description		Amount €
		Page Total b/f	1,612,000
13	**Electrical Installation**		
13.1	General Requirements		
	Incoming ESB Supply		20,000
	External SCADA & Instrumentation Cabling		12,000
	External Lighting Installation		12,000
	Communications System		25,000
	Standby Generator		200,000
			-
13.2	MCCs		-
	Switchgear		-
	Process		150,000
13.3	Cabling		-
	LV Cabling		-
	Process Power		-
	SCADA Cabling		-
	Trunking & Cable Tray		120,000
	General Services, Small Power & Communication		-
			-
13.4	Alarm Systems		-
	Gas Detection System		-
	Fire Alarm System		40,000
	Intruder Alarm System		-
	Plant Alarm System		
		Sub Total	**579,000**
14	**Ventilation & Odour Control**		
			65,000
		Sub Total	**65,000**
15	**General Items**		
15.1	Bond		15,000
15.2	Insurances		20,000
15.3	Drawings & Operating Manuals		6,000
15.4	Cranage & Scaffolding		10,000
15.5	Site Offices & Storage		10,000
15.6	Witness Testing		10,000
15.7	Testing and Commissioning		100,000
15.8	Plant Operation following Commissioning		100,000
15.9	Spare Parts		40,000
		Sub Total	**311,000**
		TREATMENT WORKS TOTAL	**2,567,000**

Low Voltage maximum Demand Charges

ESB ANNUAL COST CALCULATION SHEET

Summer Charges

Demand:	90.00	kW		
Capacity:	100.00	kW	125	kVA
Usage:	981.00	kWhr/d	40.88	kWhr

	Cost per 2 month ESB Bill		**€**
Standing Charge: (per 2 months)			145.00
PSO Levy	kVA * €1.66		207.50
Service Capacity Charge	kVA * €4.35		543.75
Demand Charge	kW * €5.60		504.00
Usage Charges			
Day Units / 2 months			
	40.88 x 15hrs x 7days x 8.667wks	37,197.68	
	First 350 kWhr @ €0.1002/kWhr	3,507.00	
	Balance day 36847.68 @ €0.06/kWhr	2,527.75	6,034.75
Night Units / 2 months			
	40.88 x 9hrs x 7days x 8.667wks	22,321.34	
	=> 22,321.34 units @ €0.046/kWhr	1,026.78	1,026.78
	Total Cost per bill		8,461.78
	Cost per 4 Bill period (Mar - Oct)		33,847.13

Winter Charges

Demand:	90.00	kW		
Capacity:	100.00	kW	125	kVA
Usage:	981.00	kWhr/d	40.88	kWhr

	Cost per 2 month ESB Bill		**€**
Standing Charge: (per 2 months)			145.00
PSO Levy	kVA * €1.66		207.50
Service Capacity Charge	kVA * €4.35		543.75
Demand Charge	kW * €6.70		603.00
Usage Charges			
Day Units / 2 months			
	40.88 x 15hrs x 7days x 8.667wks	37,197.68	
	First 350 kWhr @ €0.1117/kWhr	39.10	
	Balance day 36847.68 @ €0.0726/kWhr	2,675.14	2,714.24
Night Units / 2 months			
	40.88 x 9hrs x 7days x 8.667wks	22,321.34	
	=> 22,321.34 units @ €0.0460/kWhr	1,026.78	1,026.78
	Total Cost per bill		5,240.27
	Cost per 2 Bill period (Nov - Feb)		10,480.54

APPENDIX E

Estimated Load into Collection System

Estimation of flows to Greystones WWTW and the proposed Leamore WWTW to year 2023 under NTMK Sewerage Scheme

	2,002 (To Greystones WWTW)				2,007 (To Greystones WWTW)				2,007 (To Leamore WWTW)				2,016 (To Leamore WWTW)				2,023 (To Leamore WWTW)			
	Population	Other (PE)	Total (PE)	Flow (m3/d)	Population	Other (PE)	Total (PE)	Flow (m3/d)	Population	Other (PE)	Total (PE)	Flow (m3/d)	Population	Other (PE)	Total (PE)	Flow (m3/d)	Population	Other (PE)	Total (PE)	Flow (m3/d)
Greystones																				
Residential	11,871			2,374	18,000			3,600												
Commercial		1,000		225		1,500		338												
Schools		150		34		250		56												
IDA site		0				0														
ZAPI industrial development		0				137		31												
			13,021				19,887	4,025												
Kilcoole																				
Residential	2,826				3,694				3,694			739	4,500				5,169			
Served by new Pumping Station	1,498			300	1,958			392	1,958											
Served by existing WWTP	1,328				1,736				1,736											
(estimated by inspection of flow records)			1,498				1,958				3,694				4,500	900			5,169	1,034
Commercial		164		37		222		50		222		50		356		80		440		99
Schools		150		34		250		56		250		56		300		68		350		79
Irish Egg Products		40		9		67		15		67		15		89		20		111		25
Druids Glen GC/Hotel		231		52		311		70		311		70		378		85		444		100
			586				850	583			850	930			1,122	253			1,346	303
															5,622	1,153			6,515	1,337
Newtownmountkennedy																				
Residential	2,521				4,528				4,528			906	6,000				6,892			
Served by new P.S	1,795			359	3,802			760	3,802											
Garden Village WWTP	726				726				726											
			1,795				3,802				4,528				6,000	1,200			6,892	1,378
Commercial		200		45		250		56		250		56		300		68		350		79
Schools		100		23		140		32		140		32		170		38		200		45
Newcastle Hospital		311		70		356		80		356		80		400		90		400		90
Model World Development						1,476		332		1,476		332		1,600		360		2,000		450
Custom Packaging		32		7		32		7		32		7		32		7		32		7
			643				2,253	1,267			2,253	1,413			2,502	563			2,982	671
							8,863								8,470	1,763			9,874	2,049
					total to Greystones WWTW		28,750	5,875												
Kilpeddar																				
Residential	480			96					675		675	135	960			192	1,141			228
Commercial							347									0		50		11
Drummin development										345		78		1,034		233		1,724		388
Mountkennedy development										389		88		1,167		263		1,946		438
											734				3,162	687			4,860	1,065
Kilquade Hill	153			30					200		200	30	250			30	350			30
Additional Residential														100		20		200		40
															350	50			550	70
Newcastle																				
Residential	763			153					1,083		1,083	217	1,500			300	1,783			357
Commercial														50		11		50		11
															1,550	311			1,833	368
	15,164	2,379	17,543	3,568	26,222	4,991	28,750	17,624	10,180	3,103	14,017	2,724	13,210	5,976	19,154	3,964	15,335	8,297	23,632	4,889

	2,002	2,007 (Greystones)	2,007 (Leamore)	2,016	2,023
Greystones WWTP Sludge Digester capacity (PE)	27,000	27,000	15,000		
Est. Greystones WWTP influent (PE)	17,543	28,750 Exceeds Capacity at Greystones	14,017 Ok for Stage 1 at Leamore		
Est. influent from villages (PE)				19,154 Exceeds Capacity	23,632
New Leamore WWTP Stage 1 (PE)				15,000 at Leamore	
Leamore WWTP stage 2 upgrade (PE)					22,500
	5,980			Stage 2 by 2015	Stage 2 at capacity by 2023

Assumptions
1. Ida site in Greystones developed to 30% capacity in 2016, 60% by 2023
2. Zapi industrial site developed to 20% in 2007, 50% in 2016 and 100% by 2023
3. Kilpeddar and Newcastle will connect to Leamore and never flow to Greystones
4. Drummin and Mountkennedy sites will be developed to 20% in 2007, 60% by 2016 and 100% by 2023
5. Model World will be developed to 100% by 2007
6. Garden Village will be connected to Leamore, but not to Greystones

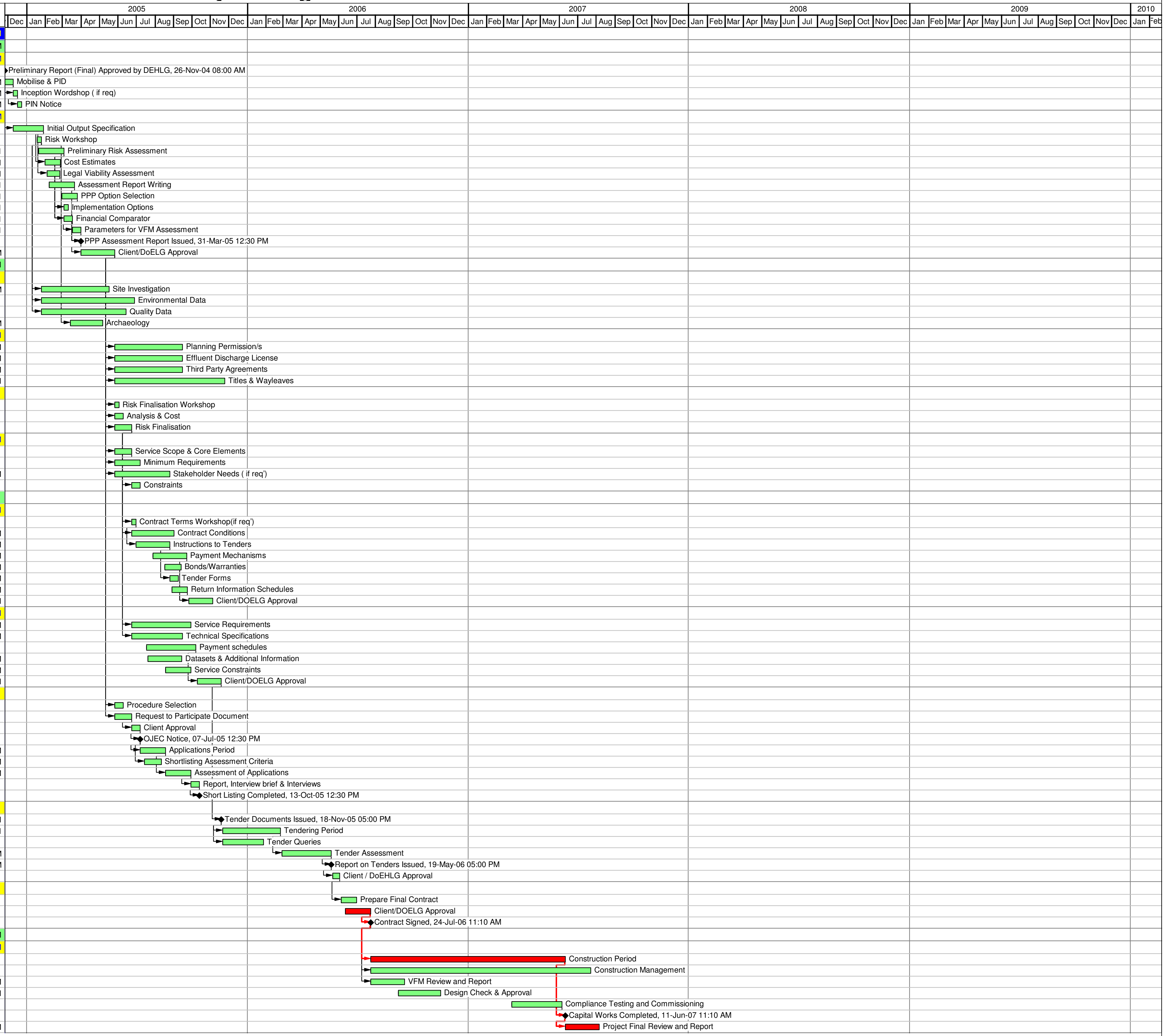
APPENDIX F

Project Programme

Project Programme

12-Jul-04

Activity Name	Original Duration	Start	Finish
Project: MDW0135 Newtownmountkennedy & Kilcoole SS	695.4d	26-Nov-04 08:00 AM	06-Aug-07 11:10 AM
WBS: MDW0135.1 Assessment	123.6d	26-Nov-04 08:00 AM	26-May-05 12:30 PM
WBS: MDW0135.1.1 Mobilistation	20.0d	26-Nov-04 08:00 AM	23-Dec-04 05:00 PM
Preliminary Report (Final) Approved by DEHLG	0.0d	26-Nov-04 08:00 AM	
Mobilise & PID	10.0d	26-Nov-04 08:00 AM	09-Dec-04 05:00 PM
Inception Wordshop (if req)	5.0d	10-Dec-04 08:00 AM	16-Dec-04 05:00 PM
PIN Notice	5.0d	17-Dec-04 08:00 AM	23-Dec-04 05:00 PM
WBS: MDW0135.1.2 PPP Assessment	113.6d	10-Dec-04 08:00 AM	26-May-05 12:30 PM
Initial Output Specification	30.0d	10-Dec-04 08:00 AM	28-Jan-05 05:00 PM
Risk Workshop	5.0d	18-Jan-05 12:00 PM*	25-Jan-05 12:00 PM
Preliminary Risk Assessment	30.0d	20-Jan-05 12:30 PM*	03-Mar-05 12:30 PM
Cost Estimates	20.0d	31-Jan-05 08:00 AM	25-Feb-05 05:00 PM
Legal Viability Assessment	15.0d	04-Feb-05 12:00 PM*	25-Feb-05 12:00 PM
Assessment Report Writing	30.0d	07-Feb-05 12:30 PM*	21-Mar-05 12:30 PM
PPP Option Selection	20.0d	28-Feb-05 08:00 AM*	25-Mar-05 05:00 PM
Implementation Options	5.0d	03-Mar-05 12:30 PM	10-Mar-05 12:30 PM
Financial Comparator	10.0d	03-Mar-05 12:30 PM	17-Mar-05 12:30 PM
Parameters for VFM Assessment	10.0d	17-Mar-05 12:30 PM	31-Mar-05 12:30 PM
PPP Assessment Report Issued	0.0d	31-Mar-05 12:30 PM	
Client/DoELG Approval	40.0d	31-Mar-05 12:30 PM	26-May-05 12:30 PM
WBS: MDW0135.2 Definition & Approach	217.1d	25-Jan-05 12:00 PM	24-Nov-05 12:30 PM
WBS: MDW0135.2.1 Investigations& data collection	110.0d	25-Jan-05 12:00 PM	28-Jun-05 12:00 PM
Site Investigation	80.0d	25-Jan-05 12:00 PM	17-May-05 12:00 PM
Environmental Data	110.0d	25-Jan-05 12:00 PM	28-Jun-05 12:00 PM
Quality Data	100.0d	25-Jan-05 12:00 PM	14-Jun-05 12:00 PM
Archaeology	40.0d	14-Mar-05 08:00 AM*	06-May-05 05:00 PM
WBS: MDW0135.2.2 Licenses and Agreements (if req)	130.0d	26-May-05 12:30 PM	24-Nov-05 12:30 PM
Planning Permission/s	80.0d	26-May-05 12:30 PM	15-Sep-05 12:30 PM
Effluent Discharge License	80.0d	26-May-05 12:30 PM	15-Sep-05 12:30 PM
Third Party Agreements	80.0d	26-May-05 12:30 PM	15-Sep-05 12:30 PM
Titles & Wayleaves	130.0d	26-May-05 12:30 PM	24-Nov-05 12:30 PM
WBS: MDW0135.2.3 Risk Transfer Finalisation	20.0d	26-May-05 12:30 PM	23-Jun-05 12:30 PM
Risk Finalisation Workshop	5.0d	26-May-05 12:30 PM	02-Jun-05 12:30 PM
Analysis & Cost	10.0d	26-May-05 12:30 PM	09-Jun-05 12:30 PM
Risk Finalisation	20.0d	26-May-05 12:30 PM	23-Jun-05 12:30 PM
WBS: MDW0135.2.4 Technical Requirements	65.0d	26-May-05 12:30 PM	25-Aug-05 12:30 PM
Service Scope & Core Elements	20.0d	26-May-05 12:30 PM	23-Jun-05 12:30 PM
Minimum Requirements	30.0d	26-May-05 12:30 PM	07-Jul-05 12:30 PM
Stakeholder Needs (if req')	65.0d	26-May-05 12:30 PM	25-Aug-05 12:30 PM
Constraints	10.0d	23-Jun-05 12:30 PM	07-Jul-05 12:30 PM
WBS: MDW0135.3 Documents & Procurement	301.8d	26-May-05 12:30 PM	24-Jul-06 11:10 AM
WBS: MDW0135.3.1 Instructions to Tenders and Conditions of Contract	96.4d	23-Jun-05 12:30 PM	04-Nov-05 05:00 PM
Contract Terms Workshop(if req')	5.0d	23-Jun-05 12:30 PM	30-Jun-05 12:30 PM
Contract Conditions	50.0d	23-Jun-05 12:30 PM	01-Sep-05 12:30 PM
Instructions to Tenders	40.0d	30-Jun-05 12:30 PM	25-Aug-05 12:30 PM
Payment Mechanisms	40.0d	29-Jul-05 08:00 AM*	22-Sep-05 05:00 PM
Bonds/Warranties	20.0d	17-Aug-05 08:00 AM*	13-Sep-05 05:00 PM
Tender Forms	10.0d	25-Aug-05 12:30 PM	08-Sep-05 12:30 PM
Return Information Schedules	20.0d	29-Aug-05 08:00 AM*	23-Sep-05 05:00 PM
Client/DOELG Approval	30.0d	26-Sep-05 08:00 AM	04-Nov-05 05:00 PM
WBS: MDW0135.3.2 Employer's Requirements, Technical Spec's and Payment Schedules	106.4d	23-Jun-05 12:30 PM	18-Nov-05 05:00 PM
Service Requirements	70.0d	23-Jun-05 12:30 PM*	29-Sep-05 12:30 PM
Technical Specifications	60.0d	23-Jun-05 12:30 PM*	15-Sep-05 12:30 PM
Payment schedules	60.0d	18-Jul-05 08:00 AM*	07-Oct-05 05:00 PM
Datasets & Additional Information	40.0d	21-Jul-05 08:00 AM*	14-Sep-05 05:00 PM
Service Constraints	30.0d	19-Aug-05 08:00 AM*	29-Sep-05 05:00 PM
Client/DOELG Approval	30.0d	10-Oct-05 08:00 AM*	18-Nov-05 05:00 PM
WBS: MDW0135.3.3 Procurement Selection and Shortlisting	100.0d	26-May-05 12:30 PM	13-Oct-05 12:30 PM
Procedure Selection	10.0d	26-May-05 12:30 PM	09-Jun-05 12:30 PM
Request to Participate Document	20.0d	26-May-05 12:30 PM	23-Jun-05 12:30 PM
Client Approval	10.0d	23-Jun-05 12:30 PM	07-Jul-05 12:30 PM
OJEC Notice	0.0d	07-Jul-05 12:30 PM	
Applications Period	30.0d	07-Jul-05 12:30 PM	18-Aug-05 12:30 PM
Shortlisting Assessment Criteria	20.0d	14-Jul-05 12:30 PM*	11-Aug-05 12:30 PM
Assessment of Applications	30.0d	18-Aug-05 12:30 PM	29-Sep-05 12:30 PM
Report, Interview brief & Interviews	10.0d	29-Sep-05 12:30 PM	13-Oct-05 12:30 PM
Short Listing Completed	0.0d		13-Oct-05 12:30 PM
WBS: MDW0135.3.4 Tendering & Tender Assessment	140.0d	18-Nov-05 05:00 PM	02-Jun-06 05:00 PM
Tender Documents Issued	0.0d		18-Nov-05 05:00 PM
Tendering Period	70.0d	21-Nov-05 08:00 AM	24-Feb-06 05:00 PM
Tender Queries	50.0d	21-Nov-05 08:00 AM	27-Jan-06 05:00 PM
Tender Assessment	60.0d	27-Feb-06 08:00 AM	19-May-06 05:00 PM
Report on Tenders Issued	0.0d		19-May-06 05:00 PM
Client / DoEHLG Approval	10.0d	22-May-06 08:00 AM	02-Jun-06 05:00 PM
WBS: MDW0135.3.5 Contract Formalisation	35.4d	05-Jun-06 08:00 AM	24-Jul-06 11:10 AM
Prepare Final Contract	20.0d	05-Jun-06 08:00 AM	30-Jun-06 05:00 PM
Client/DOELG Approval	30.0d	12-Jun-06 11:10 AM*	24-Jul-06 11:10 AM
Contract Signed	0.0d		24-Jul-06 11:10 AM
WBS: MDW0135.12 Construction	270.0d	24-Jul-06 11:10 AM	06-Aug-07 11:10 AM
WBS: MDW0135.12.1 Construction	270.0d	24-Jul-06 11:10 AM	06-Aug-07 11:10 AM
Construction Period	230.0d	24-Jul-06 11:10 AM	11-Jun-07 11:10 AM
Construction Management	260.0d	24-Jul-06 11:10 AM	23-Jul-07 11:10 AM
VFM Review and Report	40.0d	24-Jul-06 11:10 AM	18-Sep-06 11:10 AM
Design Check & Approval	50.0d	08-Sep-06 08:30 AM*	17-Nov-06 08:30 AM
Compliance Testing and Commissioning	60.0d	14-Mar-07 08:00 AM*	05-Jun-07 05:00 PM
Capital Works Completed	0.0d		11-Jun-07 11:10 AM
Project Final Review and Report	40.0d	11-Jun-07 11:10 AM	06-Aug-07 11:10 AM



Actual Work

Remaining Work

Critical Remaining Work

Milestone

% Complete

Newtownmountkennedy & Kilcoole Sewerage Scheme